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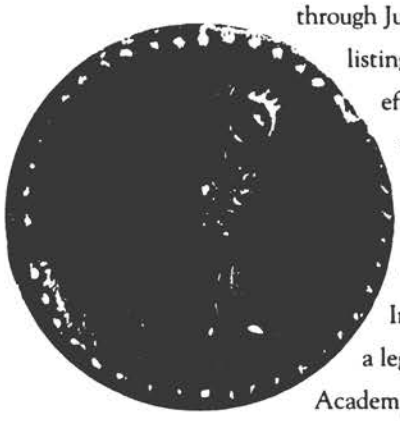
A MESSAGE FROM THE PRESIDENTS



Detail of a bronze doorknob in the Board Room of the National Academy of Sciences building. The owl appears in several architectural features throughout the historic building.

Under the terms of an 1863 congressional charter granted to the National Academy of Sciences and its sister organizations — the National Academy of Engineering, Institute of Medicine, and National Research Council — this institution has provided independent advice on important public policy questions for more than a century. From July 1996 through June of 1997, we issued more than 340 scientific and science policy studies (a complete listing can be found on pages 18–29), including a landmark report on the possible health effects of exposure to residential electric and magnetic fields, a study on the future of nuclear weapons policy, and recommendations on how to prepare for taking a more accurate national census.

In fulfilling our mission, we continue to pursue a wide range of difficult and contentious issues. This raises the possibility of legal challenges to the work that we do. Indeed, in January 1997, the independent status of the Academy came under threat from a legal ruling that applied the Federal Advisory Committee Act (FACA) to the National Academy of Sciences. We are pleased that Congress has strongly reasserted the importance of the Academy's independent advice by passing legislation in November that exempts the Academy from government control under FACA. At the same time, the new legislation requires us to do a number of things to expand public access to our processes.

Recent technology has made a degree of access possible that at one time would have been quite challenging. For example, information about our committees and our many public meetings can be obtained easily from our Web site, <www.nas.edu>. And the full texts of our reports are available free online through the National Academy Press at <www.nap.edu>. Not only are we confident that we can comply with the new legislation without jeopardizing our crucial role as an independent adviser to the government, but we believe that increased public access will benefit both the Academy and the nation.

Questions of science, technology, and medicine underlie most of the policy issues that confront society today. The Academy complex provides the means to achieve a better understanding of those issues, helping policy-makers and the public to make important decisions that are appropriately informed. We look forward with enthusiasm to another year of service to the nation.

BRUCE ALBERTS
President
National Academy of Sciences

WM. A. WULF
President
National Academy of Engineering

KENNETH I. SHINE
President
Institute of Medicine

HEALTH AND THE ENVIRONMENT

HEALTH EFFECTS OF ELECTROMAGNETIC FIELDS

Since 1979, when the first scientific report was published suggesting a link between cancer and exposures to electric and magnetic fields (EMFs), some people have worried that power lines and appliances can make them sick.

Now after examining more than 500 studies, a National Research Council committee has determined that there is no consistent, conclusive evidence to show that residential EMF exposures cause adverse health effects. In its report, *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*, the committee examines epidemiologic, animal, and cellular studies of EMF exposures and finds no evidence that they can cause cancer, affect reproduction, or change behavior.

The genesis of the concern comes from several studies conducted over the past two decades which indicated that children who live near concentrations of power lines are about 1.5 times more likely to contract leukemia, a rare cancer of the white blood cells. However, when epidemiologists measured the actual electric and magnetic fields inside the homes of these children, they failed to find any association between the measured fields and leukemia. The weak connection between power lines and leukemia might therefore be the result of factors other than EMFs, such as local air quality, a home's proximity to heavy traffic that causes pollution, or the construction features of older homes. Additional research is needed to examine these and other possible environmental influences, the committee says.

Epidemiologists also have looked at possible connections between EMF exposures and reproductive and neurobehavioral disorders. These studies do not show any consistent evidence of harmful effects, the committee says. Nor have laboratory studies of individual cells and tissues — or of laboratory animals — found any connection with cancer.

No test or study can prove that an environmental agent is not carcinogenic at some dose, in combination with some other biological agent or for some sensitive population, the committee acknowledges. But a thorough examination of the available evidence has failed to demonstrate that exposures to residential electromagnetic fields are a threat to human health.

The report can be found online at <www.nap.edu/bookstore/isbn/0309054478.html>. The study was funded by the U.S. Department of Energy.

HIGH-QUALITY CARE FOR THE DYING

The Supreme Court's decision that people do not have a constitutional right to physician-assisted suicide has not ended the debate over this emotionally charged issue. But there is one point on which everyone can agree: No one should feel that suicide is the best option because of a lack of skilled and compassionate care at the end of life.

The knowledge and tools to provide such care do exist but are underused, says an Institute of Medicine committee in its report, *Approaching Death: Improving Care at the End of Life*. An estimated four in 10 people die in pain, despite the availability of medications that can offer relief. Many fear they will experience lonely or protracted deaths, marked by neglect of important emotional and spiritual needs or overly aggressive use of life-extending technologies. They do not trust the health care system to help them die with dignity — a death free from avoidable distress and suffering for patients, families, and caregivers; in general accord with the wishes of patients and families; and reasonably consistent with clinical, cultural, and ethical standards.

As baby boomers begin to reach the age when serious illness and death become more common, systems that already are straining under an aging population and expensive, advanced technologies will be burdened even further. One promising response is "whole community" care that draws on medical and nonmedical resources to integrate care across settings in ways that provide more flexibility for patients, families, and clinicians.

The committee found that many encouraging approaches and programs exist, such as hospice programs and palliative care that seeks to treat pain and manage symptoms. But it also found serious problems. Scientifically flawed laws and regulations often keep physicians from prescribing needed drugs for pain and other symptoms, even though addiction is not a serious risk. And health insurance plans focus on acute care rather than care for people with advanced chronic illnesses that fit neither the acute nor hospice models. Public and private insurers need to test new options for coverage and payment that promote high-quality, coordinated care for dying patients.

Patients and their families should be able to expect and receive respectful and skilled care, the report says, along with better information about the physical, emotional, spiritual, and practical aspects of fatal illnesses. To hold clinicians and health care organizations accountable for good end-of-life care, better tools for assessing and improving the quality of care are needed.

The lack of understanding in how to properly care for those approaching death stems from inadequacies in medical education. Training programs need to develop the attitudes, knowledge, and skills necessary for dying patients. In addition, the nation's research establishment should define and implement priorities for strengthening the knowledge base for effective

end-of-life care. In the area of biomedical research, investigations into the physiology of pain and pain relief offer useful models.

The report is online at <www.nap.edu/bookstore/isbn/0309063728.html>. The study was funded by the Open Society Institute, the Greenwall Foundation, the Health Care Financing Administration, the Culpeper Foundation, the Robert Wood Johnson Foundation, the Archstone Foundation, and the Irvine Health Foundation.

The Hidden Epidemic

The lack of an effective national system to combat sexually transmitted diseases (STDs) is contributing to a growing epidemic of preventable illness. Approximately 12 million new cases of STDs occur across the nation each year — 3 million of them among teenagers. In fact, the United States has the highest rate of curable STDs of any developed country. These diseases cause thousands of deaths, create many other serious health problems, and cost the nation more than $17 billion annually.

Government agencies, the public and private health care sector, educators, the media, and entire communities must unite to promote actions that will lead to healthy sexual behaviors, says an Institute of Medicine committee in its report, *The Hidden Epidemic: Confronting Sexually Transmitted Diseases*. The most important steps include providing adolescents with health education and access to condoms; ensuring access to high-quality clinical services for all, particularly for underserved populations that are at risk; and fostering strong national leadership in the fight against STDs. A traditional reluctance to discuss healthy sexual behaviors openly in the United States must not be allowed to constrain effective interventions.

More than 25 infectious organisms, including eight identified just since 1980, cause the many clinical syndromes classified as STDs. Among the diseases and disorders associated with STDs are AIDS, ectopic pregnancy, infertility, liver disease, serious illness transmitted from infected mothers to their babies, and cervical, liver, and other cancers. Some health consequences, such as infertility or cancer, occur years after infection, so people may be unaware of any link to an STD. And some STDs do not cause symptoms and can go undetected, although an infected person can continue to spread the disease to others.

Many STDs are curable; all are preventable. A long-term national campaign involving elected officials, public opinion leaders, health care professionals, and the mass media should encourage healthful behaviors such as using condoms and taking other precautions against STDs, the report says. Information on the diseases must become easily available and be discussed openly.

All school districts should ensure that schools provide sequential, age-appropriate sex education, including health services, access to condoms, and clinical services to prevent, diagnose, and treat STDs. Adolescents should be strongly encouraged to delay the age at which they begin having sexual intercourse; but given the high percentage of teenagers who have had intercourse, they also must have access to information about STDs and ways to prevent them. Despite

concerns that school-based education or condom-availability programs might increase sexual activity, recent studies show that this is not the case. In schools providing both education and condom-availability programs, condom use increased but sexual intercourse did not.

In addition, the committee urges all communities to ensure universal access to comprehensive STD-related services, with the organization of services tailored to local needs and circumstances. Managed-care organizations and other health plans are essential to STD prevention efforts but have not yet shown leadership in this area. They should take more responsibility for STD prevention and work to prevent these diseases in the entire community. In particular, health care plans should provide for or cover comprehensive STD-related services for all plan members and their sex partners, regardless of the partner's insurance status.

Leadership and increased investments are essential, the report says. An independent, long-term national roundtable could serve as a neutral forum for public and private agencies to work together in developing a comprehensive system of STD-related services in the United States.

The report is on the Internet at <www.nap.edu/bookstore/isbn/0309054958.html>. The study was sponsored by the Centers for Disease Control and Prevention, Glaxo Wellcome Inc., the Henry J. Kaiser Foundation, the National Institute of Allergy and Infectious Diseases, the Office of Research on Women's Health of the National Institutes of Health, Ortho-McNeil Pharmaceutical, and SmithKline Beecham Pharmaceuticals.

MANAGING THE TRANSITION TO MANAGED CARE

As health care costs continue to rise, an increasing number of Medicare beneficiaries will receive medical services through managed-care plans rather than traditional fee-for-service arrangements. But do older Americans have enough information to know which managed-care plan is best for them or what each plan covers?

In too many cases the answer is no, concludes an Institute of Medicine committee in its report, *Improving the Medicare Market: Adding Choice and Protections*. According to surveys, Medicare beneficiaries on the whole have very limited understanding of managed care or the specific benefits of a particular managed-care plan. In contrast to most younger workers, older Americans usually do not have employers who can help them compare different plans and figure out which would be best.

The federal government and private insurers need to take steps to make all health plans more accountable and understandable to older Americans, the committee says. The federal government should allow only those firms with plans that meet strong new reporting and accountability requirements to market their plans to Medicare beneficiaries. These requirements would include:

- an annual open enrollment season to enable beneficiaries to compare more easily the value of all options,
- a guaranteed renewal of coverage with no exclusions for people with pre-existing health problems,

• the provision of information to beneficiaries that allows them to make informed choices among plans, and

• the meeting of quality certification requirements comparable to those already developed by national private accreditation organizations.

A variety of vehicles can help disseminate objective information about health care options. Toll-free telephone services, online communications through the World Wide Web, town meetings, and newsletters all could prove useful in providing information and tracking complaints, grievances, and appeals.

Traditional fee-for-service Medicare should be preserved as a viable option to build the trust and confidence of Medicare beneficiaries, the report says. Such a safe harbor for patients would protect the most vulnerable and those who have less experience with managed care.

To support the necessary information infrastructure, the committee recommends the creation of a new entity called the Informed Choice Fund, financed through a flat fee paid by participating health plans or by the Medicare beneficiaries enrolled in managed care plans. It also proposes establishing a Medicare market board — with an advisory committee that includes purchasers, providers, and consumers — that could administer the Medicare choice process.

The report can be found online at <www.nap.edu/bookstore/isbn/0309055350.html>. The study was funded by the Robert Wood Johnson Foundation, the Commonwealth Fund, the Kansas Health Foundation, and the Pew Charitable Trusts.

Protecting Earth From Martian Microbes

One of the most exciting scientific adventures of our time will begin in the first few years of the 21st century, when robotic spacecraft start bringing samples of Martian rocks back to Earth. These samples should make it possible to determine whether life ever evolved on Mars, as suggested by the tantalizing hints of fossilized life in a Martian meteorite found in Antarctica. But what if the samples also contain some sort of microbe that threatens terrestrial life?

In fact, the possibility that microbes exist on Mars and could pose a threat to life on Earth is very low, says a National Research Council task group in its report, *Mars Sample Return: Issues and Recommendations*. Mars is continually blasted by ultraviolet radiation that causes severe damage to biological molecules, and the surface is largely devoid of water, which is a prerequisite for life.

Nevertheless, the possibility of harm from Martian microbes is not zero, so the National Aeronautic and Space Administration should take precautions against any contamination when robotic explorers start returning samples from Mars.

Samples will need to be isolated physically and biologically and regarded as hazardous until proved otherwise. If instruments cannot verify the isolation of samples while en route to Earth, the samples and any spacecraft components that might have been exposed to them should be either sterilized in space or not returned to Earth. Further research and testing are needed, the report says, to develop sterilization technologies, possibly using heat, chemicals, or radiation.

Once returned to Earth, the samples should be contained and processed at a special receiving facility. The facility should be operational at least two years before the launch, to allow sufficient time for developing the necessary technologies for life detection, sample containment, and sterilization. Distribution of unsterilized samples from NASA's special receiving facility to researchers should be allowed only after rigorous analysis has been conducted to determine that no biological entities are present.

The report is available on the Internet at <www.nap.edu/bookstore/isbn/0309057337.html>. The study was funded by NASA.

A SAFE PLACE FOR RADIOACTIVE WASTE

Tons of contaminated clothing, machinery, and other objects from the manufacture of nuclear weapons are currently in temporary storage in steel drums and wooden boxes at several sites across the country. Since the 1970s, the federal government has been studying whether to dispose of these radioactive materials — collectively called transuranic waste — in a geologically stable salt layer more than 2,000 feet below the surface of the desert in southeastern New Mexico. Known as the Waste Isolation Pilot Plant, or WIPP, the federally operated facility would be the nation's first permanent disposal site for transuranic waste.

According to a Research Council report, *The Waste Isolation Pilot Plant: A Potential Solution for the Disposal of Transuranic Waste*, the WIPP site has the ability to isolate transuranic waste for more than 10,000 years, provided it is sealed effectively and remains undisturbed by human activity. Moreover, the facility can be engineered in ways that would reduce to acceptable levels the consequences of human intrusion.

Before building and operating the site, however, the U.S. Department of Energy first must demonstrate that the WIPP facility will comply with federal regulations intended to protect human health and the environment. DOE can meet this requirement if some combination of the following were to occur:

- Reducing the likelihood of future drilling could lower the projected risk of radiation releases. The Environmental Protection Agency currently assumes that the frequency of drilling for gas and oil in this area will continue unchanged for the next 10,000 years. But reserves of natural gas and oil now found in the area will be exhausted in less than 100 years, and the assumption that the drilling rate will stay the same is arbitrary and scientifically untestable, the committee says.

• Research that is planned and in progress could show that radioactive elements are very unlikely to migrate from the facility before they decay to the point at which they are considered safe.

• Placing the waste in individually sealed rooms, and sealing the repository with materials that trap radioactive isotopes, could substantially reduce the consequences of human intrusion at the facility. Evaluation of these options could increase confidence in the performance of the facility.

Speculative scenarios of human intrusion should not be used as the sole or primary basis for judging the acceptability of the site, the committee says. Predictions of what human activities and technologies will be thousands of years from now are highly conjectural and lack scientific foundation.

The report is available online at <www.nap.edu/bookstore/isbn/0309054915.html>. The study was funded by the U.S. Department of Energy.

SOCIAL ISSUES AND EDUCATION

ENSURING AN ACCURATE CENSUS

Statistical sampling procedures offer the only reasonable way to significantly improve the accuracy and efficiency of the census, says a Research Council panel in *Preparing for the 2000 Census: Interim Report II*. The Census Bureau's efforts to incorporate these procedures are a move in the right direction and would ensure more reliable data in the 2000 census.

Between 1970 and 1990, the cost of the census increased by $1.3 billion, yet in 1990 the accuracy of the count fell. A declining response rate among the population at large — coupled with the difficulty of counting such groups as homeless people and recent immigrants who may not speak English or be familiar with census-taking procedures — has contributed to significant undercounts despite efforts to contact everyone.

To address these problems, the Census Bureau is engaging in a complete redesign of the census that would use sampling techniques and statistical estimates to achieve a more thorough count at lower cost. In the redesigned census, after an attempt to count everyone through an improved questionnaire and follow-up mailings, a statistically representative sample of people who failed to respond would be contacted by census-takers. At the next stage, a large independent sample would be used to estimate those still not accounted for. This revamped census, which has been tested at several sites across the country with encouraging results, could boost public confidence in the accuracy of the census, the panel says, because quality will be improved and errors will be reduced.

Moreover, sampling will not compromise important uses such as congressional redistricting. When data from individual census blocks are grouped into meaningful legal and political units, sampling yields more accurate results.

To improve the census redesign, the panel says, the bureau should modify its sampling plans to achieve uniform accuracy; strengthen quality checks to ensure that addresses from state and local governments are current; improve ways of distributing forms in languages other than English; and conduct further research on how to count people with no address.

In accordance with the report, the Census Bureau has modified the year 2000 census plan. The report also has informed Congress and the administration during the debates over the use of sampling procedures.

The report can be found online at <www.nap.edu/bookstore/isbn/0309058805.html>. The study was funded by the Census Bureau.

Confronting the Legacy of the Cold War

The risks posed by nuclear weapons have changed since the end of the Cold War, but they remain unacceptably high, says a committee of the National Academy of Sciences in its report, *The Future of U.S. Nuclear Weapons Policy*. To reduce these risks, the United States should expand arms reductions now under way with Russia, change nuclear operations to enhance safety and prevent accidental or unauthorized use of nuclear weapons, and restrict nuclear arms use to that of deterring or responding to nuclear attack.

Such a policy stance could have important benefits. The United States and Russia could more easily negotiate deep cuts in their nuclear arsenals. As long as the remaining forces are secure, a few hundred highly accurate warheads — compared with the thousands of warheads allowed by current treaties — would be all that either country would need to maintain deterrence against a nuclear attack. At the same time, U.S. conventional forces must remain strong to continue to meet the country's own security needs and those of its allies.

The move toward fewer warheads should be accompanied by measures to extend the time it takes to launch them, the committee says. Instead of keeping nuclear forces on continuous alert so missiles can be fired within minutes, the time required to launch them could be extended to days, weeks, or even months.

A smaller arsenal also would be safer, because it would be much easier for the United States and Russia to protect their stockpiles from accident, theft, or unauthorized use. Both countries, for example, could retain only those weapons with the most modern safety and security features.

But reducing nuclear stockpiles to a few hundred weapons on each side requires much better verification methods to ensure that weapons are not being hidden. It also requires that the other nuclear weapons states — declared and undeclared — join the process.

These steps could lead toward a more ambitious goal: a global prohibition on the use of nuclear weapons. Although the knowledge of how to build these weapons cannot be eliminated, the end of the Cold War has made it possible to envision a future in which nuclear weapons are no longer necessary. The path to a complete ban on nuclear weapons is not now clear, but the potential benefits of a ban warrant serious efforts to identify and promote the conditions that would make this possible.

The report is on the Internet at <www.nap.edu/bookstore/isbn/0309063671.html>. The committee's work was supported by the John D. and Catherine T. MacArthur Foundation.

THE EFFECTS OF IMMIGRATION

Immigration has always been a topic of controversy in the United States. But new analyses are providing information that can be used to ground immigration policies in scientific understanding rather than emotion.

In the report *The New Americans: Economic, Demographic, and Fiscal Effects of Immigration*, a National Research Council panel examined the effects of immigration, to provide a scientific basis for the review of U.S. policies conducted by the Commission on Immigration Reform.

The panel's overall conclusion: The economic impact of immigration is positive for most native-born Americans.

Immigration increases the supply of labor, particularly in industries like textiles and agriculture, allowing for cheaper production of many goods and services. Moreover, the majority of immigrants contribute to government revenue as working adults; in the long run, most immigrants and their descendants have positive effects on the economy. Those contributions are magnified for immigrants with higher educational levels, who tend to have higher incomes and pay more taxes.

Some groups within the United States, however, don't fare as well. Wages may have fallen some 5 percent over the past 15 years for native-born Americans who have less than a high school education and who compete with immigrants, the committee estimates.

Also, in the short term, today's immigrants impose costs on some state and local governments by using more in services than they pay in taxes. This is particularly the case in the six states where most immigrants live: California, New York, New Jersey, Texas, Florida, and Illinois. In California, for example, the panel calculates an additional annual tax burden of $1,178 per household headed by a native-born American.

If immigration continues at today's legal level of about 800,000 immigrants per year, the panel calculates, the U.S. population will rise from the current 263 million to 387 million by the year 2050. New immigrants and their children would account for about two-thirds of that growth. Cutting immigration in half would reduce the projected population by 38 million; increasing it by half would boost the population by a similar amount.

The report is on the Internet at <www.nap.edu/bookstore/isbn/0309063566.html>. The study was funded by the U.S. Commission on Immigration Reform.

Keeping Medical Information Private

Medical records are intensely personal documents, yet the information they contain flows widely among hospitals, insurers, employers, and other institutions. As more and more of these records are transformed from paper to electronic files, renewed attention must be given to protecting them. Governments, health care organizations, and the public need to work together to provide for greater levels of security.

Use of computerized systems can raise the quality of medical care and reduce costs by increasing access among intended users and by improving the accuracy of patient information, concludes a Research Council committee in its report, *For the Record: Protecting Electronic Health Information*. However, electronic storage and transmission of health records also raise concerns about privacy. All health care organizations — including hospitals, doctors' offices, and insurance firms — need to adopt a set of technical and organizational practices to improve the security of electronic health records. For example, organizations should use access controls to keep employees from obtaining information that is not necessary for their jobs, the committee says. Automated tracking systems should be employed to monitor and record all attempts made to read electronic files. A zero-tolerance policy should be instituted for violators, regardless of their job title. Points in the system that are vulnerable should be protected through special software, encrypted passwords, dedicated modem lines, and other means.

These measures can protect the security of medical records *within* organizations. However, they do not address privacy concerns that stem from the widespread dissemination of patient health information *among* organizations. Few restrictions are in place to ensure that insurance companies, researchers, public health agencies, litigators, and managed-care organizations use the medical information in ways that respect patient privacy and interests. Patients fear that employers will use health information to make hiring or promotion decisions, that insurers will unfairly deny them coverage, or that direct marketers will intrude upon their privacy with targeted mailings.

The report makes several recommendations that address these and other concerns:

- The secretary of health and human services should establish a standing committee to help develop and update security standards for all users of health information.
- Congress should provide funding for the establishment of an organization to foster sharing of information about security threats and best practices within the health care community.
- Government and industry should promote activities that will educate the public about health privacy issues and should determine appropriate ways of establishing a "privacy ombudsman" for consumers.

• Organizations that collect, analyze, or disseminate health information should adopt fair-information practices similar to those specified in the federal Privacy Act of 1974.

• The federal government should sponsor research on technologies relevant to the security of health information.

The report can be found online at <www.nap.edu/bookstore/isbn/0309056977.html>. The study was funded by the National Library of Medicine, the Warren Grant Magnuson Clinical Center of the National Institutes of Health, and the Massachusetts Health Data Consortium.

EFFECTIVE SCIENCE EDUCATION

In an increasing number of classrooms across the nation, science education is undergoing a transformation. Instead of simply memorizing lists of terms, students are observing the world, doing experiments, developing theories, and working in groups to solve problems, much like scientists do. This approach, called inquiry-based science education, is effective for *all* students, not just the few who show promise and interest in becoming scientists, engineers, or physicians.

Two recent books generated from activities of the Research Council and the Academy of Sciences offer guidance to educators and administrators seeking to further this transformation. The first, *Science for All Children: A Guide to Improving Elementary Science Education in Your School District*, provides school districts with guidelines and suggestions for planning and implementing an inquiry-based science program. Such a program incorporates five key elements: an age-appropriate curriculum, opportunities for teachers' professional development, high-quality science materials, appropriate assessment tools, and community and administrative support. Integrating each of these into a comprehensive program will enable schools to move closer to achieving the goals set forth in the National Science Education Standards issued by the Research Council in 1996.

Prepared by the National Science Resources Center — a joint venture of the Academy complex and the Smithsonian Institution — *Science for All Children* can be found on the Internet at <www.nap.edu/bookstore/isbn/0309052971.html>.

Science Teaching Reconsidered, a handbook on college teaching, draws on the experiences of successful professors and the results of educational research to provide undergraduate science educators with assistance in understanding students, accommodating their differences, and helping them grasp the content, methods, and wonders of science. The book considers teaching styles, course curricula, effective classes and laboratories, and ways to engage students in critical thinking and problem solving. Written by scientists who also are prominent educators, the book outlines general principles of effective undergraduate teaching and gives specific examples in a variety of science courses. It also looks at the selection and use of instructional resources, including information technologies.

Funded by the National Science Foundation and the Kellogg Endowment Fund of the National Academy of Sciences and the Institute of Medicine, the book is online at <www.nap.edu/bookstore/isbn/0309054982.html>.

ENGINEERING AND TECHNOLOGY

THE FREE FLOW OF SCIENTIFIC INFORMATION

Data are the lifeblood of science, enabling researchers to build on each other's results and move the frontiers of knowledge forward. But legislation that has been proposed in Congress, and broader trends to limit the distribution of scientific information could jeopardize the exchange of research results, with potentially serious consequences for scientific and technological progress.

Policy-makers worldwide need to treat the results of research funded with tax dollars as a public good and not allow the flow of scientific data to be restricted, says a National Research Council committee in its report, *Bits of Power: Issues in Global Access to Scientific Data.* The conduct of research, like other government activities related to public health and safety, serves the public welfare. Policies that affect pricing and access to scientific data should reflect those public benefits.

Laws introduced in the last Congress and already enacted in Europe would give database vendors unprecedented property rights over some databases and potential control over the results of publicly funded research. In particular, this legislation ignores the traditional "fair use" exceptions that enable scientists, engineers, and educators to use copyrighted materials for free, or at reduced costs, if the information is used for research, teaching, or other noncommercial purposes. Although database vendors are justified in seeking protection for their investments, the report says, policy-makers must insist on maintaining inexpensive access for scientists, educators, and others working in the public interest.

More broadly, powerful trends are altering the terms of exchange for scientific data. Many government science agencies are questioning their capacity to invest at traditional levels in the creation, preservation, and dissemination of scientific data. As budgets grow tighter, governments increasingly are commercializing and privatizing these activities.

In considering data distribution policies, the committee says, several concerns must be addressed. For example, privatization should occur only if the needs of the scientific community can be protected. National and international science agencies should consider augmenting and developing an international network of data centers that can verify, document, organize, archive, and disseminate scientific information. In addition, national and international organizations should help less-developed nations acquire electronic network services, computers, software, and opportunities for related training in data management.

The report is online at <www.nap.edu/bookstore/isbn/0309056357.html>. The committee's work was funded by the National Science Foundation, the National Library of Medicine, the Defense Technical Information Center, the National Aeronautics and Space Administration, the National Institute of Standards and Technology, the National Oceanic and Atmospheric Administration, and the U.S. Department of Energy.

Toward Cleaner Ground Water

Over the next 75 years, U.S. taxpayers and corporations could spend between $500 billion and $1 trillion cleaning up contaminated ground water and soil at hundreds of thousands of sites across the country. Yet even these huge expenditures might not solve the problem. Conventional technologies have been unable to restore many of the sites to current legal standards.

Wider use of innovative technologies could greatly improve the cleanup of contaminated areas, says a Research Council committee in its report *Innovations in Ground Water and Soil Cleanup: From Concept to Commercialization*. However, these technologies will not be fully developed and applied unless financial incentives are put in place to spur their use. The committee makes a number of recommendations that could create a strong market for such technologies.

First, the U.S. Securities and Exchange Commission should clarify and strictly enforce requirements for publicly traded U.S. corporations to disclose fully their liabilities for environmental remediation. To ensure that companies do not lose a major portion of their value as a result of such disclosures, Congress should allow business firms to amortize their remediation liabilities over a period of 20 to 50 years.

In addition, the Environmental Protection Agency should be more consistent and evenhanded in enforcing cleanup requirements of the Superfund and Resource Conservation and Recovery Act programs. Such enforcement would help ensure that companies which spend money on timely cleanup of contaminated soil and water would not be placed at a competitive disadvantage compared with those that save money by delaying cleanup at their sites. EPA also should make a national registry of contaminated sites available on the Internet to provide companies with additional incentives for rapid cleanup and to give technology developers a way to assess the remediation market.

Other committee recommendations include:

- Owners of contaminated sites should be allowed to choose any remediation technology that can meet regulatory requirements for risk reduction, and EPA should speed up the approval process for selecting cleanup technologies and make it more consistent.
- EPA should spearhead the development of a system to collect, evaluate, and disseminate data on the performance and costs of decontamination technologies. Innovative cleanup technologies should undergo comprehensive peer review, which will define the state of the art, build consensus, and provide standards for new remediation methods.

• Research is needed to increase the number of available technologies and to improve the understanding and efficiency of existing methods. For example, few technologies are now available for decontaminating soil and water at the many sites that involve difficult-to-treat contaminants in complex geologic formations.

• The public should be involved in discussions and decisions about hazardous waste sites as soon as the sites are discovered.

The report is available online at <www.nap.edu/bookstore/isbn/0309063582.html>. The committee's work was funded by the Environmental Protection Agency and the U.S. Departments of Energy and Defense.

Ending the Era of Chemical Weapons

Among the most chilling relics of the Cold War are the stockpiles of chemical weapons stored at eight sites in the continental United States. Congress has given the U.S. Department of the Army the responsibility of eliminating these stockpiles. In response, the Army has developed an incineration system to destroy chemical weapons and to eliminate residual chemical agent in all containers. However, public concerns about potential health and environmental effects of incineration have threatened to delay disposal programs.

Because of public opposition to incineration, the Army has been considering other disposal technologies. It called on the Research Council to review alternative disposal plans for two sites — the Aberdeen Proving Ground in Maryland and the Newport Chemical Activity in Indiana — each of which has a single type of chemical agent stored in bulk containers, greatly simplifying the disposal process. In its report *Review and Evaluation of Alternative Chemical Disposal Technologies*, a Research Council panel said that technologies based on chemical neutralization are the most suitable substitutes for incineration at both Aberdeen and Newport. Neutralization would use water or sodium hydroxide to break the chemical agent into simpler, safer compounds, which could then be treated on site or shipped elsewhere for further treatment and safe release into the environment.

Of the alternatives to incineration examined — including destruction in a molten-metal bath and various water- and gas-based chemical processes — only neutralization has been tested on a large scale. Neutralization technologies operate at low temperatures and pressures, and are simple and easily controllable. In addition, testing processes ensure that the byproducts of this process are analyzed before being released to the environment.

An independent third party should analyze and verify the results obtained from work done in the laboratory, the panel said. Site-specific risk assessments also will be needed to ensure that processes are safe and that any byproducts are not hazardous to human health or the environment. In addition, the public must have significant involvement in making key decisions.

Some byproducts of the neutralization process will need to be treated at other sites, requiring modification of current policies that prohibit shipping neutralized byproducts to other treatment and disposal facilities. Standards for transporting wastes should be clearly defined and evaluated for consistency.

At the six other U.S. chemical weapons storage sites, multiple agents and munitions are stored, many of which contain explosives and propellants. The panel was not asked to examine the possibility of using alternative technologies at any of those sites.

The report can be found online at <www.nap.edu/bookstore/isbn/0309055253.html>. The study was funded by the U.S. Department of the Army.

Studies and Projects Completed in Fiscal Year 1997

Defense and Space

Aging of U.S. Air Force Aircraft — Interim Report

Assessment of NASA's Mars Exploration Programs

Assessment of Recent Changes in the Explorer Program

An Assessment of the Solar and Space Aspects of NASA's Space Science Enterprise Strategic Plan

Aviation Safety and Pilot Control: Understanding and Preventing Unfavorable Pilot-Vehicle Interactions

The Future of U.S. Nuclear Weapons Policy (page 10)

Lessons Learned From the Clementine Mission

Maintaining U.S. Leadership in Aeronautics: Scenario-Based Strategic Planning for NASA's Aeronautics Enterprise

Mars Sample Return: Issues and Recommendations (page 6)

Post-Cold War Conflict Deterrence

Proceedings of the Symposium on Tactical Meteorology and Oceanography: Support for Strike Warfare and Ship Self-Defense

Protecting the Space Station from Meteoroids and Orbital Debris

Public Involvement and the Army Chemical Stockpile Disposal Program

Radiation Hazards to Crews of Interplanetary Missions: Biological Issues and Research Strategies

Reducing the Costs of Space Science Research Missions — Proceedings of a Workshop

Review and Evaluation of Alternative Chemical Disposal Technologies (page 16)

Space Weather: A Research Briefing

Education

Educating One and All: Students with Disabilities and Standards-Based Reform

Evaluation of 'Redesigning the National Assessment of Educational Progress'

Freshwater Ecosystems: Revitalizing Educational Programs in Limnology

Improving America's Schools: The Role of Incentives

Improving Schooling for Language-Minority Children: A Research Agenda

Improving Teacher Preparation and Credentialing Consistent with the National Science Education Standards — Report of a Symposium

Introducing the National Science Education Standards

Mathematics and Science Education Around the World: What Can We Learn? From the Survey of Mathematics and Science Opportunities (SMSO) and the Third International Mathematics and Science Study (TIMSS)

On Implementing a National Graduate Medical Education Trust Fund

Preparing for the 21st Century: The Education Imperative

Science and Technology for Children (elementary science curriculum units):
- *Soils*
- *Comparing and Measuring*
- *Animal Studies*
- *Organisms*
- *Solids and Liquids*
- *Land and Water*
- *Motion and Design*

Science and Technology for Children Discovery Deck (activity cards):
- *Electric Circuits*
- *Microworlds*

Science for All Children: A Guide to Improving Elementary Science Education in Your School District (page 13)

Science Teacher Preparation in an Era of Standards-Based Reform

Science Teaching Reconsidered: A Handbook (page 13)

Taking Flight: Education and Training for Aviation Careers

HEALTH, SAFETY, AND SOCIAL ISSUES

Adequacy of the Comprehensive Clinical Evaluation Program: Nerve Agents

Approaching Death: Improving Care at the End of Life (page 3)

Assessing Knowledge of Retirement Behavior

Assessing Policies for Retirement Income: Needs for Data, Research, and Models

Assessment of Performance Measures for Public Health, Substance Abuse, and Mental Health

Blood and Blood Products: Safety and Risk

Blood Donors and the Supply of Blood and Blood Products

Changing Health Systems and Rheumatic Diseases

Changing Numbers, Changing Needs: American Indian Demography and Public Health

Characterizing Exposure of Veterans to Agent Orange and Other Herbicides Used in Vietnam: Scientific Considerations Regarding a Request for Proposals for Research

Community Response to High-Energy Impulsive Sounds: An Assessment of the Field Since 1981

Directory of Military Researchers Interested in Women's Health Issues

Enabling America: Assessing the Role of Rehabilitation Science and Engineering

Enhancing Organizational Performance

Environmentally Significant Consumption: Research Directions

Flight to the Future: Human Factors in Air Traffic Control

For the Record: Protecting Electronic Health Information (page 12)

Health Consequences of Service During the Persian Gulf War: Recommendations for Research and Information Systems

Health Outcomes for Older People: Questions for the Coming Decade

Healthy Communities: New Partnerships for the Future of Public Health

The Hidden Epidemic: Confronting Sexually Transmitted Diseases (page 4)

Improving Data on America's Aging Population — Summary of a Workshop

Improving Health in the Community: A Role for Performance Monitoring

Improving the Medicare Market: Adding Choice and Protections (page 5)

In Her Own Right: The Institute of Medicine's Guide to Women's Health Issues

Interactions of Drugs, Biologics, and Chemicals in U.S. Military Forces

Issues in Civilian Outplacement Strategies — Proceedings of a Workshop

The Lessons and Legacy of the Pew Health Policy Program

Linking Research and Public Health Practice: A Review of CDC's Program of Centers for Research and Demonstration of Health Promotion and Disease Prevention

Local Fiscal Effects of Illegal Immigration — Report of a Workshop

Managing Managed Care: Quality Improvement in Behavioral Health

Measuring Quality of Care: State of the Art — Summary of a Conference

Military Nursing Research: Bibliographies

Mortality of Veteran Participants in the CROSSROADS Nuclear Test

The New Americans: Economic, Demographic, and Fiscal Effects of Immigration (page 11)

New Findings on Welfare and Children's Development — Summary of a Research Briefing

Options for Poliomyelitis Vaccination in the United States — Workshop Summary

Pathways of Addiction: Opportunities in Drug Abuse Research

Paying Attention to Children in a Changing Health Care System — Summaries of Workshops

Pennington Biomedical Research Center: September 1996 Site Visit

Possible Health Effects of Exposure to Residential Electric and Magnetic Fields (page 2)

Preparing for the 2000 Census — Interim Report II (page 9)

Preparing for the 21st Century: Challenges Facing a Changing Society

Preparing for the 21st Century: Focusing on Quality in a Changing Health Care System

Representing Human Behavior in Military Simulations — Interim Report

Resource Sharing in Biomedical Research

A Review of the Radiological Assessments Corporation's Fernald Dose Reconstruction Report

Safe, Comfortable, Attractive, and Easy to Use: Improving the Usability of Home Medical Devices — Report of a Workshop

Schools and Health: Our Nation's Investment

Small-Area Estimates of School-Age Children in Poverty: Interim Report I — Evaluation of 1993 County Estimates for Title I Allocations

Spacecraft Maximum Allowable Concentrations for Selected Airborne Contaminants, Vol. 3

Tactical Display for Soldiers: Human Factors Considerations

Telemedicine: A Guide to Assessing Telecommunications in Health Care

Toxicity of Military Smokes and Obscurants, Vol. 1

Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests

Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions

Toxicology and Environmental Health Information Resources: The Role of the National Library of Medicine

Using Performance Monitoring to Improve Community Health: Framework and Community Experience — Workshop Summary

Vaccines Against Malaria: Hope in a Gathering Storm

Vitamin C in Food Aid Commodities: Initial Review of a Pilot Program

Workshop on Schizophrenia

Xenotransplantation: Science, Ethics, and Public Policy

Youth Development and Neighborhood Influences: Challenges and Opportunities — Summary of a Workshop

INDUSTRY, COMMERCE, AND TECHNOLOGY

Accelerated Aging of Materials and Structures: The Effects of Long-Term Elevated-Temperature Exposure

Ada and Beyond: Software Policies for the Department of Defense

Biomolecular Self-Assembling Materials: Scientific and Technological Frontiers

Bits of Power: Issues in Global Access to Scientific Data (page 14)

Competition in the Electric Industry: Emerging Issues, Opportunities, and Risks for Facility Operations — Conference Summary

Computing and Communications in the Extreme: Research for Crisis Management and Other Applications

Conflict and Cooperation in National Competition for High-Technology Industry

Database Needs for Modeling and Simulation of Plasma Processing

Digital Instrumentation and Control Systems in Nuclear Power Plants: Safety and Reliability Issues

Federal Facilities Beyond the 1990s: Ensuring Quality in an Era of Limited Resources — Summary of a Symposium

Fire Suppression Substitutes and Alternatives to Halon for U.S. Navy Applications

Fostering Industry-Initiated Environmental Protection Efforts

Glass as a Waste Form and Vitrification Technology — Summary of an International Workshop

Information Systems Trustworthiness — Interim Report

Marking, Rendering Inert, and Licensing of Explosive Materials — Interim Report

Materials and Processes Research and the Information Highway — Summary of a Workshop

Marine Structures Research Recommendations for Fiscal Years 1998-1999

Materials Processes Research and the Information Highway

Nonconventional Concrete Technologies: Renewal of the Highway Infrastructure

Observed Practices for Improving the Security and Confidentiality of Electronic Health Information — Interim Report

Preparing for the 21st Century: Technology and the Nation's Future

Prevention of Fracture in Ship Structure — Symposium Proceedings

Review of the Research Program of the Partnership for a New Generation of Vehicles — Third Report

Toward a New National Weather Service: Assessment of Hydrologic and Hydrometeorological Operations and Services

Toward a New National Weather Service: An Assessment of the Advanced Weather Interactive Processing System

Toward a New National Weather Service: Continuity of NOAA Satellites

Undersea Vehicles and National Needs

INTERNATIONAL AFFAIRS

America's Vital Interest in Global Health: Protecting Our People, Enhancing Our Economy, and Advancing Our International Interests

An Assessment of the International Science and Technology Center: Redirecting Expertise in Weapons of Mass Destruction in the Former Soviet Union

Biodiversity Conservation in Transboundary Protected Areas — Proceedings of an International Workshop, May 1994, Poland

Data Priorities for Population and Health in Developing Countries — Summary of a Workshop

Global Health in Transition: A Synthesis. Perspectives from International Organizations

Premature Death in the New Independent States

Proliferation Concerns: Assessing U.S. Efforts to Help Contain Nuclear and Other Dangerous Materials and Technologies in the Former Soviet Union

Reconstructing Science, Engineering, and Higher Education in Bosnia-Herzegovina and Croatia — Summary of a Meeting

Report of the Observer Panel for the U.S.-Japan Earthquake Policy Symposium

Reproductive Health in Developing Countries: Expanding Dimensions, Building Solutions

NATURAL RESOURCES AND THE ENVIRONMENT

Alluvial Fan Flooding

Barrier Technologies for Environmental Management — Summary of a Workshop

Building an Effective Environmental Management Science Program: Initial Assessment

Building an Effective Environmental Management Science Program: Final Assessment

Building a Foundation for Sound Environmental Decisions

Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies

The Dynamics of Sedimentary Basins

The Hanford Tanks: Environmental Impacts and Policy Choices

Innovations in Ground Water and Soil Cleanup: From Concept to Commercialization (page 15)

Learning to Predict Climate Variations Associated with El Niño and the Southern Oscillation: Accomplishments and Legacies of the TOGA Program

Linking Science and Technology to Society's Environmental Goals

Marine Mammals and Low-Frequency Sound: Progress Since 1994 — An Interim Report

Natural Climate Variability on Decade-to-Century Time Scales

A New Era for Irrigation

Preparing for the 21st Century: The Environment and the Human Future

Safe Water From Every Tap: Improving Water Service to Small Communities

The Scientific Basis for Preservation of the Mariana Crow

Stemming the Tide: Controlling Introductions of Nonindigenous Species by Ships' Ballast Water

Valuing Ground Water: Economic Concepts and Approaches

The Waste Isolation Pilot Plant: A Potential Solution for the Disposal of Transuranic Waste (page 7)

Wood in Our Future: The Role of Life-Cycle Analysis — Proceedings of a Symposium

THE SCIENTIFIC ENTERPRISE

1996 Assessment of the Army Research Laboratory

An Assessment of the National Science Foundation's Science and Technology Centers Program

Assessing Benefits of the Civil Works Research and Development Program: A Review of the U.S. Army Corps of Engineers Draft Report

Beyond Discovery series:
- *Global Positioning System: The Role of Atomic Clocks*
- *Human Gene Testing*
- *Modern Communication*

Can We Develop Performance Standards and Outcome Measures for the Research Enterprise?

Communication and Understanding Between Scientists and the Public

Driving Innovation Through Materials Research — Proceedings of the 1996 Solid State Sciences Committee Forum

Electrometallurgical Techniques for DOE Spent-Fuel Treatment: A Status Report on Argonne National Laboratory's R&D Activity

Electrometallurgical Techniques for DOE Spent-Fuel Treatment: Fall 1996 Status Report on Argonne National Laboratory's R&D Activity

Environmental Epidemiology, Vol. 2: Use of the Gray Literature and Other Data in Environmental Epidemiology

Evaluation of the U.S. Department of Energy's Alternatives for the Removal and Disposition of Molten Salt Reactor Experiment Fluoride Salts

An Evaluation of the U.S. Navy's Extremely Low Frequency Communications System Ecological Monitoring Program

Examining the Impact of Information Technology on Science and Engineering Research and Education

The Federal Science & Technology Budget, FY 1997

The Federal Science & Technology Budget Request FY 1998

Frontiers of Engineering: Reports on Leading Edge Engineering from the 1996 NAE Symposium on Frontiers of Engineering

The Future of Spatial Data and Society — Summary of a Workshop

The Global Ocean Observing System: Users, Benefits, and Priorities

High-Performance Computing in Seismology

Industry-University Research Collaborations — Report of a Workshop

Intellectual Property Rights and Research Tools in Molecular Biology — Summary of a Workshop

Intermetallic Alloy Development: A Program Evaluation

Laboratory Animal Management: Rodents

Massive Data Sets — Proceedings of a Workshop

Motion, Control, and Geometry — Proceedings of a Symposium

The National Scholars Program: Excellence with Diversity for the Future — Program Design

The National Scholars Program: Excellence with Diversity for the Future — Summary

NRL [Naval Research Laboratory] Strategic Series:
Boundary Layer Dynamics
Computer Science and Artificial Intelligence

Occupational Health and Safety in the Care and Use of Laboratory Animals

Preparing for the 21st Century: Science and Engineering Research in a Changing World

The Path to the Ph.D.: Measuring Graduate Attrition in the Sciences and Humanities

Radiochemistry in Nuclear Power Reactors

Rediscovering Geography: New Relevance for Science and Society

Review of the Department of Energy's Inertial Confinement Fusion Program

Review of New York State Low-Level Radioactive Waste Siting Process

Review of Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts

Satellite Gravity and the Geosphere: Contributions to the Study of the Solid Earth and Its Fluid Envelope

Technological Trajectories and the Human Environment

The Use of Multi-State Life Tables in Estimating Places for Biomedical and Behavioral Scientists — A Technical Paper

Watershed Research in the U.S. Geological Survey

World-Class Research and Development: Characteristics for an Army Research, Development, and Engineering Organization

TRANSPORTATION

1994 Northridge Earthquake

A Guidebook for Forecasting Freight Transportation Demand

A Handbook for Acquiring Demand-Responsive Transit Software

Advanced Traffic Management Systems and High-Occupancy-Vehicle Systems

Advancements in Concrete Materials Technology

Aggregate and Material Tests and Properties Related to Performance

Air Traffic Control Facilities: Improving Methods to Determine Staffing Requirements

Aircraft Noise Modeling

Application of Full-Scale Accelerated Pavement Testing

Applications of 3-D and 4-D Visualization Technology in Transportation

Asphalt Pavement Surfaces and Asphalt Mixtures

Aviation Management, Systems, and Economic Issues

Building Momentum for Change: Creating a Strategic Forum for Innovation in Highway Infrastructure

Bus Occupant Safety

The Bureau of Transportation Statistics: Priorities for the Future

Changeable Message Signs

Characteristics of Asphalt Binders

Clean Air and Highway Transportation: Mandates, Challenges, and Research Opportunities

Collecting and Managing Cost Data for Bridge Management Systems

Comparison of the 1994 Highway Capacity Manual's Ramp Analysis Procedures and the FRESIM Model

Conduct of Research & Technology Transfer Workshop Proceedings

Conference on Major Investment Studies in Transportation (MIS)

Conference on Transportation Programming Methods and Issues

Constructibility Review Process for Transportation Facilities

Constructibility Review Process for Transportation Facilities — Workbook

Continuing Project to Synthesize Information on Highway Problems

Current Research on Roadside Safety Features

Decennial Census Data for Transportation Planning: Case Studies and Strategies for 2000 — Vol. 1

Decennial Census Data for Transportation Planning: Case Studies and Strategies for 2000 — Vol. 2: Case Studies

Derailment of Transit Vehicles in Special Trackwork

Design and Construction of Asphalt Overlays and Hot-Mix Asphalt Construction Practices

Design and Evaluation of Large-Stone Asphalt Mixes

Effectiveness of Subsurface Drainage

Emerging Technologies in Geotechnical Engineering

Environmental Research Needs in Transportation

Facilitating the Implementation of Research Findings — A Summary Report

Fiber Drum Packaging for Transporting Liquid Hazardous Materials

Flexible Pavement Design and Rehabilitation Issues

Freight Transportation Data and Planning Issues, Trucking, and Marine Transportation

Freight Transportation Planning Practices in the Public Sector

Geometric and Other General Design Issues

Geosynthetics: Cold Regions, Flexible Pavements, and Other Issues

Guidelines for the Consistent Collection, Categorization, and Dissemination of Bus Transit Loss Data

Guidelines for the Development of Wetland Replacement Areas

Guidelines for the Location and Design of Bus Stops

Guidelines for Transit Facility Signing and Graphics

Highway Capacity Analysis for Interrupted and Uninterrupted Flow Facilities

Human Performance, Driving Simulation, Information Systems, and Older Drivers

Illumination Guidelines for Nighttime Highway Work

Improved Methods for Increasing Wheel/Rail Adhesion in the Presence of Natural Contaminants

Improving Transit Security

Indemnification and Insurance Requirements for Design Consultants and Contractors on Highway Projects

Innovative Transportation Data Management, Survey Methods, and Geographic Information Systems

Inspection Policy and Procedures for Rail Transit Tunnels and Underground Structures

Institutional Barriers to Intermodal Transportation Policies and Planning in Metropolitan Areas

Integrating Americans with Disabilities Act Paratransit Services and Health and Human Services Transportation

Integration of Light Rail Transit into City Streets

Intelligent Transportation Systems: Deployment and User Needs

Intermodal Freight Terminal of the Future

Intersection Sight Distance

Issues in Geotechnical Engineering Research

Land Development Regulations that Promote Access Management

Leveraging Information for Better Transit Maintenance

Maintenance and Management of Highway Structures

Maintenance Management and Winter Operations

Managing Contract Research Programs

Measuring and Valuing Transit Benefits and Disbenefits

Methods for Household Travel Surveys

Monitoring Bus Maintenance Performance

Multipurpose Fare Media: Developments and Issues

National Conference on Developing a Research Framework for Intermodal Transportation

National Conference on Intermodalism: Making the Case, Making It Happen

Nondestructive Testing of Unknown Subsurface Bridge Foundations — Results of NCHRP Project 21-5

Nonmotorized Transportation: International Perspectives on Planning and Safety

On-Site Evaluation and Calibration Procedures for Weigh-In-Motion Systems

Passenger Transfer System Review

Pavement Management Systems for Streets, Highways, and Airports

Pavement Subsurface Drainage Systems

Paying Our Way: Estimating Marginal Social Costs of Freight Transportation

Pedestrian and Bicycle Research

Performance Measurement in State Departments of Transportation

Photographic Traffic Law Enforcement

Planning Techniques to Estimate Speeds and Service Volumes for Planning Applications

Plasma Arc Cutting of Bridge Steels

Portland Cement Concrete Pavements, Bridges, and Quality Management

Procedure for Determining Work-Zone Speed Limits

Procurement Specification Guidelines for Mass-Transit Vehicle Window Glazing

Progress Report on Maintenance and Operations Personnel

Protocol for In-Service Evaluation of Bridges with Epoxy-Coated Reinforcing Steel

Public Agency Guidance on Employer-Based TDM Programs

Public Transportation 1996: Bus, Rural and Intercity, and Paratransit

Public Transportation 1996: Planning, Management, Marketing, New Technology, and Safety and Security

Public-Sector Aviation Issues: Graduate Research Award Papers 1994-1995

Public-Sector Aviation Issues: Graduate Research Award Papers 1995-1996

Rail Transit Capacity

Railroad Safety and Environmental Research

Recent Research in Pavement Performance

Recycled Rubber, Aggregate, and Filler in Asphalt Paving Mixtures

Reduced Visibility Due to Fog on the Highway

Report on the 1995 Scanning Review of European Bridge Structures

Requirements That Impact the Acquisition of Capital-Intensive Long-Lead Items, Rights of Way, and Land for Transit

Research Problem Statements for User Information Systems

Research Problem Statements: Design and Construction of Transportation Facilities

Research Problem Statements: Hydraulics, Hydrology, and Water Quality

Responding to Vandalism of Transit Bus and Rail Vehicle Passenger Windows

Review of International Practices Used to Evaluate Unsignalized Intersections

Rigid Pavement Design and Rehabilitation Issues

Settlement of Bridge Approaches: The Bump at the End of the Bridge

Small-Magnitude Measurements in Geotechnical Engineering

Statewide Transportation Planning

Statistical Methods and Accident Analysis for Highway and Traffic Safety

Structures, Culverts, and Tunnels

Technology Transfer, Evaluation, and Partnerships

The Role of Transit in Creating Livable Metropolitan Communities

Traffic and Highway Safety: Occupant Restraints, Safety Management, and Emergency and Commercial Vehicles

Traffic and Pavement Surface Monitoring Issues

Traffic Control Devices, Visibility, and Evaluations

Traffic Flow Theory and Traffic Flow Simulation Models

Traffic Management for High-Speed Networks — 4th lecture in the International Science Lecture Series

Transit and Urban Form, Vols. 1 & 2

Transit Risk Manager: Risk Management Software for Bus Transit Systems

Transit-Focused Development

Transportation Aesthetics

Transportation Demand Management and Ridesharing

Transportation Finance, Economics, and Strategic Management

Transportation Forecasting: Short-Term Practical Improvements, Travel Behavior Models and Issues, and Artificial Intelligence

Transportation History and TRB's [Transportation Research Board] 75th Anniversary

Transportation Law Issues 1996

Transportation Planning Applications

Transportation Planning, and Land Use at State, Regional, and Local Levels

Transportation-Related Air Quality and Energy

Transverse Cracking in Newly Constructed Bridge Decks

Variability in Highway Pavement Construction

Wheel/Rail Noise Mitigation

Work-Zone Safety and Pavement Markings and Materials

Current Congressionally Authorized Activities*

Public Law

102-4 **Agent Orange Act of 1991**

Periodic review, summary, and assessment of the scientific evidence, and recommendation for further scientific studies concerning the association between exposure to herbicide and each disease suspected to be associated with such exposure (Reports to be submitted at least biennially for a period of up to 10 years)

103-317 **Departments of Commerce, Justice, and State, and the Judiciary and Related Agencies Appropriations Act of 1995**

Analysis of the proposed objectivity, methodology, and application of "environmental accounting," which seeks to provide a measurement of the contribution of natural resources to the nation's economy

103-327 **Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act**

Assessment of several aspects of the Environmental Protection Agency's research and development activities

103-333 **Departments of Labor, Health and Human Services, and Education Appropriations Act**

Study of school finance equalization efforts in the states

103-446 **Veterans Benefits and Improvements Act**

Yearly review of the adequacy and implementation of the Department of Veterans Affairs' uniform and comprehensive medical evaluation protocol for Persian Gulf War veterans

104-106 **Department of Defense Authorization FY 96**

Review of current and planned service and defense-wide programs for command, control, communications, computers, and intelligence, with a special focus on cross-service and inter-service issues

104-132 **Anti-Terrorism and Effective Death Penalty Act of 1996**

Study of the marking, rendering inert, and licensing of explosive materials (see Public Law 104-208)

104-146 **Ryan White CARE Reauthorization Act of 1995**

Evaluation of state efforts in reducing perinatal transmission of HIV

104-169 **National Gambling Impact Study Commission Act**

Assessment of the impact of gambling on individuals, communities, society, and the economy

104-182 **Safe Drinking Water Act Amendments of 1996**

Study of health risks associated with exposure to low levels of arsenic in drinking water

Study of risks posed by radon in drinking water

*While all projects listed have been designated in legislation, a few lack funding and final contracts.

104-204	**Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act**
	Study of the Environmental Protection Agency's Mobile Source Emissions Factor Model
104-208	**Department of Defense Appropriations (Omnibus Spending Bill)**
	Study of the "tagging" of smokeless and black powder, by any viable technology, for purposes of detection and identification
	Review of the status of research into cancer among minorities and medically underserved
	Establishment of an advisory committee on surface transportation safety
	Review of the National Biological Survey, beginning 1998 and then every 5 years
104-264	**Federal Aviation Administration Reauthorization**
	Study of detection of weapons and explosives in commercial aviation
104-273	**Helium Privatization Act of 1996**
	Study of whether disposal of helium reserves will have a substantially adverse effect on U.S. scientific, technical, biomedical, or national security interests
104-297	**Sustainable Fisheries Act Amendments of 1996; Magnuson Fishery Conservation and Management Act**
	Report on community development quota programs for commercial fishing and processing
104-303	**Water Resources Development Act of 1996**
	Study of the U.S. Army Corps of Engineers' use of risk-based analysis for the evaluation of hydrology, hydraulics, and economics in flood-damage reduction studies
104-324	**U.S. Coast Guard Authorization Act of 1995**
	Study of the environmental and public health risks posed by discharges of group-5 fuel oil
	Study of unintentional or accidental discharge of fuel oil during lightering (fuel loading or off-loading) activity
	Study of automatic shut-off valves for marine fueling equipment
105-33	**Balanced Budget Act of 1997**
	Analysis of the expansion or modification of preventive or other benefits provided to Medicare beneficiaries under Title XVIII of the Social Security Act
	Study of payments for clinical laboratory tests, under Title XVIII Part B of the Social Security Act
	Analysis of whether the accessibility and quality of health care for low-income individuals are a consideration in the quality-assurance programs and accreditation standards applicable to managed care entities in the private sector or under contract with Medicare
	Study of early and periodic screening, diagnostic, and treatment services

105-65 **Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act of 1998**

Development of a comprehensive, prioritized, near- and long-term program for particulate matter research and monitoring

Study to evaluate the engineering challenges posed by extravehicular-activity requirements of space station construction and assembly

Study of the effectiveness of the Environmental Protection Agency's inspection and maintenance programs

105-78 **Departments of Labor, Health and Human Services, and Education Appropriations Act of 1998**

Study of the policies and process used by the National Institutes of Health to determine funding allocations for biomedical research

Study to determine if an equivalency scale can be developed that would allow scores from commercially available, standardized tests to be compared with state assessments and with the National Assessment of Educational Progress

Evaluation of all test items developed or funded by a federal agency, to determine their quality, validity, adequacy, and freedom from bias; whether they address the needs of disadvantaged, disabled, or limited-English students; and whether tests can be used for tracking the graduation or promotion of students

Study and recommendations for appropriate methods, practices, and safeguards to ensure that (1) tests to assess student performance are not used in a discriminatory manner or inappropriately for student promotion, tracking, or graduation; and (2) tests adequately assess student reading and mathematics comprehension in the form most likely to yield accurate information on student skills

Study of the effects of televised alcohol advertising on youth alcohol consumption

An evaluation of welfare reform outcomes

105-85 **National Defense Authorization Act for Fiscal Year 1998**

Assessment of aspects of the chemical non-stockpile materiel project, which includes chemical agent identification kits, plans for disposal of the kits, and the potential changes in policy and disposal alternatives that could reduce the cost of the program without reducing overall safety

105-115 **Food and Drug Administration Modernization Act of 1997**

Study of the effect on humans of the use of elemental, organic, or inorganic mercury as a drug or dietary supplement

Study of the scientific issues raised as a result of an amendment to the Federal Food, Drug, and Cosmetic Act and the Food Health Service Act regarding dissemination of written information on the safety, effectiveness, or benefit of new uses for a drug or device

105-119 **Departments of Commerce, Justice, and State, the Judiciary and Related Agencies Appropriations Act of 1998**

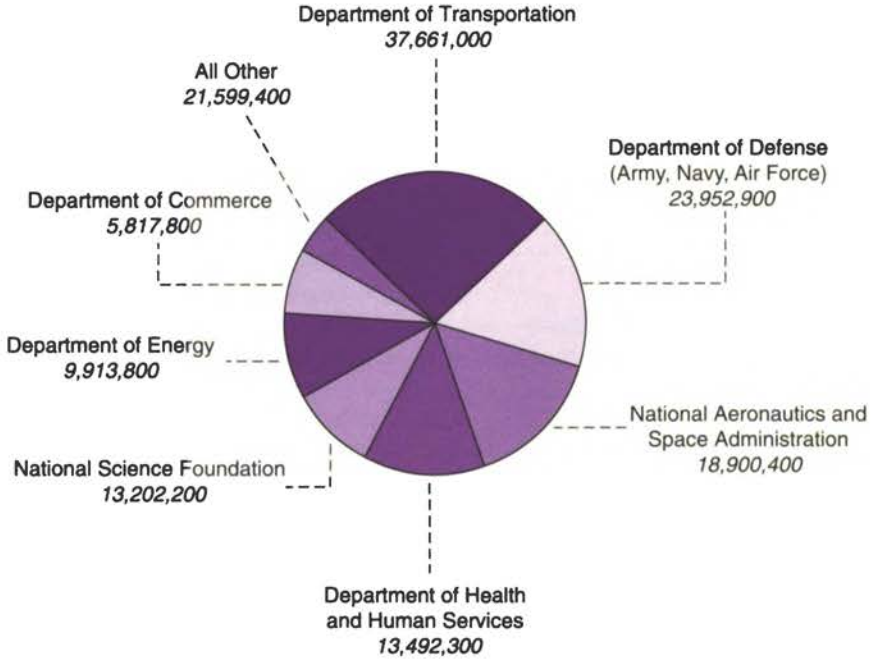
Advice on the most effective techniques and technologies to block children from receiving pornographic images via the Internet

Study of the role of marine sanctuaries in marine resource conservation, as well as the usefulness of marine reserves, including their impacts on water quality and the abundance of living marine resources

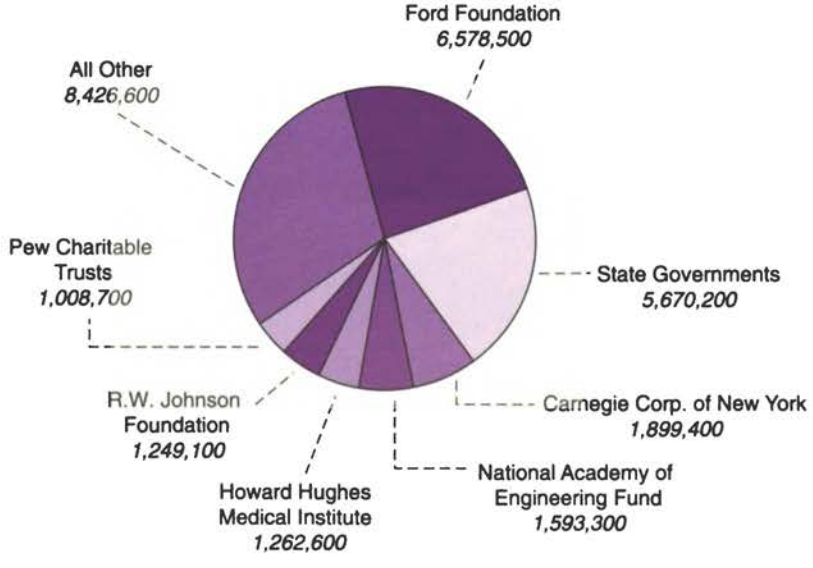
One-time study of fisheries resources of summer flounder

REVENUE APPLIED TO FISCAL YEAR 1997

Federal Sources
Total $144,539,600



Private and Nonfederal Sources
Total $27,688,400



U.S. Government Agencies (Grants and Contracts)

Agency for International Development	$1,853,000
Commission on Immigration Reform	476,100
Defense Logistics Agency	20,800
Defense Mapping Agency	68,000
Defense Special Weapons	1,593,600
Defense Supply Service	2,165,200
Department of Agriculture	1,205,400
Department of Commerce	5,817,800
Department of Defense	
Department of the Air Force	3,158,300
Department of the Army	12,862,500
Department of the Navy	7,932,100
Department of Education	2,867,800
Department of Energy	9,913,800
Department of Health and Human Services	13,492,300
Department of the Interior	1,249,100
Department of Justice	74,900
Department of Labor	583,000
Department of State	1,051,000
Department of Transportation	37,661,000
Department of Veterans Affairs	1,342,300
Environmental Protection Agency	5,364,300
Executive Office of the President	333,100
Federal Emergency Management Agency	237,100
National Aeronautics and Space Administration	18,900,400
National Science Foundation	13,202,200*
National Security Agency	31,200
Nuclear Regulatory Commission	218,000
Smithsonian Institution	10,600
Social Security Administration	313,900
U.S. Postal Service	26,900
U.S. Treasury	513,900
TOTAL	**$144,539,600**

*Includes funds transferred from other agencies

Private and Nonfederal Sources (Grants and Contracts)

American Public Transit Association	$50,000
Amtrak	50,000
Association of American Railroads	50,000
Robert C. Byrd Institute	125,000
California Wellness Foundation	50,000
Carnegie Corp. of New York	1,899,400
Annie E. Casey Foundation	137,600
Commonwealth Fund	224,000
Charles E. Culpeper Foundation	59,000
Digital Equipment Corp.	60,000
Exxon Education Foundation	209,900
Ford Foundation	6,578,500
William T. Grant Foundation	218,500
German-American Academic Council	328,900
Greenwall Foundation	156,200
Howard Hughes Medical Institute	1,262,600
ILSI Research Foundation	99,000
Robert Wood Johnson Foundation	1,249,100
Henry J. Kaiser Foundation	108,300
William Keck Foundation	106,200
W. K. Kellogg Foundation	268,400
Esther A. & Joseph Klingenstein Fund Inc.	62,500
John D. & Catherine T. MacArthur Foundation	656,200
Lucille P. Markey Charitable Trust	63,200
Andrew W. Mellon Foundation	503,900
Merck Company Foundation	75,500
Motorola Inc.	110,000
National Asphalt Paving Association	50,000
National Water Research Institute	113,900
Open Society Institute	125,900
David and Lucile Packard Foundation	64,500
Pew Charitable Trusts	1,008,700
RGB Technology Inc.	343,400
Charles H. Revson Foundation	66,400
Rockefeller Foundation	256,900
Spencer Foundation	50,000
Alfred P. Sloan Foundation	583,600
Texas Instruments Inc.	52,000
Burroughs Wellcome Co.	69,800
Robert W. Woodruff Foundation	500,000
Various state governments	5,670,200
Other (less than $45,000 per donor)	741,400
TOTAL	**$24,458,600**

Private and Nonfederal Sources (Contributions)

Amoco Corp.	$15,000
AT&T Bell Laboratories	25,000
Bristol-Meyers Co.	35,500
Chevron U.S.A. Inc.	20,000
Citibank, N.A.	25,000
Ford Motor Co.	25,000
GTE Foundation	45,000
General Electric Foundation	25,000
Hoffman-LaRoche Inc.	20,000
Honda of America MFG Inc.	12,500
Intel Foundation	60,000
International Bank for Reconstruction and Development	67,100
International Brain Research Organization	15,000
Johnson & Johnson Family of Companies	30,000
Lucent Technologies	25,000
Massachusetts Health Data Consortium Inc.	25,000
Microsoft Corp.	100,000
Milliken and Co.	35,000
Mitchell Energy and Development Corp.	225,000
Monsanto Co.	51,500
National Academy of Engineering Fund	1,593,300
National Pork Producers Council	15,000
Nissan Research & Development Inc.	25,000
Norfolk Southern Railway Co.	25,000
Northern Telecom	70,000
Northwestern University	12,500
Ortho Pharmaceutical Corp.	75,000
Pfizer Inc.	80,000
Proctor and Gamble Fund	60,000
Roadway Express Inc.	15,000
SEMATECH	25,000
Silicon Valley Group Inc.	15,000
SmithKline Beecham Pharmaceuticals	11,000
Stanford University	12,500
Texaco Foundation	15,000
Washington University	12,500
Xerox Corp.	47,500
Other (less than $10,000 per donor)	238,900
TOTAL	**$3,229,800**
TOTAL private and nonfederal	**$27,098,400**

About the Institution

The U.S. government's need for an independent adviser on science and technology matters became evident during the height of the Civil War. On March 3, 1863, President Lincoln approved the congressional charter which created that adviser, the National Academy of Sciences.

The private, nonprofit Academy has counseled the federal government in wartime and peacetime ever since. As science and technology issues have grown in complexity and scope, so too has the Academy. Four separate but related entities continue this work.

THE NATIONAL ACADEMY OF SCIENCES (NAS) is a society of distinguished scholars engaged in scientific and engineering research, and dedicated to the use of science and technology for the public welfare. In addition to its role as adviser to the federal government, NAS sponsors symposia, monitors human rights abuses against scientists worldwide, promotes the public understanding of science, and publishes a research journal, *Proceedings of the National Academy of Sciences*.

Bruce Alberts, President — E. William Colglazier, Executive Officer
Suzanne H. Woolsey, Chief Operating Officer

THE NATIONAL ACADEMY OF ENGINEERING (NAE) is an association of outstanding engineers from industry and academia. Established in 1964 under the NAS charter, NAE is autonomous in its administration and selection of its members. It shares with NAS responsibility for advising the federal government. It also conducts studies of policy issues in engineering and technology, encourages education and research, and grants awards to distinguished engineers.

Wm. A. Wulf, President — William C. Salmon, Executive Officer

THE INSTITUTE OF MEDICINE (IOM) is an association of eminent health care professionals and experts in related fields. Established by NAS in 1970, IOM examines policy matters pertaining to the health of the public. It shares responsibilities with NAS and NAE for advising the federal government. It also undertakes studies on its own initiative, addressing issues of health care, health sciences, and education.

Kenneth I. Shine, President — Karen Hein, Executive Officer

THE NATIONAL RESEARCH COUNCIL, founded in 1916, has become the principal administrative arm of NAS, NAE, and IOM. The Council's staff convenes study committees for the NAS and NAE, and most of the studies appear under the Council's name. IOM convenes its own committees, following the same quality assurance procedures used by the Council.

In addition to conducting studies, the National Research Council brings together scientists, engineers, and educators to set priorities and encourage self-examination and improvement within their professions. It also works to improve science and math education at all levels, from kindergarten through doctoral programs.

Bruce Alberts, Chair — Wm. A. Wulf, Vice Chair
E. William Colglazier, Executive Officer — Suzanne H. Woolsey, Chief Operating Officer