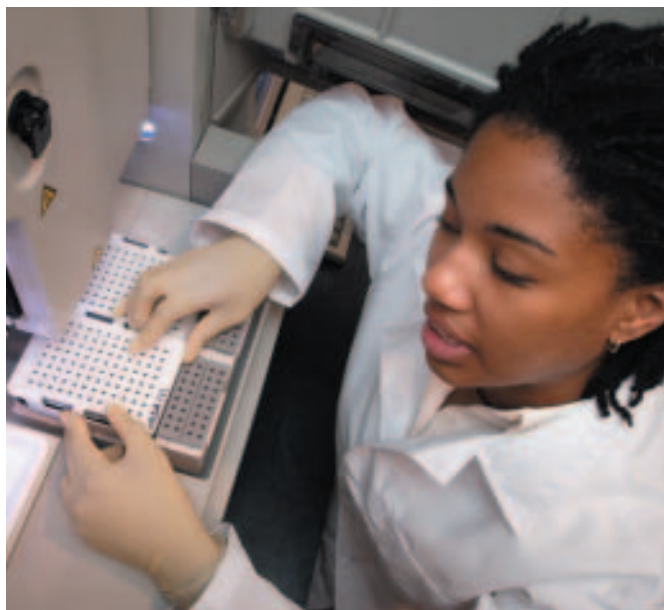


# THE NATIONAL ACADEMIES **IN FOCUS**

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Controlling Carbon Monoxide Pollution  
Fairness and Effectiveness in Policing

A National Plan to Combat Microbial Threats  
Using Teacher Insights to Improve Education

Summer 2003

# THE NATIONAL ACADEMIES

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Army trucks delivering water and supplies in southern Iraq, U.S. Department of Defense photo by Arlo K. Abrahamson, U.S. Navy; (col. 2) dispersion model of a hypothetical anthrax release, courtesy National Atmospheric Release Advisory Center

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(from top) NAS President Bruce Alberts and Richard N. Foster, member of the W.M. Keck Foundation board of directors and chair of the foundation's medical research committee, at May 2003 ribbon-cutting ceremony for the National Academies' new Keck Center, photo by Robert Turtill; Egyptian sociologist and human rights advocate Saad Eddin Ibrahim, photo by Robert Visser/Photopress Washington

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Ground assault convoy with 2nd Brigade of 101st Airborne Division (Air Assault) prepares to move into Iraq, U.S. Army photo by Joshua M. Risner

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CDC clinician removes bifurcated needle from saline solution, demonstrating how to safely and efficiently deliver smallpox vaccine, CDC photo by James Gathany

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CDC clinician Gloria Brynam demonstrates proper smallpox vaccine application on clinician Melanie King, CDC photo by James Gathany

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Fairbanks, Alaska, at 40 below zero, ©Alaska Stock Images

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Dispersion model of a hypothetical radiation release, courtesy National Atmospheric Release Advisory Center

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Elizabeth Carvellas and students in her molecular biology class at Essex High School in Essex Junction, Vt., photos by Rajan Chawla

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Paul Mugambi, chair of the Uganda National Academy of Sciences, Ousmane Fall, director of the Senegalese Academy of Sciences and Technology, and Kwesi Yankah, honorary secretary of the Ghana Academy of Arts and Sciences, during their visit to the U.S. National Academies, photo by Craig Hicks

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(col. 1) Egyptian sociologist Saad Eddin Ibrahim, photo by Robert Visser/Photopress; (col. 2) Charles McQuery (left, with his wife, Cheryl) with U.S. Department of Homeland Security Secretary Tom Ridge (right) at the National Academies, photo by William K. Geiger

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## SARS and the Threat of Emerging Infections

Imagine being the director of a major teaching hospital, and you are informed one morning that 12 staff working on a single floor of the hospital have called in sick, many with a fever and cough. By 2 p.m., the number has risen to 50. What would you do?

This was the situation that confronted the leadership of the Prince of Wales Hospital in Hong Kong one day this past March. That fateful day signaled the arrival in Hong Kong of what came to be known as severe acute respiratory syndrome, or SARS.

Eventually, the world became fully aware of SARS, and public health authorities mobilized aggressively in a number of affected places, including Hong Kong, Singapore, Vietnam, Taiwan, and Toronto. In a matter of weeks after the disease had spread internationally, scientists identified the causal agent — a coronavirus — and then sequenced the genome of the organism. By virtue of assiduous tracing and quarantining of contacts, special precautions in clinical care, and isolation of patients, the outbreak eventually subsided, but not before more than 8,000 patients were afflicted, more than 800 lives cut short, and billions of dollars lost.

No one knows whether SARS will return next winter. Quite certain, however, is that at some time, in some place, other new infectious diseases will emerge.

This expectation was one key message of the recent IOM report *Microbial Threats to Health*, released coincidentally at the time of the first media reports of SARS. The report argues that an effective national response to microbial diseases must be global in scope. Failure to monitor and report outbreaks in any one nation can, and does, affect others. Federal agencies must enhance disease surveillance and collaborate on diagnostic methods with other nations. And at home, the public health infrastructure should be shored up so that disease outbreaks can be detected, monitored, and managed expeditiously.

This report stands in a long tradition of work at the IOM on infectious diseases. The Institute is also providing ongoing guidance to the CDC on the smallpox immunization campaign. And earlier this summer, NAS President Bruce Alberts and I co-hosted a workshop on new strategies to devise drugs against smallpox. In these, and many other ways, the National Academies are working to protect the nation against biological threats to health. Fortuitously, many of the steps that guard against bioterrorism simultaneously protect against natural threats, and nature can be the most fearsome bioterrorist of all.



A stylized, handwritten signature in dark ink that reads "Harvey V. Fineberg".

HARVEY V. FINEBERG  
President, Institute of Medicine





## **WANTED:** Team Players in Proposed Education Partnership

**G**overnment agencies and private foundations have long supported education-research programs that are designed to improve schools and raise academic achievement. Such efforts have born some fruit, but still, research has not penetrated classroom practice deeply enough to significantly affect student learning.

A bold new R&D system is needed to encourage scientists and educators to work together and gain insights from one another, closely linking education research to the schoolhouse, says a new report from the National Research Council.

The report's proposed system — a “Strategic Education Research Partnership” (SERP) — would seamlessly weave education research and development with everyday practice in the nation's K-12 classrooms. Currently, researchers have few opportunities to study schooling up close, the report says. And educators seldom have a chance to scrutinize their own work or to shape research agendas.

Through the partnership, scientists, educators, and policy-makers could combine their wisdom and investigate issues over time — accumulating research-based

knowledge, taking stock of what works and in which settings, and figuring out how to expand effective approaches to teaching and school organization. Tackling teachers' problems with instruction and curricula would be a priority, said the committee that wrote the report.

SERP would have three organizational components. A central headquarters would oversee a coherent program of first-rate education research, set long-term goals, disseminate findings, and raise funds. Additionally, teams of seasoned practitioners and leading researchers in various disciplines would probe specific topics. Finally, their work would take place largely in schools and school districts across the country that volunteer to serve as field sites, the report says. These sites would be akin to teaching hospitals in the medical profession.

Providing and funding K-12 education services are primarily state responsibilities, so a compact of states would be at the heart of the partnership. One of SERP's chief goals would be to help state officials develop the skills to frame, use, and evaluate education R&D to meet their needs, the report says. But states alone cannot produce the new system. A broad coalition of stakeholders — including federal authorities, private foundations, and businesses — would be critical team players.

To take root and thrive, the initiative would require hard cash. The cost to launch SERP and fund it throughout a seven- to 10-year trial period is estimated at about \$500 million. The committee called on private foundations to play the lead role in supplying SERP with seed money. Businesses, Congress, and federal



agencies also might provide financial support during the trial period. As SERP matures, members of the state compact would be expected to take on financial responsibility.

Turning SERP's vision into a reality is a tall order. "Historically, there have been very few sustained incentives for a systemic relationship between research and professional practice in education," said committee chair Joe B. Wyatt, chancellor emeritus, Vanderbilt University, Nashville, Tenn. "And currently, there aren't any broad-based institutions devoted to routinely facilitating such collaborative relationships for improving student learning. Effective links between research and practice, and between scientists and educators, are both fragile and episodic. A fundamentally different model for education R&D is imperative."

SERP, the committee noted, hinges on the will and resources of an extensive group of organizations and individuals committed to improving the education of all U.S. students. — *Vanee Vines*

■ **Strategic Education Research Partnership.**

Committee on a Strategic Education Research Plan, Division of Behavioral and Social Sciences and Education (2003, 160 pp.; ISBN 0-309-08879-8, available from the National Academies Press, tel. 1-800-624-6242; \$29.95 plus \$4.50 shipping for single copies; also on the Internet at <[books.nap.edu/catalog/10670.html](http://books.nap.edu/catalog/10670.html)>).

The committee was chaired by **Joe B. Wyatt**, chancellor emeritus, Vanderbilt University, Nashville, Tenn. The study was sponsored by the U.S. Department of Education, John D. and Catherine T. MacArthur Foundation, Carnegie Corporation of New York, and the Spencer Foundation.



# In the Line of Duty

## CLOSING GAPS IN RESEARCH ON POLICING

**P**olice officers are perhaps the most visible faces of the law, and one of the few groups with the power to use force, if necessary, when dealing with the public.

Yet despite the pivotal role that police play in society, scientific research on the fairness or effectiveness of their work has received inadequate attention, says a new report from the National Research Council.

While communities are most often thankful for a police presence in moments of panic or calamity, concerns about misconduct and racial profiling have led some citizens to wonder whether someone needs to police the police. Currently, science provides few straightforward answers regarding the impact of race, class, gender, and other social factors in police-citizen interactions, the report notes. On the whole, policy-making could benefit from more comprehensive studies on police behavior.

Scientific evidence does, however, contradict the fear that an emphasis on fairness and restraint will necessarily weaken crime-control efforts. Fairness and effectiveness in police work clearly go hand in hand, the report says.

Further, there is strong evidence on methods that communities can use to reduce crime while improving support for police. Studies show that the more focused police strategies are, the more success officers are likely to have in controlling crime and disorder. So, instead of embracing one-size-fits-all tactics, police should tailor their work to address specific concerns. To that end, many departments have crafted highly

localized approaches to handling problems, or sought the public's input in resolving troublesome issues. Such problem-oriented and community-based policing philosophies do hold promise. Even so, they are ripe for further study because the nuts and bolts of how they work on the ground are not well-understood.

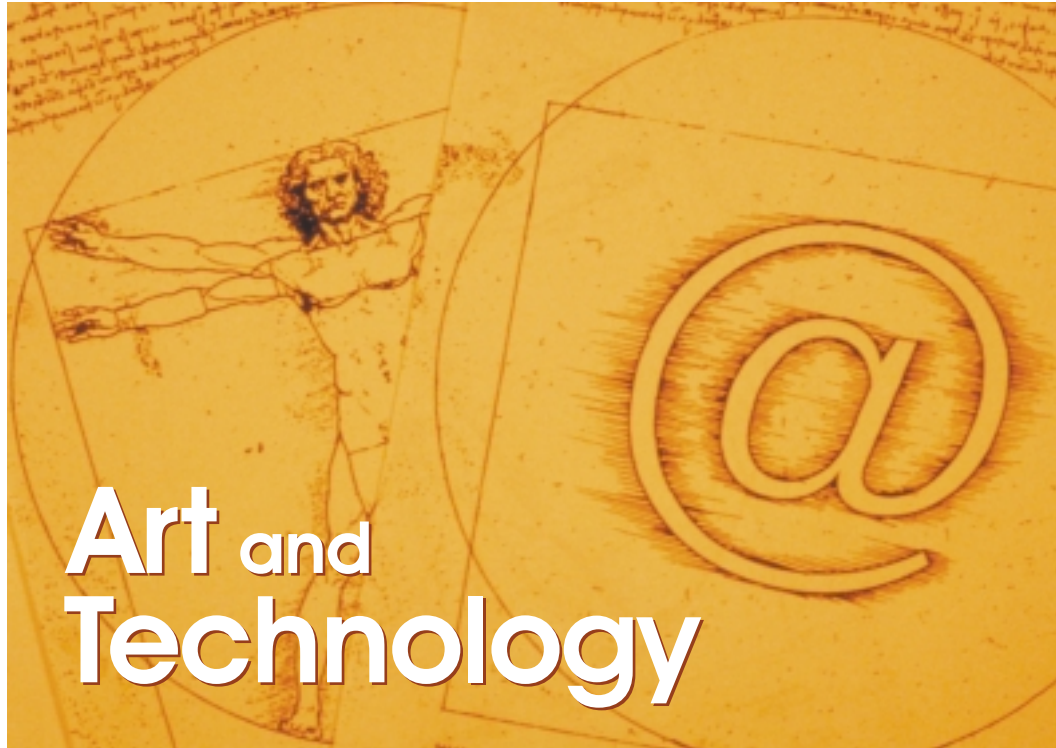
The federal government's National Institute of Justice should spearhead efforts to boost the quality and expand the scope of studies on a wide range of policing issues, the report says. Key areas of investigation should include strategies for recruiting and training officers; policing practices that support or undermine the public's confidence; the influence of organizational arrangements on police work and innovation; and how the demands of responding to terrorism affect local law-enforcement agencies.

Challenges facing today's men and women in blue are varied and complex. Officers serve increasingly diverse populations, fight crime both on the streets and in cyberspace, and fill crucial needs in the event of terrorist attacks. Closing gaps in research on police can only help their efforts, the committee said. — *Vanee Vines*

■ ***Fairness and Effectiveness in Policing: The Evidence.*** Committee to Review Research on Police Policy and Practices, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education (2003, approx. 300 pp.; ISBN 0-309-08433-4; 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/10419.html](http://books.nap.edu/catalog/10419.html)>).

The committee was chaired by **Wesley G. Skogan**, professor of political science, Northwestern University, Evanston, Ill. The study was sponsored by the U.S. Department of Justice.





## A New Approach to an Old Unity

Just as Renaissance Florence provided the conditions for extraordinary artistic and scientific creativity, present-day society needs to cultivate the partnership between information technology and creative practices.

**P**airing science and technology with creative practices occurred long before the famous Bauhaus school coined the slogan, “art and technology, a new unity.” In 19th-century France, for instance, the collaboration between an inventor and a painter of sets for the opera

led to the creation of the first daguerreotype, a step that would be key to the emerging field of photography.

This century is presented with the challenges of matching computer science with the arts and design. Known as information technology and creative practices (ITCP), this domain has already opened up new possibilities in architecture and product design, film and music, and in the creation of video games.

An essential component of supporting ITCP work is developing an environment that fosters collaboration and provides incentives to create and support the tools, skills, and venues for such work. A new report from the National Research Council calls for a coordinated effort to

encourage the collaboration needed for ITCP to flourish.

Work in ITCP challenges the boundaries of traditional disciplines as a growing number of artists and designers become hardware developers or skilled programmers and computer scientists engage seriously in the arts or design. Significant work is also produced by cross-disciplinary partnerships between artists or designers and computer scientists.

But an imbalance exists. To date, artists and designers have made greater efforts to learn relevant IT practices than computer professionals have made to adopt the arts and design. Developing a background in IT has influenced the arts and changed design methods and production. Industrial design has been recreated by computer software, leading to mass-produced but one-of-a-kind products. Digital modeling based on computer-aided design enables architects to work with complex curved surfaces and other elements that would have been much more difficult or impossible in the days of drafting. Artists and designers trained in IT have also provided unexpected insights into software and programming.

Computer scientists, on the other hand, are pursuing ITCP work to a lesser degree than their artistic and designing counterparts. The computer sciences culture seems to discourage ITCP and there are few social or economic incentives to become proficient in both IT and arts and design.

Educational institutions are central to the future of ITCP. Colleges and departments of art or design have generally embraced information technology as a new tool, but ITCP needs to be further encouraged to examine

how it may enable new forms of creativity. Computer science departments must undergo a change in attitude toward ITCP, and an increase in institutional support would help establish ITCP's credibility and reward those who enter the field.

Capitalizing on opportunities in ITCP will require more support from cultural organizations, government, and industry. "Studio-laboratories," which combine the artist's studio with the scientist's laboratory, are present in universities and industry. But while government-backed ITCP centers exist in Canada and Europe, and are emerging in Australia and Asia, the United States is lagging behind.

Much important ITCP work occurs in independent architectural design, product design, graphic design, and music and video production houses, but individuals often are limited by small budgets and lack of the necessary expertise. The costs associated with such work can be high, and major funding is needed in both the public and private sectors. Advancing ITCP will require new approaches to funding, not only allocating funding to support work in established and recognized areas of IT and the arts and design, but also fostering collaborations that open up new areas of ITCP. — *Jennifer Burris*

■ ***Beyond Productivity: Information Technology, Innovation, and Creativity.*** Committee on Information Technology and Creativity, Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2003, 268 pp.; ISBN 0-309-08868-2; available from the National Academies Press, tel. 1-800-624-6242; \$35.00 plus \$4.50 shipping for single copies; also on the Internet at <[books.nap.edu/catalog/10671.html](http://books.nap.edu/catalog/10671.html)>).

The committee was chaired by **William J. Mitchell**, professor and dean of the School of Architecture and Planning, Massachusetts Institute of Technology, Cambridge. The study was funded by the Rockefeller Foundation.



## Army Agility Depends on Modern Mobility

**T**he Army's modernization plan envisions the capability to defeat any threat to national security, whether from small groups of terrorists or full-scale forces equipped with sophisticated weapons and tactics. Trucks and trailers, which are responsible for transporting personnel, equipment, food, water, ammunition, and fuel once on the ground, represent the backbone of military operations. But the Army's current truck fleet is aging and becoming less effective over time.

To support a more agile military force and ultimately reduce logistical burdens and costs, the Army is focusing on the benefits of using high-strength, lightweight materials. It turned to the National Research Council to evaluate and recommend R&D opportunities for new manufacturing processes and materials that could reduce vehicle weight, improve fuel efficiency, increase resistance to corrosion, and lower costs over the lifetime of the vehicle without compromising safety.

Several commercially available materials and technologies can be used now to improve today's Army truck fleet, says a new report from the Research Council. For example, high-strength steels could reduce weight while maintaining protection, and aluminum and magnesium alloys could replace steel altogether in some components. Also, ceramic- and metal-matrix composites could decrease the weight of braking systems with no sacrifice in performance. These materials and processes are increasingly

being used in commercial trucks and trailers, but to a lesser extent in Army trucks.

The Army could stimulate new advances in lightweight materials and manufacturing technologies within private and academic sectors by investing directly in their R&D programs, the report adds. Good candidates for long-term investment include titanium, because of its enhanced armor and anticorrosive properties; "smart" materials that can respond to stimuli like heat and vibration to improve performance; and metal-processing technologies that could be used to repair trucks and produce spare parts in the field.

The report identifies opportunities for lightweight materials research and development that are achievable over short, medium, and longer time frames for structural components, such as vehicle frames and drive trains. Programs to retrofit or remanufacture older trucks are also discussed in the report, as are ways to better track the age and condition of vehicles and to improve the process for soliciting and procuring bids. — *Barbara J. Rice*

■ **Use of Lightweight Materials in 21st Century Army Trucks.** Committee on Lightweight Materials for 21st Century Army Trucks, National Materials Advisory Board, Division on Engineering and Physical Sciences (2003, 112 pp.; ISBN 0-309-08869-0; available from the National Academies Press, tel. 1-800-624-6242; \$26.75 plus \$4.50 shipping for single copies; also on the Internet at <[books.nap.edu/catalog/10662.html](http://books.nap.edu/catalog/10662.html)>).

The committee was chaired by **Harry A. Lipsitt**, professor emeritus, department of mechanical and materials engineering, Wright State University, now living in Yellow Springs, Ohio. The study was funded by the U.S. Army Tank-automotive and Armaments Command.

Americans have a false sense of security when it comes to infectious diseases. But West Nile, SARS, and bioterrorist threats are giving the nation an alarming wake-up call.



## A Call to Action Against Microbial Threats

### Meeting the Challenges Posed by Infectious Diseases

**N**o one wished for a case that would dramatically illustrate the major points of the Institute of Medicine's latest report on tackling emerging infections. Even so, the first major media accounts of the outbreak of severe acute respiratory syndrome, or SARS, coincided with the report's release and hammered home the gravity of its findings and recommendations, particularly its call for a shared, global effort to detect and respond to disease.

The SARS outbreak is just the latest reminder that we are still poorly prepared to combat the potential threats posed by new or re-emerging infectious microbes. In the past few decades, human health has been challenged by dozens, including HIV,

Ebola, *E. coli* 0157:H7, hepatitis C, West Nile virus, and the agent responsible for the brain-destroying variant Creutzfeldt-Jakob disease.

Looming over each new outbreak is the specter of the 1918 flu pandemic, which spread like wildfire and killed at least 24 million people across the globe. Though it has spread more gradually, HIV likely will soon overtake the 1918 flu's death toll. So far, SARS has proved less lethal, but nonetheless, it has severely sickened thousands, killed hundreds, and wreaked havoc on the economies of affected areas.

Reaction to the SARS outbreak underscored the significance of the IOM report's conclusion that an effective national response to infectious diseases

must be a global response. In today's easily and well-trafficked global village, infectious microbes can spread quickly to all points of the planet. Reticence or incapacity to tackle outbreaks by any one nation can affect others.

The United States should take a leadership role in promoting a comprehensive global surveillance system to monitor infectious diseases, particularly in the developing world where the burden of infectious illnesses is greatest and resources are most limited. Both technical and financial assistance are needed to ensure that proven public health practices are in place worldwide. The U.S. Department of Defense, Centers for Disease Control and Prevention, and National Institutes of Health should expand and enhance their surveillance programs and actively share diagnostic tools and know-how with other nations to boost their self-sufficiency in disease monitoring and response.

But improvements are not only needed abroad. Efforts also should be made at home to shore up America's own public health infrastructure, which has suffered from years of neglect. Resources must be directed to rebuild and sustain the nation's capacity to monitor and respond to both naturally occurring diseases and bioterrorist threats.

Fortunately, a rapidly expanding understanding of microbiology should allow the development of a large set of new drugs, vaccines, and other countermeasures. But the success of new or current antimicrobials depends on how wisely they are used. Antimicrobial resistance has reached the point that some bacteria are resistant to almost every available drug. Efforts to curb

inappropriate use of antibiotics should be expanded, the report urges. For example, the Food and Drug Administration should ban the use of sub-therapeutic levels of antimicrobials to enhance animal growth if those classes of drugs are also used to treat infections in people.

Meeting the challenges posed by emerging and re-emerging infectious diseases is a long-standing concern of the IOM. Since 1997, its Forum on Emerging Infections has focused attention on infectious disease issues and advanced strategies toward solutions. In addition, the National Academies and National Institutes of Health sponsored a workshop in June 2003 to brainstorm new approaches to developing drugs that could block the smallpox virus. It brought together smallpox experts and leading scientists from other fields in the hope that three or four ambitious, new ideas will emerge. If this approach is successful, it could be repeated for different viral and bacterial threats with the goal of accelerating new drug development.

— *Christine Stencel*

■ **Microbial Threats to Health: Emergence, Detection, and Response.** Committee on Emerging Microbial Threats to Health in the 21st Century, Board on Global Health, Institute of Medicine (2003, approx. 350 pp.; ISBN 0-309-08864-X; 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/10636.html](http://books.nap.edu/catalog/10636.html)>).

The committee was co-chaired by **Margaret Hamburg** and **Joshua Lederberg**. Hamburg is vice president for biological programs at the Nuclear Threat Initiative, Washington, D.C. Lederberg is professor emeritus of molecular genetics and informatics and Sackler Foundation Scholar, Rockefeller University, New York City. The study was funded by the Centers for Disease Control and Prevention, National Institutes of Health, Ellison Medical Foundation, U.S. Agency for International Development, U.S. Department of Defense, U.S. Department of Agriculture, U.S. Food and Drug Administration, and U.S. Joint Institute for Food Safety.





**IOM Advises  
First-of-Its-Kind  
Immunization  
Effort Against  
SMALLPOX**

## On Guard Against an Old Menace

**A**lthough it was virtually wiped out decades ago, smallpox once again has become one of the most fearsome microbial menaces, thanks to the worry that terrorist groups could have illicit stocks of the virus. In late 2002, the United States announced the start of a unique, nationwide campaign to immunize teams of health care and public health workers against the disease, so they are prepared to respond to a smallpox attack, should one ever occur.

The Institute of Medicine has played a key advisory role since the inception of the campaign when the Centers for Disease Control and Prevention, the agency responsible for coordinating the vaccination program, asked the IOM to provide expert guidance. Although CDC has carried out numerous vaccination efforts over the years, the agency sought an independent, expert review to help ensure that the program proceeded in the best way possible, given the unusual and potentially unknown challenges presented by this particular campaign. The vaccine — based on a live, weakened cousin of the smallpox virus — carries greater risk for adverse reactions than other vaccines. Moreover, it was last administered to members of the public

more than 30 years ago when children were the principal recipients and contracting the disease naturally was still a possibility.

From the beginning, the committee formed to address the task stressed that the safety of individuals volunteering to be immunized should be paramount and that the campaign should proceed with the greatest caution and deliberation given the vaccine's known — and possibly unknown — risks. Although CDC was given a mandate to inoculate recipients both as rapidly and as safely as possible, the committee advised the agency and its state and local partners to pause after vaccinating a limited first round of health care and public health workers. The break would enable officials to evaluate data, particularly on any adverse events, and make necessary midcourse changes before offering the vaccine to a wider group of medical, public health, and emergency response personnel. If pausing proved unfeasible, the committee urged CDC and its partners to pursue every opportunity to evaluate the program's safety and progress and make needed changes as the program progressed.

The potential for previously unrecognized risks associated with the vaccine became a reality in March, when word

came that a few vaccine recipients had experienced cardiac inflammation and a few others had suffered heart attacks, including three individuals who subsequently died. Although it is unclear whether all the cardiac problems are linked to the vaccine, they reinforced the committee's conviction that devoting time to analyze all adverse events is crucial.

As of mid-May, more than 36,600 individuals had been inoculated against smallpox, a number well below the rough estimates initially calculated to be vaccinated nationwide. Although some see the disparity as evidence that the vaccination program is lagging, the committee pointed out that preparedness to deal with a smallpox outbreak is about more than mere numbers. Just as, or even more important, is how well-coordinated and trained the recipients are and whether an appropriate mix of personnel are vaccinated in each region. CDC has called on each state to determine how many people should be immunized based upon local preparedness goals.

As the immunization program proceeds, the IOM committee will continue to assess its progress and offer insights to CDC, helping the agency's officials navigate through additional challenges that may arise. — *Christine Stencel*



■ **Review of the Centers for Disease Control and Prevention's Smallpox Vaccination Program Implementation — Letter Reports #1, #2, and #3.**

Committee on Smallpox Vaccination Program Implementation, Board on Health Promotion and Disease Prevention, Institute of Medicine (2003, 52 pp., 42 pp., and 16 pp.; available free on the Internet at <[www.nap.edu](http://www.nap.edu)>).

The committee is chaired by **Brian Strom**, professor of biostatistics and epidemiology, and of medicine and pharmacology, University of Pennsylvania School of Medicine, Philadelphia. The project is funded by the U.S. Centers for Disease Control and Prevention.



## A REGULATORY SUCCESS STORY

### Controlling Carbon Monoxide Pollution

**T**emperatures in the atmosphere usually drop as altitude increases, but in some settings — though it may seem counterintuitive — the reverse can occur. When this atmospheric inversion in temperature takes place in a valley or other location with minimal air circulation, warmer air up above keeps colder air down below, confined near the ground. It also traps pollution, making cities in these areas more susceptible to poor air quality.

A pollutant of particular concern, especially in the winter, is carbon monoxide, which at high-enough levels can aggravate chest pain for people already suffering

from heart disease, and has been correlated with abnormal childhood development and miscarriage. The continued susceptibility of some locations to high carbon monoxide levels prompted Congress to ask a National Research Council committee to look at how effective federal standards and better emissions controls in new motor vehicles have been at reducing the pollutant.

Although the committee confirmed that some areas where inversions occur are still at risk for episodes of high carbon monoxide levels, it called the regulation of this pollutant one of the “great success stories

in air pollution control,” and said there was no need to tighten current federal standards for carbon monoxide emissions from motor vehicles. Even in Fairbanks, Alaska, where atmospheric inversions and a bowl-like terrain can block the dispersion of carbon monoxide in the air, there has not been a violation of national standards in the last two years. That is a significant drop from the 1970s, when Fairbanks violated the standards on average more than 100 days a year.

When the Clean Air Act first established national standards for carbon monoxide in 1971, more than 90 percent of the locations that monitored carbon monoxide were in violation. However, violations are rare today, in large part due to new controls on vehicle emissions.

The incomplete combustion of fuel in cars and pickup trucks is the main contributor to carbon monoxide pollution. When combustion takes place in a car engine, oxygen is added to fuel carbon, converting it first to carbon monoxide and then to carbon dioxide. But if there is insufficient oxygen or not enough time to oxidize the fuel, carbon monoxide escapes in the exhaust before it can be converted. New technologies, such as catalytic converters that provide additional oxidation and onboard computers that control the combustion process, have reduced carbon monoxide emissions.

State vehicle inspection and maintenance programs, especially those that target older cars, and low-sulfur gasoline that improves catalyst efficiency have also contributed to the reduction in carbon monoxide emissions. And in some cold-weather places, such as Fairbanks, the use

of engine-block heaters helps motorists to warm up their cars faster, thus reducing the time before the emissions-control catalyst is fully functional.

Problem locales should continue to take advantage of countermeasures such as these, the committee said, adding that the communities should plan for the worst-case combinations of high emissions and atmospheric inversions. They will need to keep monitoring the air for unacceptable carbon monoxide levels as well. In fact, the committee recommended that carbon monoxide monitors be left in place even in areas not expected to violate standards, since carbon monoxide can indicate the presence of other pollutants that present a health risk, such as particulate matter.

The committee noted that another benefit of the tougher standards was revealed in a study last year by the Centers for Disease Control and Prevention. It showed that over a 30-year time span, the stricter controls prevented 11,000 deaths from carbon monoxide poisoning, which can occur accidentally when a person spends too much time in an unventilated car with a malfunctioning or blocked tailpipe. — *Bill Kearney*

■ **Managing Carbon Monoxide Pollution in Meteorological and Topographical Problem Areas.**

Committee on Carbon Monoxide Episodes in Meteorological and Topographical Problem Areas; Board on Environmental Studies and Toxicology and Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies; and Transportation Research Board (2003, 214 pp.; ISBN 0-309-08923-9; available from the National Academies Press, tel. 1-800-624-6242; \$50.00 plus \$4.50 shipping for single copies; also on the Internet at <[books.nap.edu/catalog/10689.html](http://books.nap.edu/catalog/10689.html)>).

The committee was chaired by **Armistead G. Russell**, Georgia Power Distinguished Professor of Environmental Engineering, Georgia Institute of Technology, Atlanta. The study was funded by the U.S. Environmental Protection Agency.



# DERAILING BIOTERRORISM

## Atmospheric Models Can Help Track Hazardous Materials

It's a nightmare scenario that keeps emergency planners and homeland security officials awake at night.

Terrorists release a virus or toxic chemicals or detonate a radioactive “dirty bomb” in a major city. One of the first duties of emergency responders will be to determine how a plume of hazardous material may fan out or a virus may spread through a population.

As difficult as this task might be, atmospheric scientists have developed computer models that can help predict how hazardous agents disperse in the air. Used to track pollution or accidental releases from industrial sites, these models are also available to emergency personnel in the event of a chemical, biological, or radiological attack.

When a hazardous agent is released, scientists working with emergency responders can enter information about the hazard source along with atmospheric conditions — such as wind and temperature — into a computer and obtain an estimate of where and how fast the agent is moving in the air.

But emergency responders are faced with a confusing array of atmospheric models and often do not have a clear understanding of where to turn for immediate assistance, according to a new report from the National Research Council. The report also notes that most atmospheric dispersion models are not well-designed for complex topographical features or urban environments and do not sufficiently describe uncertainties that are part of any dispersion forecast.

The report is the result of a workshop held last summer in Woods Hole, Mass.,

where atmospheric scientists and emergency management officials discussed ways to improve the models as well as the communication between first responders and the scientists who run the models and monitor meteorological data. One suggestion that emerged from these discussions was that a single federal point of contact, such as a toll-free telephone number, should be established to immediately connect rescue personnel across the country with appropriate modeling centers.

Improving modeling and observational capabilities can be costly, so they should be tested in areas that are most likely to be targeted by terrorists. These resources could be used for many other purposes such as monitoring air pollution and forecasting severe weather, the report says.

“With a more effective application of available tools, and development of new technologies and capabilities, we can increase the confidence of emergency responders in addressing this critical national security concern,” said Robert Serafin, chair of the committee that wrote the report. — *Patrice Pages*

■ **Tracking and Predicting the Atmospheric Dispersion of Hazardous Material Releases: Implications for Homeland Security.** Committee on the Atmospheric Dispersion of Hazardous Material Releases, Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies (2003, 114 pp.; ISBN 0-309-08926-3; available from the National Academies Press, tel. 1-800-624-6242; \$27.00 plus \$4.50 shipping for single copies; also on the Internet at <[books.nap.edu/catalog/10716.html](http://books.nap.edu/catalog/10716.html)>).

The committee was chaired by **Robert Serafin**, director emeritus, National Center for Atmospheric Research, Boulder, Colo. The study was funded by the National Science Foundation, NASA, National Oceanic and Atmospheric Administration, and the National Research Council.



## *New Teacher Advisory Council Injects Classroom Realities Into Education Research*

**W**hen Elizabeth “Betty” Carvellas became president of the National Association of Biology Teachers, she was automatically made a member of the Council of Scientific Society Presidents, an elite group of leaders of scientific organizations. At one of her first council meetings, Carvellas felt intimidated by the achievements of most participants, who included a nuclear physicist and a rocket scientist. She didn’t have a doctorate. Only a few other women were there. She figured her expertise in the classroom mattered little. “I just kept my mouth shut,” she recalled.

Her outlook soon changed. When reflecting back on the council’s science and math education subcommittee, she quipped: “I very quickly realized that they had little knowledge about what was happening in education. ... I also found out that once I spoke up, they really did want to know.” Nearly 10 years later, she’s still involved with the Washington, D.C.-based council as a steering committee member.

Because Carvellas knows what it feels like to squelch one’s own insights and opinions,



she’s ecstatic about a new National Academies initiative to make K-12 teachers’ voices a more influential part of discussions and agenda-setting within the scientific research enterprise — starting with the Academies. The endeavor, called the Teacher Advisory Council (TAC), has gathered 11 stellar teachers from across the country — including Carvellas — to infuse the “wisdom of practice” perspectives of top-notch teachers in the Academies’ education-research proposals and current projects, as well as in its many outreach activities that target educators.

The teachers critique ideas, brainstorm, and serve as sounding boards for staff members across the Academies. TAC plans to develop a network of teacher “associates” in each state to help spread useful information about research findings, scientific meetings, and related activities. Bruce Alberts, president of the National Academy of Sciences, earmarked about \$300,000 from an internal endowment to get TAC off the ground.

“Research is wonderful, but it doesn’t always have that ‘reality base,’” said

Carvellas, now a biology teacher and science department co-chair at Essex High School in Essex Junction, Vt. The advisory group is “empowering,” she said, because it assigns critical roles to teachers in a team effort to enrich the full classroom experience.

The classroom, after all, is where teachers must breathe life into research findings. One recent morning, about 20 sophomores buzzed around Carvellas’ molecular biology class while working on a lab assignment about sickle cell disease, an inherited blood disorder that often causes red blood cells to look more like crescents than doughnuts. With microscopes, they observed red blood samples and wrote about their findings. They manipulated a piece of steel tubing and red Play-Doh shaped like various blood cells to establish how normal red blood cells flow through the body. Other workstations were designed to help students better understand blood proteins and a laboratory technique called electrophoresis, which was demonstrated with a clear, squishy protein gel that revealed tiny blue “bands” after normal and diseased hemoglobin had been exposed to an electric current.

“It’s kind of exciting,” said 16-year-old Cliff Kida. “She gives you some projects to make you really think.” Carvellas gently coached from the side, asking probing questions and urging students to synthesize findings to see the big picture.

The gap between education research and teachers’ everyday classroom experiences is a national problem that can thwart reform measures, Alberts said. The impetus for TAC stemmed from his concerns about some of the Academies’ own education studies.



“In my opinion, we have generally failed to get a strong-enough ‘teacher’s voice’ in our education reports, despite putting several outstanding teachers on each relevant committee,” he said. On many of the Academies’ education committees, K-12 teachers tend to defer to university professors and people with other kinds of expertise. Alberts wants the Academies, education administrators, and law-makers at all levels to place greater value on input from excellent teachers when it comes to everything from crafting school reforms to setting education policies.

Barbara Schulz of Issaquah, Wash., an award-winning science teacher, coordinates TAC’s work and oversees the selection process for its membership. The high-profile initiative recognizes teachers as true professionals, taking their insights and concerns seriously, she said.

The effort has real merit, said TAC participant Dayo Akinsheye, a mathematics resource teacher at Seaton Elementary School in Washington, D.C. “Nonpractitioners make most education policy decisions,” she pointed out. “Members of TAC are positioned to provide an invaluable link to the real nuts-and-bolts issues that confront educators on a daily basis.”

— Vanee Vines

## *New Initiative Strives to Advance the Potential of* **Interdisciplinary Research**

Leaders at the National Academies have long believed that extraordinary societal challenges call for reaching beyond the established patterns and organization of the research community. While the need for and impulse toward interdisciplinary research is growing, there are still persistent barriers to communication that result from disciplinary specialization and vastly different cultures in science, engineering, and medical research. These barriers inhibit leaps forward in discovery and obstruct the application of new knowledge. Successful communication among individuals who work in different professional worlds is key to advancing science, engineering, and medicine for the improvement of the human condition.

Recognizing this opportunity, the W.M. Keck Foundation has provided the Academies with \$40 million for a program to stimulate and support exciting new collaborative research. Called the “National Academies Keck *Futures Initiative*,” this

ambitious project is designed to foster and fund innovative interdisciplinary research that could yield significant benefits to society.

The centerpiece of the initiative is a series of *Futures* Conferences where outstanding researchers from diverse disciplines can meet to share new ideas. The annual theme for the conferences will be selected based on assessments of where the intersection of science, engineering, and medical research has the greatest potential to spark new discovery. The research theme of the first year’s conference, to take place this November in Irvine, Calif., is “Signals, Decisions, and Meaning in Biology, Chemistry, Physics, and Engineering.” The researchers who are invited to and attend the conference may apply for “seed” grants to begin collaborative research inspired by ideas and relationships developed during the conferences.

The National Academies are also conducting a study on facilitating interdisciplinary research to identify current obstacles that stifle cross-disciplinary collaborations, and make recommendations on how to incite and support such research.

Another important component of the *Futures Initiative* is the creation of the National Academies Communication Awards. Three \$20,000 prizes annually will be awarded to an author, journalist, and television or radio reporter/producer who have made significant contributions to the public understanding of science, engineering, and medicine. The first awards will be presented at the November *Futures* Conference.

For more information about the initiative, visit [national-academies.org/keck](http://national-academies.org/keck).

— Maureen O’Leary



The inauguration of the National Academies Keck *Futures Initiative* was celebrated in May at the Academies’ new building in downtown Washington, D.C. The building was officially named “The Keck Center of the National Academies.”

*The California-based W.M. Keck Foundation funds grants that are focused primarily on pioneering efforts in the areas of medical research, science, and engineering. For more information, visit [www.wmkeck.org](http://www.wmkeck.org).*

## Raising the Voice of Science in Africa

Africa gave birth to the human race, and the continent's cultural and ecological diversity is breathtaking. But Africa has enormous needs in areas that require science, engineering, and medical expertise. Academies of science across the continent have worked hard to recognize the contributions and accomplishments of their members. Even so, the groups have little clout in their governments' public-policy debates and have been in

existence for only a few decades or less.

The U.S. National Academies, in partnership with the InterAcademy Panel's program on international issues, are working to strengthen the role of science advice in policy-making in Africa. The panel is

a worldwide network of 90 academies that counsel public officials and citizens on the scientific aspects of major global issues such as sustainable development and infectious disease.

Representatives from seven African academies visited the U.S. National Academies for nearly two weeks in early April to learn more about their operations and to share personal experiences. The itinerary included meetings with staff executives and senior scientists, plus sessions with various federal officials and leaders of professional societies.



“We need science to develop our continent,” said Ousmane Fall, who directs the Academy of Sciences and Technology of Senegal, at an introductory meeting in Washington, D.C. Other participants — who represented Cameroon, Nigeria, Ghana, Uganda, Kenya, and the African Academy of Sciences, an umbrella group based in Nairobi — emphasized how the collaboration would provide valuable advice and give them greater visibility back home.

The visit was orchestrated by several staff members in the National Academies' Office of International Affairs, including executive director John Boright and program officer Clara Cohen. “Such outreach efforts benefit everyone,” Boright said. “By working together on important issues identified by our partner countries' governments, we can contribute to their policies and help stimulate the institutional capability of African academies to play active roles in more policy areas.”

Additional information about the InterAcademy Panel is available at [national-academies.org/iap](http://national-academies.org/iap). — *Vanee Vines*

## Freed Egyptian Sociologist Visits National Academies

Scientist and human rights advocate Saad Eddin Ibrahim was the featured speaker at a briefing held by the Committee on Human Rights during this year's annual meeting of the National Academy of Sciences. Ibrahim was acquitted on March 18, 2003, by Egypt's high court of justice after being tried three times on the same charges and incarcerated repeatedly over the course of nearly three years. Charges against him included receiving foreign



funding without permission from authorities, falsifying election documents, and disseminating false information harmful to Egypt. His arrest was widely criticized by the international community as being unjust and politically motivated.

Ibrahim received widespread support throughout his ordeal from human rights and scientific organizations, including the National Academies. In two letters to Egypt's President Hosni Mubarak, the presidents of the National Academies said they were deeply distressed by their colleague's situation. "Professor Ibrahim is known to us and many of our members as a man of integrity and scholarly distinction. He has shown commitment to justice, human rights, democratic values, and his native Egypt."

The Committee on Human Rights urges Academies members to appeal for unjustly imprisoned colleagues around the world, and actively campaigned for Ibrahim's release, sent observers to his trial, and issued a report on his case. — *Valerie Chase*

## Homeland Security Science Chief Sworn In

The Great Hall of the National Academies building was the setting for the swearing-in ceremony of Charles McQueary as the first undersecretary for science and technology

at the U.S. Department of Homeland Security. DHS Secretary Tom Ridge delivered the oath of office to McQueary, who has a Ph.D. in engineering mechanics and is the retired president of General Dynamics. McQueary said his new job offers him a "great chance to give something back to my country."

The Academies called on Congress to establish McQueary's new post in last year's report *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism*, which stated that the position was crucial to keep the new department connected to other research-oriented agencies such as the National Science Foundation and National Institutes of Health.

McQueary said that getting national and local emergency personnel access to cutting-edge technologies will be among his first priorities. He also added that he would be focusing on how to improve the public's understanding of the risks posed by potential attacks involving biological, chemical, or radiological agents.

— *Bill Kearney*





## 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.*

### **The Future of Supercomputing.**

Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences. Project director: Cynthia Patterson. Co-chairs: Susan Graham, distinguished professor of computer science, University of California, Berkeley, and chief computer scientist, National Partnership of Advanced Computations Infrastructure; and Marc Snir, head of the department of computer science and Michael Faiman and Saburo Muroga Professor, University of Illinois, Urbana-Champaign. Sponsor: U.S. Department of Energy.

### **New Frontiers in Contraceptive Research.**

Board on Health Sciences Policy, Institute of Medicine. Project director: Sharyl Nass. Chair: Jerome F. Strauss III, Luigi Mastroianni Jr. Professor and director, Center for Research on Reproduction and Women’s Health, and associate chairman, department of obstetrics and gynecology, University of Pennsylvania Medical Center, Philadelphia. Sponsor: Bill & Melinda Gates Foundation.

### **Public Participation in Environmental Assessment and Decision-making.**

Committee on the Human Dimensions of Global Change, Division of Behavioral and Social Sciences and Education. Project director: Paul Stern. Chair: Thomas Dietz, professor of sociology, and of

crop and soil sciences; acting director, Environmental Science and Policy Program; and acting associate dean for environmental science and policy in the College of Agriculture and Natural Resources, College of Natural Science, and College of Social Science at Michigan State University, East Lansing. Sponsors: Food and Drug Administration, U.S. Department of Energy, and U.S. Environmental Protection Agency.

### **Review of Smithsonian Institution’s National Zoological Park and Conservation and Research Center.**

Board on Agriculture and Natural Resources and Institute for Laboratory Animal Research, Division on Earth and Life Studies. Project director: Jamie Jonker. Chair: R. Michael Roberts, Curator’s Professor of Animal Science, Biochemistry, and Veterinary Pathobiology, University of Missouri, Columbia. Sponsor: Smithsonian Institution.

### **Transforming Our Common Destiny: Hispanics in the United States.**

Committee on Population, Center for Social and Economic Studies, Division of Behavioral and Social Sciences and Education. Project director: Faith Mitchell. Chair: Marta Tienda, Maurice P. Daring Professor in Demographic Studies, and professor of sociology and public affairs, Princeton University, Princeton, N.J. Sponsors: Andrew W. Mellon Foundation, U.S. Census Bureau, National Cancer Institute, National Institute for Occupational Safety and Health, National Institute of Child Health and Human Development, NIH Office of Behavioral and Social Sciences Research, NIH Office of Minority Health and Research, National Institute of Mental Health, National Institute on Aging, and Robert Wood Johnson Foundation.

### **Transportation of Radioactive Waste.**

Board on Radioactive Waste Management, Division on Earth and Life Studies; and Division of Studies and Information Services, Transportation Research Board. Project director: Kevin Crowley. Chair: Neal Lane, university professor, department of physics and astronomy, and fellow, James A. Baker III Institute for Public Policy, Rice University, Houston. Sponsors: EPRI, National Cooperative Highway Research Program, U.S. Nuclear Regulatory Commission, Nye County, Nev., U.S. Department of Energy, and U.S. Department of Transportation.

## 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.*

### **Accelerating the Research, Development, and Acquisition of Medical Countermeasures Against Biological Warfare Agents — Interim Report**

Medical Follow-up Agency, Institute of Medicine; and Board on Life Sciences, Division on Earth and Life Studies (2003, 18 pp.; available only online at <www.nap.edu>).

### **Adaptive Monitoring and Assessment for the Comprehensive Everglades Restoration Plan**

Water Science and Technology Board and Board on Environmental

Studies and Toxicology, Division on Earth and Life Studies (2003, 122 pp.; ISBN 0-309-08892-5; available from NAP, \$28.25 plus \$4.50 shipping).

**Building an Electronic Records Archive at the National Archives and Records Administration: Recommendations for Initial Development**

Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2003, approx. 86 pp.; available only online at <www.nap.edu>).

**Characterizing Exposure of Veterans to Agent Orange and Other Herbicides Used in Vietnam — Interim Findings and Recommendations**

Board on Health Promotion and Disease Prevention, Institute of Medicine (2003, 36 pp.; ISBN 0-309-08943-3; available from NAP, \$12.00 plus \$4.50 shipping).

**Cities Transformed: Demographic Change and Its Implications in the Developing World**

Committee on Population, Division of Behavioral and Social Sciences and Education (2003, approx. 535 pp.; ISBN 0-309-08862-3; available from NAP, \$52.50 plus \$4.50 shipping).

**Describing Death in America: What We Need to Know**

National Cancer Policy Board, Institute of Medicine and Division on Earth and Life Studies (2003, 128 pp.; ISBN 0-309-08725-2; available from NAP, \$33.00 plus \$4.50 shipping).

**Effectiveness of Air Force Science and Technology Program Changes**

Air Force Science and Technology Board, Division on Engineering and Physical Sciences (2003, 78 pp.; ISBN 0-309-08895-X; available from NAP, \$18.00 plus \$4.50 shipping).

**End Points for Spent Nuclear Fuel and High-Level Radioactive Waste in Russia and the United States**

Board on Radioactive Waste Management, Division on Earth and Life Studies; and Office for Central Europe and Eurasia Development, Security, and Cooperation, Division on Policy and Global Affairs (2003, 154 pp.; ISBN 0-309-08724-4; available from NAP, \$33.75 plus \$4.50 shipping).

**Ensuring the Quality of Data Disseminated by the Federal Government — Workshop Report**

Science, Technology, and Law Program, Division on Policy and Global Affairs (2003, 92 pp.; ISBN 0-309-08857-7; \$18.00 plus \$4.50 shipping).

**The Experiences and Challenges of Science and Ethics — Proceedings of an American-Iranian Workshop**

Division on Policy and Global Affairs, in cooperation with the Academy of Sciences of the Islamic Republic of Iran and the Academy of Medical Sciences of the Islamic Republic of Iran (2003, 126 pp.; ISBN 0-309-08890-9; available from NAP, \$29.00 plus \$4.50 shipping).

**Future Hydrogen Production and Use — Interim Letter Report**

Board on Energy and Environmental Systems, Division on Engineering and Physical Sciences; and National Academy of Engineering (2003, 7 pp.; available only online at <www.nap.edu>).

**Guatemala: Human Rights and the Myrna Mack Case**

Committee on Human Rights, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (2003, 54 pp.; ISBN 0-309-08916-6; available from NAP, \$18.00 plus \$4.50 shipping).

**Guidelines for the Care and Use of Mammals in Neuroscience and Behavioral Research**

Institute for Laboratory Animal

Research, Division on Earth and Life Studies (2003, 55 pp.; ISBN 0-309-08903-4; available from NAP, \$14.95 plus \$4.50 shipping).

**Health Professions Education: A Bridge to Quality**

Board on Health Care Services, Institute of Medicine (2003, 192 pp.; ISBN 0-309-08723-6; available from NAP, \$35.00 plus \$4.50 shipping).

**Improving the Scientific Basis for Managing DOE's Excess Nuclear Materials and Spent Nuclear Fuel**

Board on Radioactive Waste Management, Division on Earth and Life Studies (2003, 124 pp.; ISBN 0-309-08722-8; available from NAP, \$28.75 plus \$4.50 shipping).

**Improving Undergraduate Instruction in Science, Technology, Engineering, and Mathematics — Report of a Workshop**

Center for Education, Division of Behavioral and Social Sciences and Education (2003, 176 pp.; ISBN 0-309-08929-8; available from NAP, \$40.00 plus \$4.50 shipping).

**Initial Steps in Rebuilding the Health Sector in East Timor**

Roundtable on the Demography of Forced Migration, Committee on Population, Division of Behavioral and Social Sciences and Education; and Program on Forced Migration and Health, Mailman School of Public Health, Columbia University (2003, 70 pp.; ISBN 0-309-08901-8; available from NAP, \$18.00 plus \$4.50 shipping).

**International Human Rights Network of Academies and Scholarly Societies: Proceedings — Symposium and Fifth Biennial Meeting, Paris, May 10-11, 2001**

Committee on Human Rights, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (2003, 156 pp.; available only online at <www.nap.edu>).

**Long-Term Stewardship of DOE Legacy Waste Sites — A Status Report**

Board on Radioactive Waste Management, Division on Earth and Life Studies (2003, 73 pp.; available only online at <www.nap.edu>).

**Materials Science and Technology: Challenges for the Chemical Sciences in the 21st Century**

Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2003, 98 pp.; ISBN 0-309-08512-8; available from NAP, \$18.00 plus \$4.50 shipping).

**The Measure of STAR: Review of the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) Research Grants Program**

Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2003, 190 pp.; ISBN 0-309-08938-7; available from NAP, \$40.00 plus \$4.50 shipping).

**Measuring Access to Learning Opportunities**

Center for Education and Committee on National Statistics, Division of Behavioral and Social Sciences and Education (2003, 144 pp.; ISBN 0-309-08897-6; available from NAP, \$29.00 plus \$4.50 shipping).

**Medicare Coverage of Routine Screening for Thyroid Dysfunction**

Board on Health Care Services, Institute of Medicine (2003, approx. 100 pp.; ISBN 0-309-08885-2; available from NAP, \$18.00 plus \$4.50 shipping).

**Monitoring International Labor Standards: National Legal Frameworks — Summary of a Workshop**

Division of Behavioral and Social Sciences and Education, and Division on Policy and Global Affairs (2003, 76 pp.; ISBN 0-309-08942-5; available from NAP, \$18.00 plus \$4.50 shipping).

**Novel Approaches to Carbon Management: Separation, Capture, Sequestration, and Conversion to Useful Products — Workshop Report**

Board on Energy and Environmental Systems, Division on Engineering and Physical Sciences; and Board on Earth Sciences and Resources, Division on Earth and Life Studies (2003, approx. 45 pp.; ISBN 0-309-08937-9; available from NAP, \$12.00 plus \$4.50 shipping).

**Occupational Health and Safety in the Care and Use of Nonhuman Primates**

Institute for Laboratory Animal Research, Division on Earth and Life Studies (2003, 184 pp.; ISBN 0-309-08914-X; available from NAP, \$35.00 plus \$4.50 shipping).

**Offspring: Human Fertility Behavior in Biodemographic Perspective**

Committee on Population, Division of Behavioral and Social Sciences and Education (2003, 400 pp.; ISBN 0-309-08718-X; available from NAP, \$59.00 plus \$4.50 shipping).

**Preparing for the Psychological Consequences of Terrorism: A Public Health Strategy**

Board on Neuroscience and Behavioral Health, Institute of Medicine (2003, 180 pp.; ISBN 0-309-08953-0; available from NAP, \$36.00 plus \$4.50 shipping).

**Progress in Improving Project Management at the Department of Energy — 2002 Assessment**

Board on Infrastructure and the Constructed Environment, Division on Engineering and Physical Sciences (2003, 125 pp.; ISBN 0-309-08909-3; available from NAP, \$25.00 plus \$4.50 shipping).

**Psychosocial Concepts in Humanitarian Work With Children: A Review of the Concepts and Related Literature**

Roundtable on the Demography of Forced Migration, Committee on

Population, Division of Behavioral and Social Sciences and Education; and Program on Forced Migration and Health, Mailman School of Public Health, Columbia University (2003, 142 pp.; ISBN 0-309-08933-6; available from NAP, \$31.75 plus \$4.50 shipping).

**Reducing the Time From Basic Research to Innovation in the Chemical Sciences — A Workshop Report to the Chemical Sciences Roundtable**

Chemical Sciences Roundtable, Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2003, 142 pp.; ISBN 0-309-08734-1; available from NAP, \$31.75 plus \$4.50 shipping).

**The Resistance Phenomenon in Microbes and Infectious Disease Vectors: Implications for Human Health and Strategies for Containment — Workshop Summary**

Forum on Emerging Infections, Board on Global Health, Institute of Medicine (2003, 336 pp.; ISBN 0-309-08854-2; available from NAP, \$45.00 plus \$4.50 shipping).

**A Review of the Dose Reconstruction Program of the Defense Threat Reduction Agency**

Board on Radiation Effects Research, Division on Earth and Life Studies (2003, approx. 390 pp.; ISBN 0-309-08902-6; available from NAP, \$54.00 plus \$4.50 shipping).

**Science and Technology for Army Homeland Security — Report 1**

Board on Army Science and Technology, Division on Engineering and Physical Sciences (2003, 184 pp.; ISBN 0-309-08701-5; available from NAP, \$38.75 plus \$4.50 shipping).

#### Scientific Criteria to Ensure Safe Food

Food and Nutrition Board, Institute of Medicine; and Board on Agriculture and Natural Resources, Division on Earth and Life Studies (2003, 342 pp. ISBN 0-309-08928-X; available from NAP, \$44.95 plus \$4.50 shipping).

#### Securing the Future: Regional and National Programs to Support the Semiconductor Industry

Board on Science, Technology, and Economic Policy, Division on Policy and Global Affairs (2003, 344 pp.; ISBN 0-309-08501-2; available from NAP, \$66.00 plus \$4.50 shipping).

#### Survey Automation — Report and Workshop Proceedings

Committee on National Statistics, Division of Behavioral and Social Sciences and Education (2003, 274 pp.; ISBN 0-309-08930-1; available from NAP, \$39.00 plus \$4.50 shipping).

#### Working Families and Growing Kids: Caring for Children and Adolescents

Board on Children, Youth, and Families, Institute of Medicine and Division of Behavioral and Social Sciences and Education (2003, 275 pp.; ISBN 0-309-08703-1; available from NAP, \$54.00 plus \$4.50 shipping).

## HOT OFF THE PRESS

### Prime Obsession

Bernhard Riemann and the Greatest Unsolved Problem in Mathematics

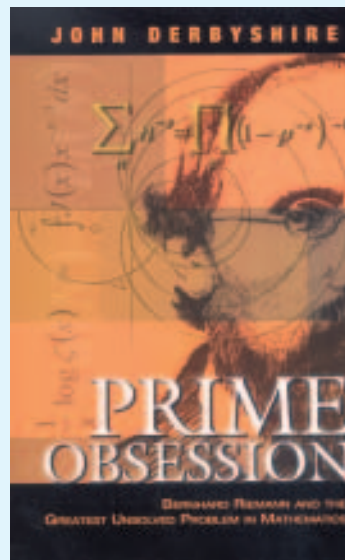
John Derbyshire

In August of 1859, Bernhard Riemann, a 32-year-old mathematician, posed a deceptively simple question to the Berlin Academy: Is there a logical formula for calculating how many prime numbers there are in a given quantity? More than 150 years later, the solution to this critical problem remains elusive.

Riemann's investigation led him to ponder whether there is a pattern to prime numbers. Ultimately, his question would become the obsession of generations, and it continues to challenge and excite mathematicians the world over.

In *Prime Obsession*, author and mathematician John Derbyshire alternates chapters of extraordinarily lucid exposition with chapters of biography and history, presenting a fascinating and fluent account of an epic mathematical mystery and the man behind it.

Joseph Henry Press  
ISBN 0-309-08549-7  
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# Upcoming Exhibitions

**At the National Academy of Sciences**  
2100 C St. N.W., Washington, D.C.  
Hours: Weekdays 9 a.m. - 5 p.m.

## **Seeing Beyond: Recent Works by Susan Pasquarelli**

**Sept. 8, 2003 - Feb. 13, 2004**

Upstairs Gallery



Pasquarelli's works "are like writing in a dream language or something seen through a microscope ... these tiny, tight, quilt-like renderings are landscapes of internal geographic narrative."

— *Art Matters*,  
March 2002

*Reception with the  
artist on Oct. 5  
at 1 p.m.*



## **Under Antarctic Ice: Photography by Norbert Wu**

**Sept. 29 - Dec. 24**

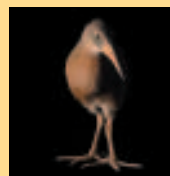
Rotunda Gallery

"These southern seas are proving to be full of surprises. ...rich in extraordinary life, unexpectedly colorful, and filled with eerie symphonies of Weddell seals. I was captivated by the magic of this pristine place." — *Norbert Wu*

## **At the Keck Center of the National Academies**

500 Fifth St. N.W., Washington, D.C.

The Keck Center is home to permanent installations by D.C.-based artist Larry Kirkland, as well as paintings, photographs, and exhibits by other contemporary artists.



## **Portraits of Vanishing Species**

**Sept. 18, Oct. 16,  
Nov. 20, 5 p.m. - 8 p.m.**

Offers a retrospective of the works of award-winning photographers David Liittschwager and Susan Middleton, who have been photographing rare and endangered species since 1986. Their work is the subject of three books and of an Emmy Award-winning National Geographic television special.

*Presentation by the artists on  
Nov. 20 at 6 p.m.*

*Open houses to be held in conjunction  
with "Third Thursday," a monthly celebration of the arts in downtown D.C.*

*Sponsored by the National Academies' Office of Exhibitions and Cultural Programs  
For more information, visit <[national-academies.org/arts](http://national-academies.org/arts)>, e-mail [arts@nas.edu](mailto:arts@nas.edu), or call 202-334-2436*

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