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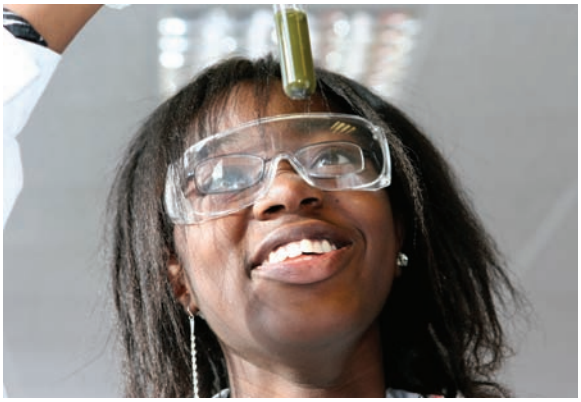

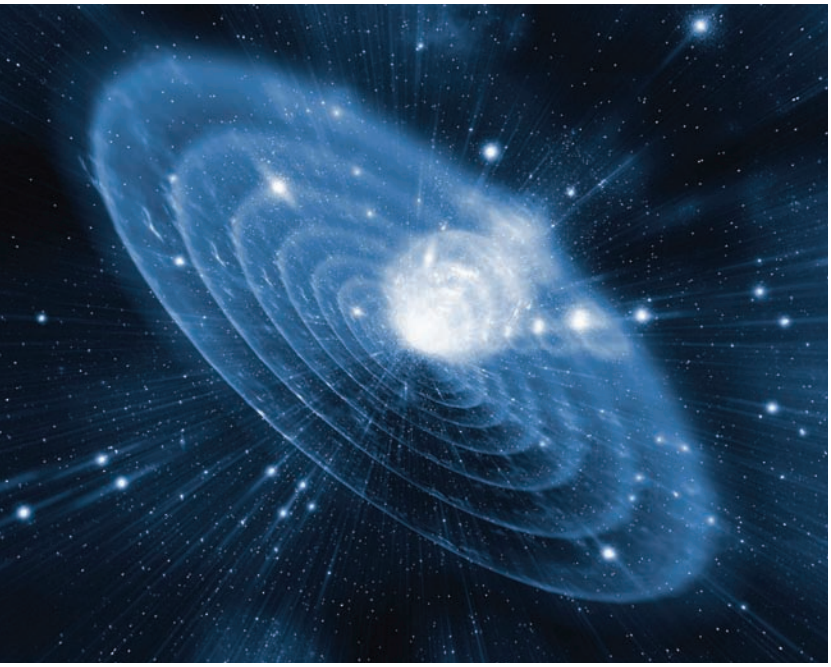

Envisioning a New Path for K-12 Science Education

Restoration Programs for Chesapeake and California's Bay Delta

Should U.S. Physics Research Go Deep Underground?

Fall 2011
vol. 11 number 2

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

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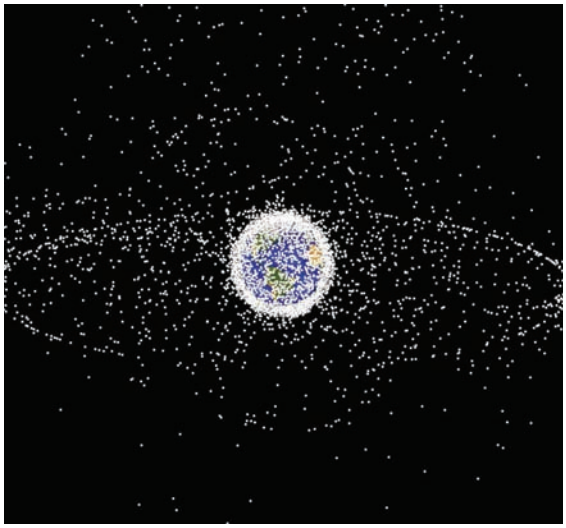

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Bill Colglazier, Farewell and Hello

In June E. William Colglazier retired from the Academies. Known to all as "Bill," he served as executive officer of the National Academy of Sciences and National Research Council since 1994 and chief operating officer since 2001. His deep understanding of science and public policy as well as of people and organizations helped him make an invaluable and enduring contribution to the work and mission of the Academies.

Bill had a passionate commitment to our role as an independent and objective adviser to the federal government and to the important role science and technology can play in the life of the nation and the world. So in late July, we were delighted to learn that the Department of State had selected him to be Secretary Hillary Clinton's new science and technology adviser. In his new position, Bill now serves as an advocate for science-based policy at the State Department and helps identify and evaluate scientific and technical issues that are likely to affect U.S. strategic and foreign policy interests. In announcing his appointment, the State Department said that Bill will "serve the U.S. national interest by promoting global scientific and technological progress as integral components of U.S. diplomacy including building partnerships with the national and international scientific communities."

Bill has begun his new job in Foggy Bottom, across the street from the historic National Academy of Sciences building. And he has taken on a post established as a result of a 1999 National Research Council report on the role science, technology, and health can play in our nation's international diplomacy. So, while we will miss him here at the Academies, we can also say "Welcome back!"

(Reprinted from the July/August 2011 issue of In the Loop, the National Academies' newsletter for staff)

Plans to Restore Two Bays Receive Expert Reviews

On opposite coasts of the country, significant efforts are under way to conserve and restore two of the nation's most critical waterways — the Chesapeake Bay and the California Bay Delta. Shaped by human activity over the last century, the bays are homes to thousands of plant and animal species and serve as important commercial and recreational resources. The National Research Council was called upon to review the restoration programs and evaluate how to improve their missions for successful results.

On the East Coast, the U.S. Environmental Protection Agency, the six Chesapeake watershed states, and the District of Columbia have formed a cooperative partnership called the Chesapeake Bay Program that focuses on limiting the entry of pollutants such as nitrogen, phosphorus, and sediment into bay waters. The committee that looked at this program found its two-year milestone strategy to track pollution control practices improves upon past strategies by committing states to tangible, near-term goals. However, the consequences for failing to attain the goals remain unclear.

The committee's report also says that nearly all states in the program have insufficient information to evaluate how well they are reducing nutrient pollution, limiting their capacity to make midcourse corrections. Numerous challenges affect the consistency and accuracy of the tracking and accounting of nutrient reduction practices, which could lead to an incomplete and possibly inaccurate picture of overall progress.

The committee was concerned that the public may have overly optimistic expectations for the program. Because visible evidence of improved water quality will be delayed significantly, public confidence may wane. To sustain support, these uncertainties and lag times should be communicated clearly.

The Research Council also reviewed the draft Bay Delta Conservation Plan (BDCP), which aims to serve as a habitat

conservation plan and gain authorization under the federal Endangered Species Act and companion California legislation for a proposed water diversion project, such as a canal or tunnel, in the delta region. Under the plan, water would be taken from the northern part of the delta directly to the central and southern part of the state for agricultural and domestic uses — while trying to mitigate the project's impact on the region's ecosystems, particularly endangered and threatened fishes.

The report says that the BDCP has critical missing components including a clearly defined purpose. In addition, the plan states that the principal component of a habitat conservation plan is a scientific analysis of the potential impacts on delta species and how those species would benefit from conservation actions. However, the analysis was not included in the plan because it is still being prepared. The study panel noted that this omission results in a critical gap in the science and makes it hard to evaluate alternative mitigation and conservation actions.

Moreover, the BDCP lacks clarity in its purpose, which makes it difficult to properly understand, interpret, and review the science that underlies the plan. Specifically, it is unclear whether the BDCP is exclusively a habitat conservation plan or intended to also be a plan that achieves California's "co-equal goals" of providing reliable water supply and protecting and enhancing the delta ecosystem.

"There is a strong body of solid science to support some of the actions discussed in the BDCP, but because the science is not well-integrated, we are getting less from the science than we could," said Henry Vaux, chair of the study panel. "A stronger and more complete plan could contribute importantly to solving the problems that beset the delta."

— Jennifer Walsh & Lorin Hancock

Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay: An Evaluation of Program Strategies and Implementation. Committee on the Evaluation of Chesapeake Bay Program Implementation for Nutrient Reduction to Improve Water Quality, Water Science and Technology Board, Division on Earth and Life Studies (2011, 258 pp.; ISBN 0-309-21079-8). The committee was chaired by **Kenneth H. Reckhow,** professor of water resources at the Nicholas School of the Environment, Duke University, Durham, N.C. The study was funded by the U.S. Environmental Protection Agency.

A Review of the Use of Science and Adaptive Management in California's Draft Bay Delta Conservation Plan. Panel to Review California's Draft Bay Delta Conservation Plan, Water Science and Technology Board and Ocean Studies Board, Division on Earth and Life Studies (2011, 100 pp.; ISBN 0-309-21231-6). The panel was chaired by **Henry J. Vaux,** professor emeritus of resource economics at the University of California in Berkeley and Riverside. The study was funded by the U.S. departments of the Interior and Commerce.

Both reports are available from the National Academies Press, tel. 1-800-624-6242; also on the Internet at <www.nap.edu>.

UNDER THE ICE

Research in One of the World's Last Frontiers

Antarctica's icy landscapes may seem harsh and distant, but the region is a porthole into the changes taking place in the global climate system and may be a litmus test of changes to come in ecosystems everywhere.

In particular, Antarctica holds promise for scientific discovery. While conducting research in severe conditions is challenging, recent findings have uncovered enormous lakes and mountain ranges buried beneath the ice and entire ecosystems of never-before-seen life forms. Antarctica's ice and sediment records may well provide clues about Earth's history, genetic secrets to surviving in extreme environments, and an unparalleled platform for observing the solar system and the universe, including space weather such as solar storms.

The National Science Foundation's U.S. Antarctic Program holds primary responsibility for supporting U.S. research in Antarctica and the Southern Ocean. A recent report from the National Research Council identifies eight questions that could drive the program over the next two decades and points to opportunities to sustain and leverage the program.

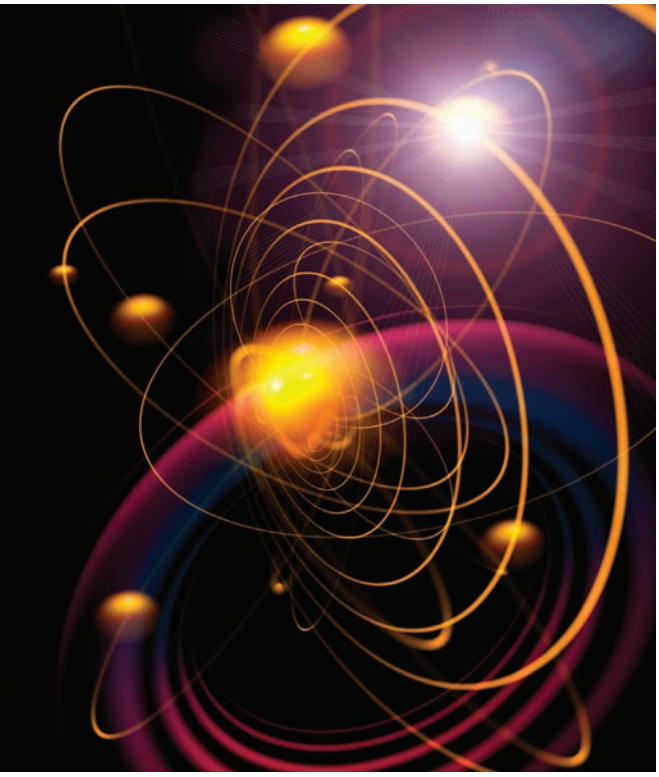
One of the questions is how Antarctica's massive ice sheet will contribute to changes in global sea level. Approximately 90 percent of the world's ice and fresh water lies within these ice sheets. A warming climate could lead to increased melting, and if all of this ice melted, global sea levels would rise by more than 60 meters. Scientists need to examine if the ice loss will accelerate and how quickly sea level will rise, the report says. Other questions explore the past role the area has played in changing the planet; how has life adapted to the Antarctic and Southern Ocean environments; and how the universe began, what is it made of, and what determines its evolution.

To sustain and improve the U.S. Antarctic Program, the report calls for collaboration among nations, advances in energy and technology to make research more cost-effective, education efforts to spark interest in polar science, a network of observing systems that can collect and record ongoing data, and improvements in scientific models to strengthen the simulation and prediction of future global climate patterns.

Preserving the unique environment of the Antarctic for new observations and experimental science requires continued commitment to stewardship, the report says. The next 20 years of research in the region has the potential to advance understanding of Earth and beyond, and a robust and efficient program is needed to realize this potential. — *Jennifer Walsh*

Future Science Opportunities in Antarctica and the Southern Ocean. Committee on Future Science Opportunities in the Antarctic and Southern Ocean, Polar Research Board, Division on Earth and Life Studies (2011, 230 pp.; ISBN 0-309-21469-6; available from the National Academies Press, tel. 1-800-624-6242; $50.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13169.html>).

The committee was chaired by **Warren Zapol,** emeritus anesthetist in chief at Massachusetts General Hospital and the Reginald Jenney Professor of Anesthesia at Harvard Medical School, Cambridge, Mass. The study was funded by the National Science Foundation.



Should U.S. Physics Research **Go Underground?**

EXPERIMENTS DEEP BENEATH THE EARTH'S SURFACE COULD PROVIDE SIGNIFICANT BREAKTHROUGHS

Physicists have long been intrigued with the study of neutrinos — "ghost" particles that fill the universe and interact only weakly with ordinary matter. Many researchers believe that neutrinos could answer some of science's most profound questions, such as how the universe began. Laboratories located deep underground provide the extremely quiet environment needed to study neutrinos' faint signals, as well as rare events such as proton decay. World-class underground laboratories have been built in Canada, Japan, and Europe, but U.S. efforts in this area have been modest to date.

Recently, scientists engaged in this type of research developed an integrated suite of experiments centered around the Deep Underground Science and Engineering Laboratory (DUSEL), a major research facility proposed for location in a former mine in Lead, South Dakota. The National Science Foundation and the U.S. Department of Energy, which have overseen the effort to develop the DUSEL program, asked the National Research Council to assess the scientific value of the physics experiments proposed for the laboratory and the need to conduct the research in the U.S., given the existence of similar science programs in other countries. During the course of the study, however, NSF announced it would no longer be the principal steward for the facility. The two agencies are deciding how to proceed.

Should the project move forward, three major experiments are planned for DUSEL. The direct detection dark matter experiment would broaden knowledge about dark matter, a substance that makes up approximately 80 percent of the material universe. The long-baseline neutrino

oscillation experiment would advance the study of neutrinos and enable other important physics research, such as examining whether protons decay. And the neutrinoless double beta decay experiment would establish the only practical setting to determine whether neutrinos are their own antiparticles, information vital to

understanding how particles came into existence in the early universe.

The Research Council's report found that these experiments would present exceptional opportunities for major scientific advances and give the U.S. a leading role in underground science. Each of the principal experiments addresses scientific questions of "paramount importance" that would give physicists a foundation of study for decades to come.

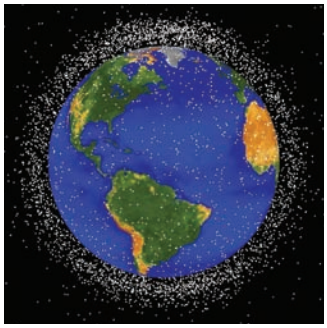
Benefits to the U.S. particle and nuclear physics communities would be greatest if the three experiments are led and conducted in a U.S.-based facility, the report says. In particular, performing the long-baseline neutrino oscillation experiment in the U.S. would make the nation a world leader in this area because researchers could also draw on the capabilities of the Fermilab accelerator complex, located in Illinois. In addition, co-locating the three experiments in one facility would also allow for efficient sharing of infrastructure and personnel. However, if a domestic site is not available for the dark matter and neutrinoless double beta decay experiments, U.S.-led projects in sites abroad would still impart important benefits to the nation's research communities, the report notes.

Although the final decision on building an underground national lab will involve many factors, including costs and the goals of funding agencies, such a laboratory could offer considerable advantages over sending U.S. scientists to conduct experiments at facilities in other countries. A U.S. facility would assure the United States a leadership role in underground science and particle physics; would provide U.S. scientists access to experiments in a laboratory on U.S. soil; and it could help meet increasing global demands for underground research facilities. What's more, other areas of science such as geology and biology could also reap benefits from the facility, the report says. — *Molly Galvin*

An Assessment of the Deep Underground Science and Engineering Laboratory. Ad Hoc Committee to Assess the Science Proposed for a Deep Underground Science and Engineering Laboratory (DUSEL), Board on Physics and Astronomy, Division on Engineering and Physical Sciences (2011, approx. 94 pp.; ISBN 0-309-21723-7; available from the National Academies Press, tel. 1-800-624-6242; $21.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13204.html>).

The committee was chaired by **Andrew Lankford,** professor of physics and astronomy at the University of California, Irvine. The study was funded by the National Science Foundation and the U.S. Department of Energy.

TAKING OUT THE **SPACE TRASH**



In June of this year, the crew of the International Space Station was forced to take shelter in escape capsules because space junk passed dangerously close to the research outpost. An unidentified piece of debris came within 850 feet of the station, narrowly avoiding collision. A few months later, orbital debris again made headlines when the Upper Atmosphere Research Satellite, decommissioned in 2005, fell to Earth.

Abandoned space equipment, meteoroids, spent rocket bodies, and fragments from past collisions in space pose a substantial long-term threat to spacecraft and astronauts. Over the past 50 years NASA has been working to mitigate that risk and made significant progress. NASA's meteoroid and orbital debris programs are respected national and internationally, and their models are now widely used. However, a recent report from the National Research Council warns the increasing complexity and severity of the orbital debris environment is outpacing NASA's ability to address the threat posed by objects in orbit. Some scenarios generated by NASA models show that the debris currently in orbit has reached a point where it will continually collide and create even more debris, making space operations ever riskier.

The Research Council's report found that the agency's meteoroid and orbital debris programs have used their resources responsibly, but with new and more complex work, the agency must stretch those resources even further. The report proposes a strategic plan to help the agency prioritize and streamline its meteoroid and orbital debris-related operations — for example, establishing a single management office to coordinate and budget for all the agency's orbital debris and meteoroid activities.

The agency recognizes that any long-term solution will involve removing debris from orbit, which introduces a new set of complexities. Developing and testing the technology to safely and effectively capture and/or return orbital debris to Earth will be a time-consuming and expensive undertaking. In addition, only about 30 percent of the objects can be attributed to the United States. According to international legal principle, no nation may salvage or otherwise collect other nations' space objects; to do so could be considered an act of war. As NASA considers strategies for debris removal, diplomatic communication and political goodwill will be essential components.

Moving forward, the report says NASA should lead public discussion of the space debris problem and emphasize that debris is a long-term concern that must continue to be addressed. — *Lorin Hancock*

Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs. Committee for the Assessment of NASA's Orbital Debris Programs, Aeronautics and Space Engineering Board, Division on Engineering and Physical Sciences (2011, 180 pp.; ISBN 0-309-21974-4; available from the National Academies Press, tel. 1-800-624-6242; $45.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13244.html>).

The committee was chaired by **Donald J. Kessler,** senior scientist for orbital debris research, NASA (retired), Asheville, N.C.; and vice chaired by **George J. Gleghorn,** vice president and chief engineer, TRW Space and Technology Group (retired), Rancho Palos Verdes, Calif. The study was funded by NASA.

Just Baby Fat?

Habits for Healthy Weight Need to Start Young

Few things stir greater delight in new parents than a smile framed by their infant's chubby cheeks. But for an increasing number of American babies and toddlers, those cherubic features may signal extra pounds that will stay with them into adulthood.

The rate of excess weight among children ages 2 to 5 has doubled since the 1980s. Currently, slightly over 20 percent are overweight or obese, and about 10 percent of children from infancy to age 2 carry excess weight, according to a report by the Institute of Medicine on policies to prevent early childhood obesity.

Concerns about extra pounds on babies and toddlers fly in the face of long-held convictions that a pudgy baby is a thriving baby and that young kids naturally grow out of their baby fat as they learn to walk and become more active. But the same factors that promote weight gain among

older children and adults — an increase of sedentary behaviors, overconsumption of calories, and insufficient sleep — are contributing to persistent excess weight among too many of the youngest children.

The problem cannot be solved by tackling any one factor by itself, the report stresses. It recommends a range of steps that should be taken by pediatricians, preschool teachers and child care providers, nutrition program officials, and others responsible for guiding children's development and activities. These actions focus on identifying when young children show signs of putting on too much weight, promoting healthy eating, increasing physical activity, and ensuring adequate sleep.

Studies show that many parents do not understand the consequences of extra pounds on infants and young children and do not see baby fat as a potential problem. Health professionals therefore should measure infants' and young children's weight and height as a standard procedure at every well-child visit. They should be able to recognize signs of excess weight and discuss the health risks with parents.

Pediatricians, early childhood educators, and child care professionals also need to be trained to counsel parents about age-appropriate sleep times and habits. Sufficient sleep is associated with healthy weight, and the amount of sleep obtained by children under age 3 has declined notably in recent years.

In addition, preschools and child care facilities must buck the trend toward increasing sedentary behaviors by creating space and resources for physically active play and limiting the time children spend watching television and using digital devices or being confined to strollers and swings. It is up to the agencies that regulate child care facilities to determine appropriate standards, the report notes, but they could include requiring facilities to ensure their charges are physically active for at least a quarter of the time spent in care and restricting the use of cribs, car seats, and high chairs to their intended purposes.

Health care providers, preschool educators, and child care professionals also can do more to help instill good dietary habits at an early age. Health care professionals and organizations should step up efforts to support breast-feeding. Regulatory agencies should ensure that all child care facilities and preschools follow the meal patterns established by the federal Child and Adult Care Food Program, which reflect age-appropriate amounts of sugar, salt, fat, and necessary nutrients and promote consumption of fruits, vegetables, and whole grains.

"The obesity epidemic is not sparing the youngest children," said Leann Birch, chair of the committee that wrote the report. "But there are effective ways to reduce the risk for obesity by creating healthy environments and implementing positive practices during the crucial early years of development," she said. — *Christine Stencel*

Early Childhood Obesity Prevention Policies. Committee on Obesity Prevention Policies for Young Children, Food and Nutrition Board, Institute of Medicine (2011, 191 pp.; ISBN 0-309-21024-0; available from the National Academies Press, tel. 1-800-624-6242; $49.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13124.html>).

The committee was chaired by **Leann Birch,** Distinguished Professor of Human Development and director, Center for Childhood Obesity Research, Pennsylvania State University. The study was funded by the Robert Wood Johnson Foundation.

RELIEVING AMERICA'S CRISIS OF PAIN

Pain is universal, yet every person experiences it uniquely. It presents one of the most complex problems faced by health care professionals.

Even though pain arises as a symptom of many conditions, health professionals receive relatively little training in pain management as they learn to deal with organs, bones, or the brain's inner workings. There is no blood test or other yardstick to objectively measure pain, and different individuals can react to the same stimulus very differently. Only recently has research revealed how pain can rewire the nervous system and persist even after the initial cause is resolved. The difficulties of controlling addiction to and abuse of powerful pain medications add yet another layer of complexity.

Health care providers and the public are hardly in a position to ignore or downplay these challenges, but a review by the Institute of Medicine suggests that it happens all too often. Underdiagnosed and undertreated, chronic pain amounts to an unrecognized public health crisis afflicting more than 116 million adult Americans each year and costing the nation $560 billion to $635 billion annually in medical and economic expenses, says the IOM's report.

The report offers an integrated approach to pain treatment, management, and prevention that would respond to all the factors that influence pain. To start, training programs for health professionals need to include pain education in their curricula. Only five of the nation's 133 medical schools require students to take pain courses and just 17 offer such classes as electives. Medical licensing and certification exams should include assessment of pain-related knowledge. Programs that train specialists or offer training in advanced pain care need to be expanded given the relatively small number of specialists.

The majority of pain care should take place through primary care providers and patient self-management with specialty care services reserved for more complex cases. Health care organizations should take the lead in developing innovative approaches and materials to coach patients in pain management.

In addition, health insurance plans need to cover interdisciplinary pain care. Individualized care requires time to counsel patients and families, consultation with multiple providers, and often more than one form of therapy. Current reimbursement systems are not designed to efficiently pay for this kind of multipronged approach.

Pain is a major driver for medication consumption, doctor visits, and disability. The IOM's report lays out the case for why and how it can be better managed.

— *Christine Stencel*

Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. Committee on Advancing Pain Research, Care, and Education, Board on Health Sciences Policy, Institute of Medicine (2011, 382 pp.; ISBN 0-309-21484-X; available from the National Academies Press, tel. 1-800-624-6242; $59.95 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13172.html>).

The committee was chaired by **Philip Pizzo,** dean, Carl and Elizabeth Naumann Professor of Pediatrics, and professor of microbiology and immunology, Stanford University School of Medicine, Stanford, Calif. The study was funded by the National Institutes of Health.

In recent years many policymakers and organizations — the National Research Council among them — have sounded alarms about the need for better science and engineering education in the United States. But what can actually be done to improve it? What needs to change in American classrooms? A new report from the National Research Council offers a framework to serve as the basis for new K-12 science education standards — one that embodies a significant shift in how science and engineering are taught.

"It has been 15 years since the last science standards were developed, and our understanding — both in terms of science itself and how students learn about it — has progressed a great deal since then," said Helen Quinn, chair of the committee that wrote the report. "We hope the framework we developed will guide improvements in standards and in science education over many years."

Currently, the report says, science education in the U.S. tends to place too much emphasis on having students learn an unconnected array of facts, and too little on helping them understand how scientists established those facts. Students need to learn the processes of science, not just the

products. The framework describes key practices — for example, engaging in argument from evidence and designing and conducting investigations — that all students should learn and be able to do by the time they graduate high school.

The framework also identifies eight "crosscutting concepts" that students should learn and be involved with over the course of their education. The concepts are ideas that have value across many fields of science and engineering which should become familiar touchstones to students as they progress from grade to grade, the committee said. By encountering the same ideas in different fields, students can connect knowledge across many disciplines into a coherent, scientific view of the world.

As another step toward increasing coherence, the framework also identifies core ideas in each of four disciplinary fields — physical sciences; life sciences; earth and space sciences; and engineering, technology, and the applications of science — that should be the focus of K-12 science education. Examples of core ideas in physical sciences include "matter and its interactions" and "energy," while the life sciences' list includes "heredity" and "biological evolution." Students should revisit the ideas over subsequent grade levels at increasing levels of sophistication.

And if students are to truly understand how science works, all three parts of the framework — the key practices, crosscutting concepts, and disciplinary core ideas — need to be integrated, the committee said. For example, students should use the scientific practices, such as conducting an investigation and then interpreting the data, to help them acquire new knowledge about the core ideas.

To implement the framework, 20 states have committed to work with nonprofit education group Achieve to develop new K-12 science education standards, which will describe in detail what students should learn at various grade levels. It will then be up to each state whether to adopt the new standards to guide science education in its public schools.

Although the new standards will be crucial, they are not the only facet of the science education system that needs to change, the report says. Curricula and assessments will need to reflect the ideas and practices laid out in the framework, teachers will need opportunities to deepen their own knowledge, and adequate classroom time will need to be devoted to science education — changes that will not happen overnight, the committee acknowledged. "What we're prescribing is evolutionary — not revolutionary — change," Quinn said. — *Sara Frueh*

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards, Board on Science Education, Division of Behavioral and Social Sciences and Education (2011, approx. 320 pp.; ISBN 0-309-21742-3; available from the National Academies Press, tel. 1-800-624-6242; $39.95 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13165.html>).

The committee was chaired by **Helen R. Quinn,** professor emerita of physics at SLAC National Accelerator Laboratory, Stanford University, Stanford, Calif. The study was funded by the Carnegie Corporation of New York.

Pilot Fatigue

DO COMMUTES POSE A FLIGHT RISK?

Although many airline pilots have work commutes no longer than the rest of us do, some live hundreds or even thousands of miles from the airports where they are based. This fact has prompted fear that fatigue from their commutes may cause pilots to arrive at work too tired to operate a plane safely. Following a fatal Colgan Airlines crash that raised concerns about pilot commuting practices, Congress asked the National Research Council to examine the issue.

Commuting has the potential to cause fatigue — for pilots as for everyone — but the extent to which it has been a safety risk is not known, the study committee concluded. Currently, there is not enough data to determine the degree to which commuting may be a risk or whether it should be regulated. The report recommends that FAA fund a study to determine the relationships between commuting distance and risk factors for fatigue. It should include a large random sample of pilots from many airlines representing major parts of the industry. In addition, FAA, pilots, and airlines should take steps now to lower the likelihood that commuting practices will pose a risk to safety, the report says.

Research shows that fatigue can lower performance if a person is awake continuously for more than about 16 hours or sleeps less than six hours on the day prior to work. In light of these findings, pilots should plan their commutes and other preduty activities so that they will not have been awake more than about 16 hours by the time their duty is completed. They should also try to sleep at least six hours before reporting for duty, and they should consider the amount of time they've spent asleep and awake when deciding whether they should inform their supervisors whether they are too tired to fly, the report says. For their part, airlines should consider policies to help pilots plan nonfatiguing commutes and to minimize the negative consequences for pilots if disrupted commutes leave them too weary for duty.

The report also recommends that FAA fund an independent organization, such as the Flight Safety Foundation, to convene a joint working group made up of labor organizations, airlines, and government to assess industry policies on pilot commuting, sick leave, attendance, and fatigue, and to develop best practices. — *Sara Frueh*

The Effects of Commuting on Pilot Fatigue. Committee on the Effects of Commuting on Pilot Fatigue; Board on Human-Systems Integration, Division of Behavioral and Social Sciences and Education, and the Transportation Research Board (2011, 220 pp.; ISBN 0-309-21696-6; available from the National Academies Press, tel. 1-800-624-6242; $48.25 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13201.html>).

The committee was chaired by **Clinton V. Oster Jr.,** professor, School of Public and Environmental Affairs, Indiana University, Bloomington. The study was funded by the Federal Aviation Administration.

A Conversation About **America's Climate Choices**

A suite of five National Research Council studies requested by Congress to inform the nation of its options for responding to climate change was an enormous effort, involving approximately 100 people, who included not only scientists and engineers but also economists, business leaders, an ex-governor, a former congressman, and other policy experts. The Research Council's most comprehensive assessment of climate change to date, *America's Climate Choices,* culminated this past spring with the release of the final report and a conversation on the topic with host Heidi Cullen, vice president of external communications for Climate Central, and nine of the report's authors. Echoing their findings, the committee members stressed that action is needed to manage climate change risks, including limiting the magnitude of climate change and preparing to adapt to its impacts.

In these reports, said committee chair Albert Carnesale, "we reaffirmed the conclusion that climate change is occurring, that it is largely due to human actions, and that it poses a significant risk to human society and to the natural environment."

The final report finds that scientific evidence points to human activities — especially the release of carbon dioxide and other greenhouse gases into the atmosphere — as the most likely cause for the major part of global warming that has occurred over the last several decades. Moreover, this trend cannot be explained by natural factors, and the impacts of climate change can generally be expected to intensify with warming.

The vice chair of the committee, William L. Chameides, illustrated that we need to think of our understanding of climate science as looking at a jigsaw puzzle. "We have a lot of the puzzle pieces in place, and therefore we know the basic picture."

While climate change is inherently a global issue requiring an international response, the report focused on the charge from Congress to identify steps and strategies that U.S. decision makers could adopt now.

"In order to be successful at all of this, it has to be a nationally coordinated effort," Carnesale said. "That's not the same as a nationally directed effort, but we do require coordination to make sure we can learn from each other and put the pieces together most effectively."

"We know there are risks out there. We know those risks are serious. And we know they are getting worse," Chameides asserted. If you expect a flood and the water is rising, he said,

"you don't wait for the expert to tell you how high the water is going to get. You get out the sandbags, and you develop an evacuation plan. It's time for us to begin to develop our plan for prevention — for limiting — and our plan for adaptation."

Other committee members who participated in the conversation discussed how substantial reductions of greenhouse gas emissions should be part of the national response. Although the exact magnitude and speed of reductions will depend on how much risk society deems acceptable, it would be imprudent to delay taking action. The most efficient way to accelerate reductions is through a nationally uniform price on greenhouse gas emissions with a price trajectory sufficient to spur investments in energy efficiency and low-carbon technologies, the report says.

In addition to the capstone event, a new exhibit at the Koshland Science Museum is based in part on the America's Climate Choices studies. *Earth Lab: Degrees of Change* has interactive components that allow visitors to explore the impacts of climate change and take on the role of decision makers who identify priorities, evaluate trade-offs, and decide how to respond to climate change. — *Jennifer Walsh & William Kearney*

To watch the video of the Conversation on America's Climate Choices or to read the report series, visit <americasclimatechoices.org>. For more information on the Koshland Science Museum, visit <www.koshland-dc.org>.

Health Data Initiative Forum Highlights New Health Apps and Innovation Challenges

A new program that supports health care entrepreneurs, an "idea lab" focused on developing nursing homes of the future, and a new app to help patients make informed decisions about surgery were some of the many highlights that marked the second annual Health Data Initiative Forum convened by the Institute of Medicine and the U.S. Department of Health and Human Services last June.

The forum provided opportunities for health leaders, software and IT developers, entrepreneurs, funders, and policymakers to interact and accelerate the transformation of public health data into innovative products that improve people's health and communities' well-being. The event included demonstrations of more than 45 new or updated technologies designed to serve the needs of patients, health professionals, policymakers, and others. It also featured 11 announcements of technology development challenges and other new initiatives.

In their keynote remarks, HHS Secretary Kathleen Sebelius and Lisa Jackson, administrator of the U.S. Environmental Protection Agency, described the wealth of health and environmental data available through their agencies that innovators can access for free. Jackson announced the launch of "Apps for the Environment," a challenge to apply EPA data innovatively to tackling major environmental health issues.

"By joining the creativity and enthusiasm of the tech sector with the health sector's dedication to improving the well-being of Americans, we can develop new solutions to the many serious health issues facing the nation," said Judith A. Salerno, Leonard D. Schaeffer Executive Officer of the IOM.

The Health Data Initiative does not endorse particular applications, organizations, or efforts, but rather enables their independent development by giving individuals and groups free access to expanded health data. Descriptions of all the products showcased at the forum are available at <www.iom.edu/healthdataforum>. Among the products demonstrated were:

- a tool that enables patients and their families to learn about surgical procedures and options;
- a virtual grocery marketplace intended to help people — especially those in communities lacking grocery stores and farmers' markets — get affordable, healthy foods; and
- an online tool that provides one-stop shopping for statistics and other health data that journalists, bloggers, and others can readily find and incorporate in their work.

In addition, several organizations announced new initiatives and other actions including competitive challenges that call on participants to develop tools to improve cancer and diabetes care, a new graduate program in health informatics, and an entrepreneurial support program for start-up firms that use health data.

— *Christine Stencel*

National Academies Press Grants
Free, Global Access to All Reports

The National Academies Press has released all of its PDF content to the public free of charge. More than 4,500 reports from the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council can now be downloaded by anyone with access to the Internet.

"Flipping the switch" on June 2 was the culmination of more than 15 years of work by the publishing house for the National Academies to disseminate its online content as widely as possible while remaining financially self-sufficient. For NAP to sustain itself, proceeds from book sales and services must cover printing, production, and dissemination costs as well as support a staff of about 30 employees.

In order to live up to its goal of widespread dissemination, NAP sought to remove the price barrier for its electronic content. In 1994 it began offering full text of books online in a page-by-page format. In 2002 NAP conducted an online experiment to determine how much revenue would be lost if all reports were available free in PDF form. The research concluded that NAP could anticipate a $2 million decrease in sales each year.

"At the time, our leadership decided that NAP should sell PDF versions of our books while continuing to provide the free page-by-page format online," said Barbara Kline Pope, executive director of NAP. "We weren't prepared in 2002 to lose such a huge portion of our budget. Since then, we have gradually made more and more content free online, and we've reduced our costs. All of this translated into a financially responsible evolution of our business model."

By the time of the June announcement, more than 65 percent of NAP's books were free to anyone, and 100 percent were available as free PDFs to the developing world. The 35 percent with a price tag were popular new reports and classic volumes like "How People Learn," which reliably bring in the lion's share of the revenue.

NAP has worked over the past decade to streamline operations so this remaining 35 percent could also be free to anyone. In addition to cost cutting to bridge the budget gap, NAP is receiving some financial support from the Academies. "In this environment of perpetual transition for publishers, we are fortunate to be an integral part of our organization," said Kline Pope. "It's been a universal goal to make the results of our work even more available to the American public and to readers throughout the world."

Based on the performance of NAP's free PDF reports before the announcement, projections suggested that this change will enhance report distribution from about 700,000 downloads per year to more than 3 million by 2013. The impact on dissemination is already apparent: Since June 2, readers all over the world have downloaded more than 500,000 free reports — more than double the number downloaded in the same period last year. To peruse the publisher's catalog of National Academies publications, visit <www.nap.edu>. — *Lorin Hancock*

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.

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Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2011, 322 pp.; ISBN ISBN-10: 0-309-21987-6; available from NAP).

Advancing Regulatory Science for Medical Countermeasure Development — Workshop Summary
Board on Health Sciences Policy, Institute of Medicine (2011, 150 pp.; ISBN 0-309-21490-4; available from NAP).

Adverse Effects of Vaccines: Evidence and Causality
Board on Population Health and Public Health Practice, Institute of Medicine (2011, approx. 800 pp.; ISBN 0-309-21944-2; available from NAP).

Assessing 21st Century Skills — Summary of a Workshop
Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education (2011, 158 pp.; ISBN 0-309-21790-3; available from NAP)

Assessing National Resilience to Hazards and Disasters: The Perspective from the Gulf Coast of Louisiana and Mississippi — Summary of a Workshop
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Ocean Studies Board, Division on Earth and Life Studies (2011, approx. 126 pp.; ISBN 0-309-21044-5; available from NAP).

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Water Science and Technology Board, Division on Earth and Life Studies (2011, 156 pp.; ISBN 0-309-21562-5; available from NAP).

Assessment of Approaches for Using Process Safety Metrics at the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants
Board on Army Science and Technology, Division on Engineering and Physical Sciences (2011, 60 pp.; ISBN 0-309-16345-5; available from NAP).

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An Assessment of the National Institute of Standards and Technology Center for Neutron Research: Fiscal Year 2011
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An Assessment of the National Institute of Standards and Technology Information Technology Laboratory: Fiscal Year 2011
Laboratory Assessments Board, Division on Engineering and Physical Sciences (2011, 42 pp.; ISBN 0-309-22002-5; available from NAP).

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