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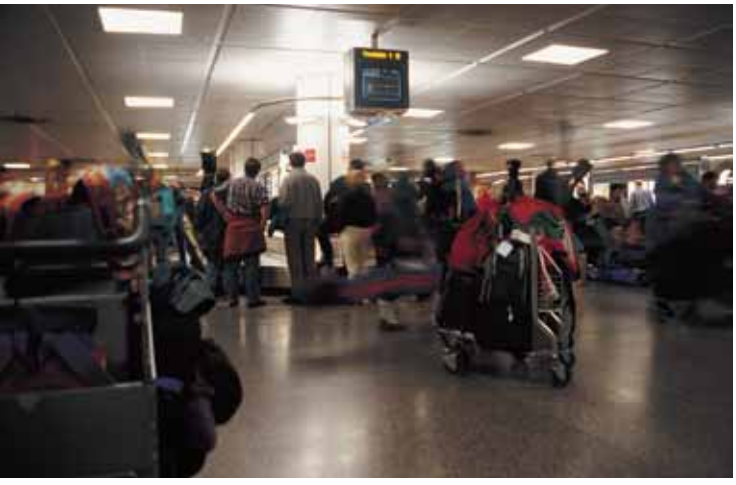

Steps to Protect Mars From Contamination

Placing Science Labs Under the Microscope

Scrutinizing the Cleanup of Coeur d'Alene

America's Frontline Defense Against Disease

Fall 2005
vol. 5 number 3

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

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THE NATIONAL ACADEMIES

Supporting Science by Communicating It

As the new president of the National Academy of Sciences and chair of the National Research Council, I want to introduce myself. But before doing so, let me express my deep appreciation and respect to Bruce Alberts. His 12 years of leadership here were characterized by high levels of energy and integrity and many impressive achievements.

My journeys in science have been wide and personally stimulating. Through my undergraduate and graduate student years, I studied electrical engineering with emphasis on physics and applied mathematics. Plasma physics led me to the Earth's ionosphere; the chemistry of the atmosphere followed as my research focus. The chemical composition of air is controlled by physical chemistry, by microbiological and geochemical sources, and the interaction of electromagnetic radiation with atoms and molecules, and it varies over short and long times and geographically. In my research on these phenomena, human inputs and influences became increasingly detectable, introducing roles of human behavior, technology, and public policy on the global environment.

In fields from cosmology through fundamental biology, science is able to map out such mechanisms by observing and explaining phenomena, and it poses new, deeper questions. Science also empowers humans by serving as the basis for beneficial technologies and health care and for wise societal decisions.

The public has been well-rewarded for supporting scientific research and indeed all of higher education. Yet today, recognition of the great rewards that have accrued from science and of potential future benefits is not at all commensurate. We have strong supporters but there is also widespread apathy and, in some quarters, antagonism toward science.

We must improve our communications with the public, to demonstrate better the benefits of science to individuals and to the entire country. Similarly we must assure people that the study of science and mathematics is exciting and important. By building understanding and re-building enthusiasm for science, we can gain political and financial support for science and for higher education.

Our National Academies reports are an excellent starting point. Our nonpartisan, peer-reviewed studies analyze complex and controversial topics. They provide the basis for effective use of resources — both natural and financial — in all matters of science, technology, medicine, and social policy.

All of you who participate in these studies help create this great resource. We will be calling on you to help us communicate more effectively with the public at large. A more science-oriented public is an outcome that will reward all of our efforts.

Ralph J. Cicerone

RALPH J. CICERONE
President, National Academy of Sciences

Educating America's ENGINEERS

The Vital Role of Community Colleges

For many U.S. students who aspire to earn bachelor's or graduate degrees in engineering, community colleges can be a critical pipeline to four-year institutions.

Consider: Studies show that 20 percent of people with engineering degrees started their academic careers by earning at least 10 credits at community colleges. And 40 percent of graduates who received bachelor's or master's degrees in engineering in 1999 and 2000 had attended a community college. In some parts of the country, the trend is even more pronounced. In 2002 the California Council on Science and Technology reported that 48 percent of graduates with science or engineering degrees from the state system got their start at community colleges and later transferred to four-year schools.

Community colleges are essential to the schooling of many American engineers, says a new report from the National Academy of Engineering and the National Research Council, but this educational pipeline is operating beneath its capacity in this field. Four-year institutions should work more closely with community colleges to recruit, retain, and train students seeking bachelor's or advanced degrees in engineering. Two- and four-year schools that team up for this purpose also

should have clear, effective "articulation agreements" — programs and policies to foster seamless transfers of community college students to four-year colleges or universities. Moreover, the best articulation agreements focus on student outcomes, such as mastery of important skills.

On the whole, educators, legislators, and industry representatives should pay more attention to the pool of prospective engineers at community colleges, the report says. Two-year institutions attract many minority and female students, making community colleges good places for initiatives to increase diversity in the nation's engineering work force. Plus, research shows that transfer students with associate's degrees in engineering science are just as likely to receive B.S. degrees in engineering as students who attend only four-year campuses.

There is no "one size fits all" approach to the academic preparation of students pursuing engineering degrees or to enhancing the community college pathway to this field. But good communication and true collaboration are often the keys to successful transfer partnerships between two- and four-year colleges, the report emphasizes. As a start, partners should work together to recruit engineering students. High school outreach programs could be developed jointly, for example. And four-year institutions could support community colleges as a viable route to bachelor's degrees. Individualized counseling also should be provided early and often to engineering students at both two- and four-year institutions.

Successful partners communicate frequently, visit each other's campuses, discuss changes in curricula, and sometimes share faculty, says the report, which includes descriptions of stellar programs and practices. One example is the Transfer Opportunity Program (TOP), a collaboration between the University of California, Davis, and 15 northern California community colleges. The university's TOP coordinators visit participating colleges to counsel students and parents on admission to UCD and to discuss issues such as financial aid and academic requirements for particular majors. Students who transfer through TOP receive counseling the summer before their fall enrollment, as well as full-time undergraduate staff advisers from engineering departments and early intervention services if they run into academic difficulties.

But generally, more research is needed on how community college students ultimately fare in engineering, the report says. All too often, community colleges lose sight of students once they transfer to four-year institutions — precisely when community colleges should begin tracking their graduates' educational and career development. Better data in this area could be used to improve transfer partnerships. Also, publicizing information on transfer students' successes in obtaining B.S. or advanced degrees and rewarding careers in engineering would demonstrate the value of community colleges' engineering programs — and likely boost recruitment rates. — *Vanee Vines*

Enhancing the Community College Pathway to Engineering Careers. Committee on Enhancing the Community College Pathway to Engineering Careers, National Academy of Engineering and National Research Council (2005, approx. 106 pp.; ISBN 0-309-09534-4, available from the National Academies Press, tel. 1-800-624-6242; $26.00 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11438.html>).

The committee was chaired by **James M. Rosser,** president, California State University, Los Angeles. The study was sponsored by the National Science Foundation.

A CRUCIAL SCIENCE PROJECT

Improving the Quality of U.S. High School Science Labs

Most U.S. high school science labs are themselves ripe for experimentation. On average, high school students enrolled in science classes spend about one period each week on laboratory work, such as comparing different cell types under a microscope. Lab activities have the potential to help students reach important goals, including cultivating an interest in science, developing scientific reasoning skills, and mastering science subjects. However, that potential is not being realized, says a new report from the National Research Council.

The report uses the term "laboratory experiences" to refer to students' direct interactions with the natural world or with data drawn from it. More study is needed on the value of such experiences and their role in science education, the report says. But teachers, curriculum developers, and other leaders can act now to make improvements using current research that embraces four key principles of solid instruction:

- Design science lab experiences with clear learning outcomes in mind
- Thoughtfully sequence lab experiences into science instruction
- Integrate learning science content and learning about the processes of science
- Incorporate ongoing student reflection and discussion

Researchers have begun to design and study "integrated instructional units" that connect lab experiences with lectures, class discussions, and other types of science learning. In this approach, students help frame research questions, create experiments, and construct scientific arguments. Evidence so far shows promising gains in science mastery, reasoning skills, and interest in science among diverse groups of students, the report notes.

Old habits may die hard, though. Historically, lab work has been disconnected from the flow of science lessons in U.S. classrooms. This is still typical, the report says. Lab experiences are often narrow in scope and more focused on mechanical procedures than on meaning. Old-style lab work persists for several reasons. Teachers rarely receive adequate training to lead effective labs, or they have inadequate access to curricula that marry lab experiences and instruction. The way schedules, space, and other resources are organized in most high schools also may thwart educators' efforts to learn how to improve science teaching. Plus, teachers may feel too pressed for time to teach labs well if they believe they must primarily focus on covering particular topics in their state's science standards.

In an increasingly complex, high-tech society, U.S. high school graduates need a basic understanding of science and technology to lead productive lives, the report says. To improve their understanding, most science laboratory experiences must be reformed. — *Vanee Vines*

America's Lab Report: Investigations in High School Science. Committee on High School Science Laboratories: Role and Vision, Board on Science Education, Center for Education, Division of Behavioral and Social Sciences and Education (2005, approx. 230 pp.; ISBN 0-309-09671-5, available from the National Academies Press, tel. 1-800-624-6242; $39.95 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11311.html>).

The committee was chaired by **Susan Singer,** professor of biology, Carleton College, Northfield, Minn. The study was sponsored by the National Science Foundation.

Blocking DISEASE at the BORDER

WAYS TO INTERCEPT MICROBIAL THREATS FROM ABROAD

Every year, some 120 million people pass in and out of America's many airports, seaports, and border crossings. Millions of tons of livestock, food products, and other cargo move through these ports of entry as well. And hitchhiking in any of these goods or people may be microbes capable of spreading a dangerous infectious disease.

For decades, a cadre of quarantine personnel from the U.S. Centers for Disease Control and Prevention stationed at national entry points has provided frontline defense against microbial threats from abroad by inspecting travelers and cargo for signs of infection or contamination. At one time, more than 500 personnel staffed 55 federal quarantine stations. But the perceived triumph over infectious disease led to the dismantling of most of the quarantine system in the 1970s. As of the beginning of this year, eight quarantine stations remained.

The emergence of nearly 40 new infectious diseases since 1973 — including SARS and more recently a new strain of bird flu — and the heightened fear of bioterrorism rekindled concern about the nation's capacity to intercept and respond to microbial agents arriving through the nation's ports of entry. Earlier this year, CDC embarked on a plan to increase the

number of quarantine stations to as many as 25. The agency asked the Institute of Medicine to offer insights on enhancing the effectiveness of these stations and the broader quarantine system.

Given the rapid pace of modern trade and transport and the new threats posed by bioterrorism, the committee convened to study the issue concluded that the traditional functions of quarantine stations — such as observing passengers as they disembark from planes — have their place, but by themselves are no longer sufficient to meet the modern challenges.

"Quarantine has to evolve into a system of clearly defined connections among a range of individuals and agencies with the

skills and resources to detect and respond to a serious communicable disease or bioterrorism," said committee chair Georges Benjamin, executive director of the American Public Health Association. "And that network should be led by CDC and guided by a comprehensive national plan."

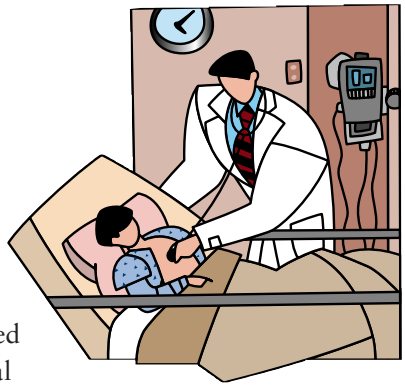
Dealing with microbial threats involves many organizations and individuals, ranging from local public health departments and hospitals staffs to customs and border protection agents, agriculture inspectors, and the U.S. departments of State and Homeland Security. Currently, it is not clear who would have the ultimate authority for coordinating a response should another SARS virus or a pandemic flu reach U.S. shores through international travel and trade. CDC is the appropriate agency to assume this leadership role, the committee said, but in doing so the agency should work collaboratively with its many partners, recognizing the various jurisdictions involved and taking into account local resources and emergency response plans already in place. Federal and state laws should ensure that quarantine personnel have clear authority to carry out their tasks.

Because foresight is crucial to ensuring the most coordinated and effective response, CDC quarantine officials should begin assessing the risks posed by various infectious agents that could enter the country via people or cargo and develop a national strategic plan based on the results, the committee said. The plan should outline the roles and responsibilities for the various organizations that would participate in a response and spell out the lines of authority and communication that should be followed. This will ensure that finite resources are used effectively and that those involved know who is in charge of different activities in routine and emergency situations. — *Christine Stencel*

Quarantine Stations at U.S. Ports of Entry Protecting the Public. Committee on Measures to Enhance the Effectiveness of the CDC Quarantine Station Expansion Plan for U.S. Ports of Entry, Board on Global Health and Board on Population Health and Public Health Practice, Institute of Medicine (2005, approx. 300 pp.; ISBN 0-309-09951-X; available from the National Academies Press, tel. 1-800-624-6242; $42.00 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11435.html>).

The committee was chaired by **Georges C. Benjamin,** executive director, American Public Health Association, Washington, D.C. The study was funded by the U.S. Centers for Disease Control and Prevention.

Medical Device Monitoring Needs a BOOST



Pacemakers, wheelchairs, stents, and other medical technologies save countless lives and help people lead fuller lives. Although the complexity of some devices like pacemakers necessitates extensive clinical evaluation before they can be used with patients, premarket testing may not catch all potential problems. And problems with even comparatively simple medical devices can lead to serious injuries, for instance when the stiff wire arms of orthodontic headgear unintentionally spring free as the wearer sleeps.

To ensure the safety of medical devices after they are put on the market — especially ones used with children — Congress should see to it that the U.S. Food and Drug Administration establishes a better system for postmarket monitoring, says a new report from the Institute of Medicine.

Approximately 80,000 medical devices are marketed in the United States, ranging from simple plastic tubing to cerebrospinal fluid shunts. Postmarket surveillance is intended to detect early on any safety problems that may arise. Devices used with young people merit particular attention because children's rapid growth and active lifestyles can affect the longevity and functioning of many products, and likewise the devices may affect children's development.

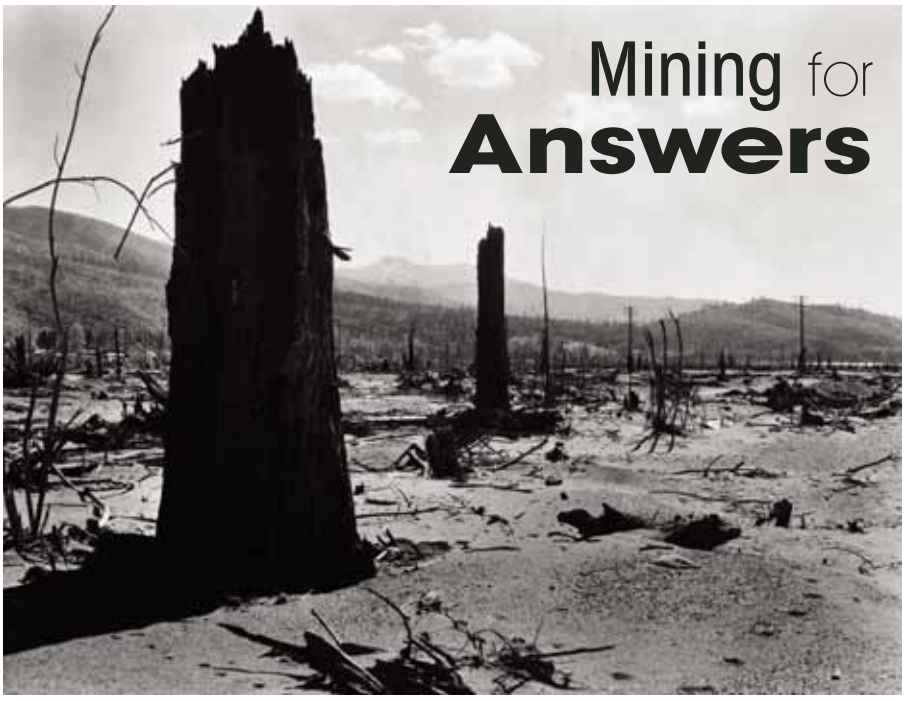
The report calls on Congress to bolster FDA's authority to require manufacturers to conduct postmarket safety studies for certain categories of devices. And given children's growth spurts and developmental changes, which can occur over many years, studies of devices used with children should not be limited to the typical three years. The agency also needs to monitor more carefully the status of these studies. Although FDA has asked for dozens of postmarket studies, it could not say with certainty which had been initiated or completed or otherwise confirm their progress because of inadequate systems for tracking them, the report says. Moreover, FDA needs to share publicly the data collected.

FDA should encourage health care providers and patients and their families to submit reports about problems associated with devices. Patients, families, and others who are taking on greater responsibility for operating complex medical equipment may not know that they can report problems to FDA or that the agency has a safety checklist for using medical devices at home.

It is important to note that device-related problems are relatively rare. While millions of patients use medical equipment every year, 151,900 reports on adverse events were submitted to FDA in 2004. At least 2,684 involved patients under age 21, although this number is undoubtedly low due to lack of age information on many reports. — *Christine Stencel*

Safe Medical Devices for Children. Committee on Postmarket Surveillance of Pediatric Medical Devices, Board on Health Sciences Policy, Institute of Medicine (2005, approx. 352 pp.; ISBN 0-309-09631-6; available from the National Academies Press, tel. 1-800-624-6242; $44.95 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11313.html>).

The committee was chaired by **Hugh Tilson,** professor of public health leadership, epidemiology, and health policy, University of North Carolina, Chapel Hill. The study was funded by the U.S. Food and Drug Administration.



Mining for Answers

REPORT WEIGHS EPA'S DECISIONS ON A CONTROVERSIAL CLEANUP

For over a century, the steep hills of the Coeur d'Alene region of Idaho were home to some of the richest metal mines in the United States, producing huge amounts of silver, zinc, and lead. But for the region itself, mining was a mixed blessing. It provided a living — albeit a difficult and dangerous one — to many residents and made a few of them wealthy, but it also left a less welcome inheritance: widespread and lingering pollution.

Unhampered by environmental laws for much of the 20th century, these mining operations emitted large quantities of sulfur dioxide and lead into the air and dumped mining and milling waste into the Coeur d'Alene River and its tributaries. Metals were washed throughout the river basin, poisoning fish and waterfowl, settling in the soil of residential yards, and eventually turning up in the bloodstreams of local children.

High levels of lead in children's blood and in the environment prompted the U.S. Environmental Protection Agency in 1983 to designate a 21-square-mile area around the Bunker Hill Mining and Metallurgical Complex for cleanup under the federal Superfund law. EPA later broadened the Superfund project to include all polluted areas within the 1,500-square-mile Coeur d'Alene River Basin, and in 2002 proposed

a $359 million plan to clean up much of the contamination over 30 years.

The expansion was unpopular with many of the basin's residents, who were skeptical that the massive effort was necessary and worried that the Superfund label would frighten businesses and tourists away, further hurting an economy already devastated by the loss of mining jobs. Other residents, including the Coeur d'Alene Tribe, demanded that the pollution be addressed. The National Research Council stepped into this contentious mix after being asked by Congress to evaluate whether EPA's assessment of the basin's problems and its cleanup plan were scientifically sound.

The study committee's report says that EPA was correct in concluding that lead in the environment poses a health risk to some residents in the wider basin. And the agency's main solution for countering this risk — replacing polluted soil in residential yards with clean soil — also was warranted. But given the high levels of lead in the soils of many communities, the committee said that the rate of blood testing has been less than optimal. All children ages 1-4 throughout the basin should be screened annually for blood lead.

Though EPA's decisions about human health risks were generally sound, the committee found some serious blind spots in the agency's plan for cleaning up the environment and protecting fish and wildlife. For example, the plan doesn't adequately consider the basin's frequent floods, which could recontaminate areas that have been cleaned. And groundwater has not been targeted, even though the main source of dissolved metals in rivers and lakes — and the greatest threat to aquatic life in the basin — is zinc that seeps into surface water from groundwater. EPA should identify specific places where zinc is leaching into groundwater and set priorities for removing or stabilizing these materials.

The Coeur d'Alene River Basin is not the only region in the nation that is struggling to cope with pollution left over from mining. Scores of other mining areas are on the Superfund cleanup list as well, including some as large as the Coeur d'Alene site. In dealing with these complex mining "megasites," the committee said, rigid long-term cleanup plans won't work. Instead, plans should be implemented in phases and adjusted after the results of each step are evaluated. And institutions are needed that can sustain the cleanup over the long haul, since sites such as Coeur d'Alene will be dealing with their unwanted legacy for the foreseeable future. — *Sara Frueh*

Superfund and Mining Megasites: Lessons from the Coeur d'Alene River Basin. Committee on Superfund Site Assessment and Remediation in the Coeur d'Alene River Basin, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2005, approx. 382 pp.; ISBN 0-309-09714-2; available from the National Academies Press, tel. 1-800-624-6242; $55.00 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11359.html>).

The committee was chaired by **David J. Tollerud,** professor of public health, medicine, and pharmacology/toxicology, and chair, department of environmental and occupational health sciences, School of Public Health and Information Sciences, University of Louisville, Louisville, Ky. The study was funded by the U.S. Environmental Protection Agency.

Rounding Up Disaster Experts

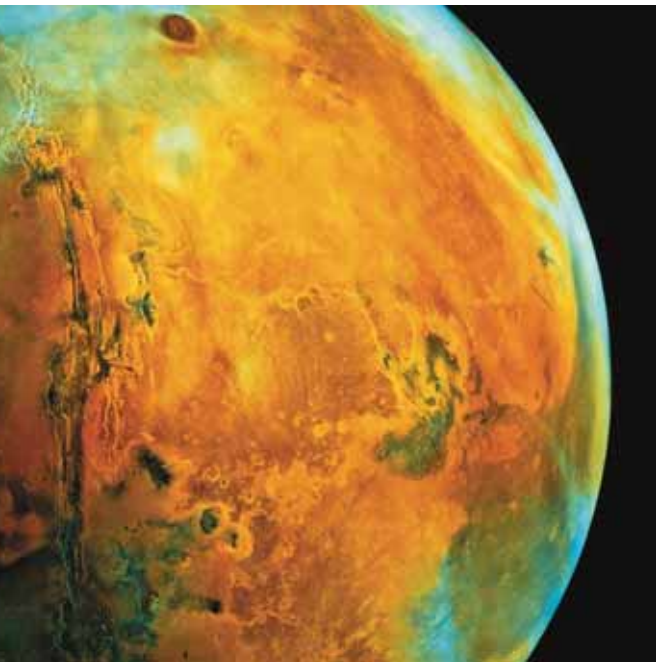
Before an audience of emergency management officials, meteorologists, and disaster researchers that was gathered at the National Academies this past March, Shirley Laska, director of the Center for Hazards Assessment, Response, and Technology at the University of New Orleans, warned of the risks a category 4 or 5 hurricane posed to her city — including an inability to evacuate carless residents and the possibility that levees could give way to an overwhelming storm surge. No one in the room knew how horrifyingly prophetic her remarks would become in six months' time.

Laska was speaking to the National Research Council's Disasters Roundtable, which meets at least three times a year to bring together experts in hazard reduction and disaster response for a dialogue on what lessons can be learned from past disasters and how to better prepare for future ones. Besides hurricanes, recent roundtables have focused on last year's devastating tsunami in the Indian Ocean; how sprawl is putting more homes in the path of forest fires; and what the "emergency manager of the future" will look like. Roundtable steering committee member Dennis Wenger, a program officer at the National Science Foundation, which funds many of the roundtable's activities, said the workshops help to drive research agendas and to put important disaster issues on the radar screens of policy-makers. Wenger says its meetings attract some of the nation's foremost experts. "The roundtable provides a forum for free and open exchange," he said, adding that they also afford a rare opportunity for "good interaction" among officials from different agencies.

Previously called the Natural Disasters Roundtable, the group dropped the "Natural" in its name to reflect the inclusion of terrorism in its discussions. In fact, Wenger notes that a meeting held in the aftermath of Sept. 11 helped dispel the notion that the country was treading in completely uncharted waters when it came to confronting terrorism in the homeland. "We helped officials realize that there's 50 years of disaster research to draw on."

The government's disjointed response to Hurricane Katrina and why warnings about New Orleans' vulnerability to a storm of such magnitude seemed to have gone unheeded will undoubtedly be the topic of an upcoming roundtable meeting. Meanwhile, this fall the Research Council is expecting to release a study — in progress well before Katrina — reviewing plans by the U.S. Army Corps of Engineers to remediate erosion and wetland losses along Louisiana's coastline, which, as Laska pointed out in her March presentation, are adding to the region's susceptibility to flooding. — *Bill Kearney*

Disasters Roundtable. The Disasters Roundtable is part of the Division on Earth and Life Studies. The steering committee is chaired by **William H. Hooke,** senior policy fellow and director of the policy program, American Meteorological Society, Washington, D.C. The roundtable is funded by the National Science Foundation, National Oceanic and Atmospheric Administration, U.S. Geological Survey, NASA, PB Alltech Inc., Pacific Gas and Electric Corp., and the Public Entity Risk Institute. Summaries of meetings are available online at <dels.nas.edu/dr>.



Alien INVADERS

Preventing Earth Microbes from Contaminating Mars

The setting is Mars. The year is 2016. A rover is searching the planet's surface for traces of life. Weeks later and millions of miles away on Earth, scientists begin analyzing the data they have received and cannot believe what they see: DNA. What's more, the DNA belongs to organisms that look like the bacteria found on Earth.

Could this scenario happen in the future? Twelve spacecraft have already landed or crashed on Mars, possibly carrying microorganisms from Earth. Although each craft was cleaned before takeoff, the level of cleanliness is now being questioned. Some microorganisms called extremophiles might survive and grow in extreme, Mars-like conditions — such as very low-temperature and high-salt environments. But since many of these microbes were undiscovered until recently, detection and cleaning techniques currently in use may only be spotting and eliminating a fraction of them. Should these organisms go undetected and survive the trip to Mars, their chance of survival is increased if they encounter water — although the presence of liquid water on or below the Martian surface today has not been confirmed.

To prevent contamination of Mars and avoid hampering efforts to find life there,

NASA should develop over the coming decade new measures to detect and eliminate microorganisms on robotic spacecraft before they leave Earth, says a new report from the National Research Council.

"We don't know enough about how many and which of these hardy microorganisms may be on our spacecraft," said study chair Christopher F. Chyba, professor of astrophysics and international affairs

at Princeton University, Princeton, N.J. "We need to better understand which of those organisms found on the spacecraft have the best chances for growing in Martian environments and then devise techniques to get rid of them."

NASA currently uses procedures that detect heat-resistant and spore-forming bacteria and then attempts to eradicate them by cleaning the spacecraft and, in certain circumstances, baking parts of it with dry heat. NASA has been developing other methods but greater resources are needed, the report says.

To identify a larger variety of microorganisms, NASA should apply techniques already used by biologists that do not require extra time for culturing the organisms in a laboratory and adapt these methods to provide more accurate estimates of the types and number of microorganisms present on and inside spacecraft and in their assembly areas. These advanced methods — which can determine genetic sequences of organisms and link them to known microbial species — could allow NASA to tailor sterilization techniques toward spacecraft contaminants of greatest concern, the report says.

NASA should investigate and test alternative cleaning methods — such as radiation or vapor disinfectants — for their effectiveness in killing different types of microorganisms and for their effects on various spacecraft materials. If such techniques are fully tested and implemented in time for spacecraft launching in 2016, the scenario described above can be averted. By preventing the introduction of Earth microbes to Mars, scientists may one day find life forms genuinely native to the red planet. Once humans set foot there — as envisioned by NASA's new Vision for Space Exploration — it will be tougher to avoid contamination. — *Patrice Pages*

Preventing the Forward Contamination of Mars. Committee on Preventing the Forward Contamination of Mars, Division on Engineering and Physical Sciences (2005, approx. 180 pp.; ISBN 0-309-09724-X; available from the National Academies Press, tel. 1-800-624-6242; $38.00 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11381.html>).

Christopher F. Chyba, professor of astrophysics and international affairs at Princeton University, Princeton, N.J., chaired the committee. The study was funded by NASA.

ENGINEERING BETTER HEALTH CARE

Since the late 1990s, health care costs have been rising at double-digit rates — three times faster than inflation — claiming a growing share of Americans' income, inflicting economic hardships on many, and decreasing access to care. At the same time, 43 million Americans are uninsured, close to 100,000 patients die each year as a result of medical mistakes or negligence, and more than a half-trillion dollars is wasted annually because of inefficiencies in the health care system.

One way to help address these challenges is for the U.S. health care sector to take advantage of engineering strategies and technologies that have revolutionized quality, productivity, and performance in many other industries, says a recent report from the National Academy of Engineering and Institute of Medicine.

"Health care is deeply mired in crises related to safety, quality, cost, and access that pose serious threats to the welfare of many Americans," said Jerome H. Grossman, co-chair of the committee that wrote the report. "Unfortunately, it has been very slow to embrace engineering tools and clinical information technologies."

"Systems-engineering tools," which are developed for the design, analysis, and control of complex interactions among various parts of a system, have been used by many businesses to improve the safety and quality of products and services and to lower production costs. The report says that when applied to the health care sector, these tools could help deliver care that is safe, effective, timely, efficient, equitable, and patient-centered — the six "quality aims" envisioned by the Institute of Medicine for the health system of the 21st century.

"While medicine has advanced rapidly in recent decades thanks to new diagnostic and therapeutic technologies developed by engineers, the health care industry has virtually ignored a broad spectrum of other technologies that could radically improve the safety and efficiency of care," said study co-chair W. Dale Compton.

Engineers and health professionals should begin working together to hasten the transformation of the health care system, the report says. The federal government, in partnership with the private sector, universities, and state governments, should establish multidisciplinary centers at institutions of higher learning to foster the formation of collaborations, which would eventually lower the barriers that have impeded the widespread use of engineering and technology in health care. Also, organizations that have already adopted or promoted the use of systems engineering tools should step up their outreach and spread the word about their successes. — *Patrice Pages*

Building a Better Delivery System: A New Engineering/Health Care Partnership. Committee on Engineering and the Health Care System, National Academy of Engineering and Institute of Medicine (2005, 276 pp.; ISBN 0-309-09643-X; available from the National Academies Press, tel. 1-800-624-6242; $39.00 plus $4.50 shipping for single copies; also on the Internet at <books.nap.edu/catalog/11378.html>).

Jerome H. Grossman, senior fellow and director of the Health Care Delivery Policy Program, Harvard University, Cambridge, Mass., and **W. Dale Compton,** Lillian M. Gilbreth Distinguished Professor Emeritus of Industrial Engineering, Purdue University, West Lafayette, Ind., co-chaired the committee. The study was funded by the National Science Foundation, Robert Wood Johnson Foundation, and National Institutes of Health.

Dr. Cicerone Goes to Washington

Ralph J. Cicerone, 21st president of the National Academy of Sciences, arrived in Washington, D.C., in the midst of a July heat wave as much political as meteorological. Before he could unpack his office, Cicerone was called twice to Capitol Hill to testify before senators trying to come to grips with the scientific evidence on global climate change. *Science* called his testimony "politically savvy." But as a veteran atmospheric scientist and university administrator, Cicerone is no stranger to congressional hearing rooms. Indeed, his research on atmospheric chemistry and climate change has involved him in shaping science and environmental policy — nationally and internationally — for years.

Ralph Cicerone's research earned him a citation for the 1995 Nobel Prize in chemistry awarded to University of California, Irvine colleague F. Sherwood Rowland. The Franklin Institute recognized his fundamental contributions to the understanding of greenhouse gases and ozone depletion by naming Cicerone the 1999 laureate for the Bower Award and Prize for Achievement in Science. One of the most prestigious American awards in science, the Bower also recognized his leadership in advancing public policy to protect the global environment.

In 2001, he led a National Academy of Sciences study requested by President Bush to examine the current state of climate change science and identify the areas of greatest certainty and uncertainty. The American Geophysical Union awarded him its 2002 Roger Revelle Medal for outstanding research contributions to the understanding of Earth's atmospheric processes, biogeochemical cycles, and climate. And the World Cultural Council honored him in 2004 with the Albert Einstein World Award of Science.

Cicerone received his bachelor's degree in electrical engineering from the Massachusetts Institute of Technology where he was also a varsity baseball player.

Both his master's and doctoral degrees are from the University of Illinois in electrical engineering, with a minor in physics. During his early career at the University of Michigan, Cicerone was a research scientist and held faculty positions in electrical and computer engineering. In 1978 he joined the Scripps Institution of Oceanography as a research chemist, and in 1980 moved to Colorado to become senior scientist and director of the atmospheric chemistry division at the National Center for Atmospheric Research in Boulder. In 1989 he was appointed Daniel G. Aldrich Jr. Professor of Earth System Science at the University of California, Irvine, where he founded and chaired until 1994 the department of earth system science. For the next four years, while serving as dean of physical sciences, he brought outstanding faculty to the school and strengthened its curriculum and outreach programs.

From 1998 to 2005, Cicerone was chancellor of the University of California, Irvine, where his leadership and fundraising contributed to rapid expansion at the campus and medical school as well as to UCI's growing national reputation for excellence. As NAS president, he hopes to improve communications between the scientific community and the public and build a base of support for science while taking firm stands for science in the rough and tumble world of Washington politics. As he told an interviewer from *Nature,* "I don't want to be part of an organization that just shoots off its mouth with opinions that are not as well-justified as can be." Instead, Cicerone wants the National Academies to stay very close to what it does best: giving nonpartisan, objective advice based on independent, peer-reviewed study of the facts by the nation's best scientists.

— *William Skane*

News and Terrorism

Communicating in a Crisis

The National Academies, in collaboration with the U.S. Department of Homeland Security and the Radio-Television News Directors Foundation, just completed a nationwide series of 10 interactive workshops called "News and Terrorism: Communicating in a Crisis."

The one-day workshops brought together, on the local level, groups that seldom share experiences — government officials, journalists, scientists, engineers, and health professionals. Each event included a discussion of science and technology related to terrorism led by a prominent expert. They also included a presentation on how journalists can safely cover an incident involving potential weapons of mass destruction.

The workshops featured a unique two-hour "tabletop" terrorism scenario that focused on communication issues. Through this dynamic exercise, participants began to better understand each other's needs and concerns during a crisis. National broadcast journalists moderated the quickly unfolding events of a terrorist attack and forced participants to make on-the-spot decisions with limited information, time, and resources. Here are examples of how three of the scenarios began:

A large explosion rips through a downtown Atlanta convention center next to CNN. It's obviously a mass casualty situation, but it turns out there's more — radioactivity.

In Kansas City, a flour processing plant is contaminated with a biological toxin. It sickens several workers who display dramatic symptoms. Thousands of nearby residents, who are following unfolding events through the media, are wondering what they should do.

Sportscasters announcing a live Major League baseball game at Fenway Park in Boston notice groups of fans throughout the stadium collapsing. Cameras zoom in on people convulsing, vomiting, or not moving at all.

The "News and Terrorism" scenarios were powerful experiences. For example, besides grappling with scientific questions and risk communication, participants often had to determine how their priorities might shift if a VIP, or maybe their own child, was near the site of an attack.

The news media will be at the forefront, should any terrorist crisis involving weapons of mass destruction take place. Journalists must react quickly, even instinctively, as they attempt to guide public understanding of and response to unfolding events. It's a responsibility that's as vital as those of traditional "first responders," because the media can save lives through efficient delivery of accurate information.

Effectively communicating complex information in the midst of a crisis will be a difficult challenge. While that duty falls largely upon the news media, it isn't only their responsibility. And it is not just the government's responsibility. It's the engineering, science, and medical communities' responsibility as well.

The National Academies have produced fact sheets on different types of terrorist attacks to answer basic questions, dispel common misperceptions, and provide reputable sources for more information. Fact sheets on biological, chemical, nuclear, and radiological attacks are available online at <www.nae.edu>.

Journalists have few precedents for reporting on this new type of warfare, which is vastly different from traditional war. They need a strategy to deal with it, and a ready pool of trusted experts who are good communicators. It is difficult to prepare for things that haven't happened before. Thinking through the information flow before a disaster occurs is vital in this fast-moving information age. The public expects to be informed right away, and they will be. The questions are: By whom? And how well?

The science and engineering communities have a much bigger role in homeland security than simply creating the latest technologies to counter terrorism. They must also work to get good information into the hands of the media quickly in the event of a cyber, radiological, nuclear, chemical, or biological attack. Scientists, engineers, and medical experts must work with journalists — before a crisis — to figure out the best ways of doing that. — *Randy Atkins*

Oversight for "News and Terrorism" was provided by a steering committee chaired by **Lewis M. Branscomb,** professor emeritus of public policy and corporate management, John F. Kennedy School of Government of Harvard University. The project was funded by the U.S. Army/U.S. Department of Homeland Security and by the Gannett Foundation. Workshops were held in Chicago; Kansas City, Mo.; Portland, Ore.; Philadelphia; Miami; Austin, Texas; Atlanta; Denver; Boston; and San Francisco.

Teens Battle Low Health Literacy in Their Communities

As a member of the Institute of Medicine committee that wrote the report *Health Literacy: A Prescription to End Confusion,* Bill Smith learned firsthand that 90 million Americans from all walks of life suffer the consequences of low "health literacy," or difficulty understanding and acting on health information. He found the links between poor health literacy, high health care costs, and disparities in care sobering, but what galvanized him to action was the realization of how little attention the issue is getting at the community level.

Smith, the executive vice president of the Academy for Educational Development (AED), spurred his organization to partner with the IOM in coordinating a project to "map" the health resources in two model communities — one urban, the other suburban — and lay a foundation for improving health literacy in these and other communities. IOM's Kellogg Health of the Public Fund and AED provided financial support for the initiative.

The "Community YouthMapping" was carried out by two teams of high school students, one from the Harlem Children's Zone based in Harlem, N.Y., and the other from the Pinellas County 4-H Youth As Resources program, which covers St. Petersburg and Clearwater, Fla. AED staff trained teens in data-entry and communication skills as well as the challenges posed by lack of health literacy. But then it was up to the students to canvass pharmacies, clinics, and other health care organizations; collect written materials and analyze them for readability; and interview fellow citizens about their understanding of health information.

The teens' findings paint both a grim and encouraging picture of existing services and gaps. Anthony George, a member of the Harlem youth team reported counting zero physicians' offices along two 25-block stretches in Harlem as compared to 119 doctors' offices along a same-sized stretch in the Upper East Side. As a result, the relatively small number of clinics that are situated in the 7.5 square mile area of Harlem that the team surveyed were crowded and marked by long wait times.

Still, the team praised the staffs of the mobile health vans that serve the community, and Alexis Tripp and Artrese Reid

pointed to two community outreach programs as role models. The teens visited a total of 46 health care organizations and analyzed the content of more than 300 print and online forms of health information. For low-income communities where people often rely on public transportation, outreach initiatives and the clustering of a range of health services near public transportation are particularly important actions, the teens concluded.

The Pinellas County youth team hit the streets to hear from fellow residents about how easy it is to comprehend health information. Of the 301 people they interviewed, 197 reported knowing someone who has experienced trouble reading or understanding information dispensed by their physician or pharmacist, team member Tyler Butler noted. More than two-thirds of the health care organizations they visited reported that low health literacy is a serious problem and almost one-third acknowledged that they haven't tested their written materials with audiences or made them available in multiple languages.

On the plus side, the Pinellas teens found that more than three-quarters of the 135 items of printed and online health information they analyzed were easy to read and understand, Takia West said. These materials could be further improved with larger print and greater brevity.

Though the teens must now turn their attention to schoolwork, their efforts on health literacy are not necessarily ended. They plan to present their findings to additional stakeholders in their communities and are finalizing video documentaries that can encourage other communities to begin similar projects to prevent problems that arise from trouble understanding health information — something that Harlem team member Todd Holland says he is now personally prepared to handle. "I don't want it to happen to my family, but if it does, I'll be ready." — *Christine Stencel*

Projects

The following projects have been recently undertaken by units of the National Academies. The latest information about all current committee activities — including project descriptions, committee rosters, and meeting information — is available in "Current Projects" on the National Academies' Web site.

Climate Change and U.S. Transportation.
Studies and Information Services, Transportation Research Board; and Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies. Project director: Nancy Humphrey. Chair: Henry G. Schwartz Jr., senior professor and director, engineering management program, Washington University, St. Louis. Sponsors: U.S. Department of Transportation, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, National Cooperative Highway Research Program, Transit Cooperative Research Program, and the Transportation Research Board.

Competitiveness and Workforce Needs of U.S. Industry.
Board on Science, Technology, and Economic Policy, Division on Policy and Global Affairs. Project director: Stephen Merrill. Chair: To be selected. Sponsor: U.S. Department of Education.

Creation of Science-Based Industries in Developing Countries.
Development, Security, and Cooperation, Division on Policy and Global Affairs, in collaboration with the Nigerian Academy of Sciences. Project director: Michael Greene. Chair: Rita R. Colwell, chair, Canon U.S. Life Sciences Inc., and Distinguished University Professor, University of Maryland, College Park. Sponsor: National Academy of Sciences.

Enhancing the Robustness and Resilience of Future Electric Transmission and Distribution in the United States to Terrorist Attack.
Board on Energy and Environmental Systems, Division on Engineering and Physical Sciences. Project director: Jack Fritz. Chair: M. Granger Morgan, Lord Chair Professor in Engineering; professor and department head, engineering and public policy; professor, electrical and computer engineering; and professor, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, Pittsburgh. Sponsor: U.S. Department of Homeland Security.

The Mississippi River and the Clean Water Act.
Water Science and Technology Board, Division on Earth and Life Studies. Project director: Jeffrey Jacobs. Chair: David A. Dzombak, professor, department of civil and environmental engineering, Carnegie Mellon University, Pittsburgh. Sponsor: The McKnight Foundation.

Nutrition Standards for Foods in Schools.
Food and Nutrition Board, Institute of Medicine. Project director: Janice Rice Okita. Chair: To be selected. Sponsor: U.S. Centers for Disease Control and Prevention.

The Role of Naval Forces in the Global War on Terror.
Naval Studies Board, Division on Engineering and Physical Sciences. Project director: Arul Mozhi. Co-chairs: Miriam E. John, vice president, California division, Sandia National Laboratories, Livermore; and Richard L. Wade, principal scientist, health sciences practice, Exponent Inc., Irvine, Calif. Sponsor: U.S. Department of the Navy.

Publications

For documents shown as available from the National Academies Press (NAP), write to 500 Fifth St., N.W., Lockbox 285, Washington, D.C. 20055; tel. 202-334-3313 or 1-800-624-6242; or order on the Internet at <www.nap.edu>. Documents from a specific unit of the National Academies are available from the source as noted. Prices and availability of all documents are subject to change. Charges listed are for single copies; discounts are available for bulk orders.

Asking the Right Questions About Electronic Voting
Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2005, approx. 126 pp.; ISBN 0-309-10024-0; available from NAP, $29.00 plus $4.50 shipping).

Assessment of NIH Minority Research and Training Programs: Phase 3
Board on Higher Education and Workforce, Division on Policy and Global Affairs (2005, 240 pp.; ISBN 0-309-09575-1; available from NAP, $48.50 plus $4.50 shipping).

Autonomous Vehicles in Support of Naval Operations
Naval Studies Board, Division on Engineering and Physical Sciences (2005, 256 pp.; ISBN 0-309-09676-6; available from NAP, $51.00 plus $4.50 shipping).

Biological Science and Biotechnology in Russia: Controlling Diseases and Enhancing Security
Office for Central Europe and Eurasia, Development, Security, and Cooperation, Division on Policy and Global Affairs, in cooperation with the Russian Academy of Sciences (2005, approx. 186 pp.; ISBN 0-309-09704-5; available from NAP, $39.00 plus $4.50 shipping).

Building an Electronic Records Archive at the National Archives and Records Administration: Recommendations for a Long-Term Strategy
Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2005, 112 pp.; ISBN 0-309-09696-0; available from NAP, $26.50 plus $4.50 shipping).

Educating the Engineer of 2020: Adapting Engineering Education to the New Century
National Academy of Engineering (2005, approx. 152 pp.; ISBN 0-309-09649-9; available from NAP, $23.00 plus $4.50 shipping).

Engineering Research and America's Future: Meeting the Challenges of a Global Economy
National Academy of Engineering (2005, approx. 54 pp.; ISBN 0-309-09642-1; available from NAP, $35.00 plus $4.50 shipping).

Ethical Considerations for Research on Housing-Related Health Hazards Involving Children
Board on Children, Youth, and Families, National Research Council and Institute of Medicine (2005, approx. 216 pp.; ISBN 0-309-09726-6; available from NAP, $35.00 plus $4.50 shipping).

Globalization of Materials R&D: Time for a National Strategy
National Materials Advisory Board, Division on Engineering and Physical Sciences (2005, approx. 170 pp.; ISBN 0-309-09603-0; available from NAP, $35.00 plus $4.50 shipping).

Government-Industry Partnerships: Partnering Against Terrorism — Summary of a Workshop
Board on Science, Technology, and Economic Policy, Division on Policy and Global Affairs (2005, 164 pp.; ISBN 0-309-09428-3; available from NAP, $36.00 plus $4.50 shipping).

Health Risks From Exposure to Low Levels of Ionizing Radiation: BEIR VII — Phase 2
Board on Radiation Effects Research, Division on Earth and Life Studies (2005, approx. 750 pp.; ISBN 0-309-09156-X; available from NAP, $75.00 plus $4.50 shipping).

Improving Data to Analyze Food and Nutrition Policies
Committee on National Statistics, Division of Behavioral and Social Sciences and Education (2005, approx. 105 pp.; ISBN 0-309-10005-4; available from NAP, $25.50 plus $4.50 shipping).

Improving Evaluation of Anticrime Programs
Committee on Law and Justice, Division of Behavioral and Social Sciences and Education (2005, 90 pp.; ISBN 0-309-09706-1; available from NAP, $24.00 plus $4.50 shipping).

Innovating for Profit in Russia: Developments in the Urals Region — Summary of a Workshop
Office for Central Europe and Eurasia; Development, Security, and Cooperation; Division on Policy and Global Affairs, in cooperation with the Russian Academy of Sciences (2005, approx. 68 pp.; ISBN 0-309-09727-4; available from NAP, $18.00 plus $4.50 shipping).

Integrating Employee Health: A Model Program for NASA
Food and Nutrition Board, Institute of Medicine (2005, 200 pp.; ISBN 0-309-09623-5; available from NAP, $35.00 plus $4.50 shipping).

John R. La Montagne Memorial Symposium on Pandemic Influenza Research — Meeting Proceedings
Board on Population Health and Public Health Practice, Institute of Medicine (2005, 214 pp.; ISBN 0-309-09731-2; available from NAP, $43.75 plus $4.50 shipping).

Mathematics and 21st Century Biology
Board on Mathematical Sciences and Their Applications, Division on Engineering and Physical Sciences (2005, 162 pp.; ISBN 0-309-09584-0; available from NAP, $35.00 plus $4.50 shipping).

Measuring Literacy: Performance Levels for Adults — Interim Report
Board on Testing and Assessment, Center for Education, Division of Behavioral and Social Sciences and Education (2005, 265 pp.; ISBN 0-309-09652-9; available from NAP, $45.00 plus $4.50 shipping).

Measuring Performance and Benchmarking Project Management at the Department of Energy
Board on Infrastructure and the Constructed Environment, Division on Engineering and Physical Sciences (2005, 52 pp.; ISBN 0-309-09708-8; available from NAP, $18.00 plus $4.50 shipping).

Midsize Facilities: The Infrastructure for Materials Research
Solid State Sciences Committee, Board on Physics and Astronomy, Division on Engineering and Physical Sciences (2005, approx. 200 pp.; ISBN 0-309-09702-9; available from NAP, $32.00 plus $4.50 shipping).

Monitoring at Chemical Agent Disposal Facilities
Board on Army Science and Technology, Division on Engineering and Physical Sciences (2005, approx. 104 pp.; ISBN 0-309-09732-0; available from NAP, $25.25 plus $4.50 shipping).

Navy's Needs in Space for Providing Future Capabilities
Naval Studies Board, Division on Engineering and Physical Sciences (2005, 266 pp.; ISBN 0-309-09677-4; available from NAP, $52.50 plus $4.50 shipping).

Protection, Control, and Accounting of Nuclear Materials: International Challenges and National Programs — Workshop Summary
Development, Security, and Cooperation, Division on Policy and Global Affairs (2005, approx. 53 pp.; ISBN 0-309-09711-8; available from NAP, $18.00 plus $4.50 shipping).

Reopening Public Facilities After a Biological Attack: A Decision Making Framework
Board on Life Sciences, Division on Earth and Life Studies (2005, 224 pp.; ISBN 0-309-09661-8; available from NAP, $36.00 plus $4.50 shipping).

Review of Goals and Plans for NASA's Space and Earth Sciences
Space Studies Board, Division on Engineering and Physical Sciences (2005, approx. 71 pp.; ISBN 0-309-09943-9; available from NAP, $18.00 plus $4.50 shipping; also available free from the board, tel. 202-334-3477 or e-mail <ssb@nas.edu>).

Review of the GAPP Science and Implementation Plan
Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies (2005, approx. 66 pp.; ISBN 0-309-09678-2; available from NAP, $18.00 plus $4.50 shipping).

Review of NOAA's Plan for the Scientific Data Stewardship Program
Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies (2005, 38 pp.; ISBN 0-309-09703-7; available from NAP, $12.00 plus $4.50 shipping).

Review of Testing and Evaluation Methodology for Biological Point Detectors — Abbreviated Summary
Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2005, 38 pp.; ISBN 0-309-09179-9; available from NAP, $12.00 plus $4.50 shipping).

Review of the Research Program of the FreedomCAR and Fuel Partnership — First Report
Board on Energy and Environmental Systems, Division on Engineering and Physical Sciences; and Transportation Research Board (2005, approx. 150 pp.; ISBN 0-309-09730-4; available from NAP, $18.00 plus $4.50 shipping).

Sea Basing: Ensuring Joint Force Access From the Sea
Naval Studies Board, Division on Engineering and Physical Sciences (2005, 104 pp.; ISBN 0-309-09517-4; available from NAP, $25.25 plus $4.50 shipping).

Strengthening Long-Term Nuclear Security: Protecting Weapon-Usable Material in Russia
Office for Central Europe and Eurasia; Development, Security, and Cooperation; Division on Policy and Global Affairs; in cooperation with the Russian Academy of Sciences (2005, approx. 140 pp.; ISBN 0-309-09705-3; available from NAP, $31.50 plus $4.50 shipping).

Strengthening U.S.-Russian Cooperation on Nuclear Nonproliferation: Recommendations for Action
Development, Security, and Cooperation, Division on Policy and Global Affairs; and Russian Academy of Sciences (2005, 104 pp.; ISBN 0-309-09669-3; available from NAP, $34.75 plus $4.50 shipping).

Sustainability in the Chemical Industry: Grand Challenges and Research Needs — A Workshop Report
Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2005, approx. 168 pp.; ISBN 0-309-09571-9; available from NAP, $34.00 plus $4.50 shipping).

Systems for State Science Assessment
Board on Testing and Assessment, Center for Education, Division of Behavioral and Social Sciences and Education (2005, approx. 240 pp.; ISBN 0-309-09662-6; available from NAP, $34.95 plus $4.50 shipping).

Tank Wastes Planned for On-Site Disposal at Three Department of Energy Sites: The Savannah River Site — Interim Report
Nuclear and Radiation Studies Board, Division on Earth and Life Studies (2005, 88 pp.; ISBN 0-309-09693-6; available from NAP, $18.00 plus $4.50 shipping).

Technological Options for User-Authorized Handguns: A Technology-Readiness Assessment
National Academy of Engineering (2005, 80 pp.; ISBN 0-309-09699-5; available from NAP, $18.00 plus $4.50 shipping).

Technology Pathways: Assessing the Integrated Plan for a Next Generation Air Transportation System
Aeronautics and Space Engineering Board, Division on Engineering and Physical Sciences (2005, approx. 78 pp.; ISBN 0-309-09733-9; available from NAP, $18.00 plus $4.50 shipping).

Thirteenth Interim Report of the Subcommittee on Acute Exposure Guideline Levels
Committee on Toxicology, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2005, 34 pp.; ISBN 0-309-09707-X; available from NAP, $12.00 plus $4.50 shipping).

Toxicogenomic Technologies and Risk Assessment of Environmental Carcinogens — A Workshop Summary
Committee on Emerging Issues and Data on Environmental Contaminants, Board on Life Sciences, Division on Earth and Life Studies (2005, approx. 55 pp.; ISBN 0-309-09700-2; available from NAP, $12.00 plus $4.50 shipping).

Water Resources Planning for the Upper Mississippi River and Illinois Waterway
Water Science and Technology Board, Division on Earth and Life Studies; and Transportation Research Board (2005, approx. 42 pp.; ISBN 0-309-09945-5; available from NAP, $12.00 plus $4.50 shipping).

NEW ONLINE CONTENT

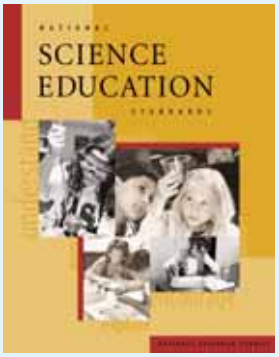
Academies Present New Web Resource on Evolution

A new Web site — <*national-academies.org/evolution*> — allows easy, free access to books, position statements, and additional resources on evolution education and research.

Visitors to the site can find downloadable PDF files of reports on evolution published by the National Academies:

- *Teaching About Evolution and the Nature of Science*
- *Science and Creationism: A View from the National Academy of Sciences, 2nd edition*
- *Evolution in Hawaii: A Supplement to* Teaching About Evolution and the Nature of Science

The theory of evolution is one of science's most robust theories, and the National Academies have long supported the position that evolution be taught as a central element in any science education program. Its landmark *National Science Education Standards*, which lays out clear guidelines about what students should learn about science and evolution between kindergarten and 12th grade, is also available at the evolution site.



The Academies have been and will continue to play a leading role in efforts to confront challenges to the teaching of evolution and the introduction of non-scientific alternatives into science courses and curricula. The institution has formed a committee to update *Science and Creationism* and provide more information about intelligent design and the reasons why much of the scientific community does not consider it science. The new report will be available in 2006.

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