

THE NATIONAL ACADEMIES **IN FOCUS**

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Lessons Learned From the Deepwater Horizon
Initiative to Help Us Think Evolutionarily
A Final Word on Unintended Acceleration

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THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

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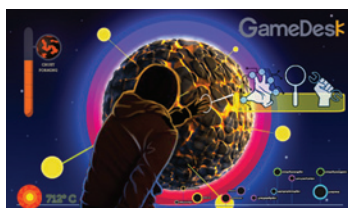
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National Academy of Sciences 150th Celebrated at Library of Congress

The Library of Congress and Carnegie Corporation of New York hosted a daylong symposium on June 25 to commemorate the 150th anniversaries of the establishment of the National Academy of Sciences, the passage of the Morrill Act — which led to the creation of the nation’s land-grant colleges — and the contributions of Andrew Carnegie to the public library system.

A central theme of the public event was making a new commitment to knowledge-based democracy. A panel led by NAS President Ralph J. Cicerone discussed the cultural and intellectual conditions under which NAS was founded in 1863 and the development of a national science infrastructure in the late 19th century. But it also focused on the need to look forward. “We need to capitalize on the American spirit of participatory democracy,” Cicerone said.

Fellow panelist U.S. Representative Rush Holt (D-N.J.) issued a call to return to scientific thinking and to reintegrate science into society. And Yale historian Daniel Kevles cited several examples of evidence-based policy recommendations from NAS and others and their positive impact on society. He noted that while some were well-received — such as the NAS suggestion to consolidate land surveys, leading to the formation of the U.S. Geological Survey — others were met with opposition from those with conflicting political and economic interests.

But it is the Academy’s ability to issue reports from an objective, nonpartisan, and evidence-driven stance that is a “fabulous advantage,” Cicerone said, and it serves as a model for other countries trying to create similar programs. “We have an incredible resource here, and we work hard to maintain its credibility,” he said.

NAS Vice President Barbara Schaal added that we are expanding our role from speaking primarily to the government to speaking directly to the public as well, pointing to several NAS initiatives such as the development of booklets on topics important to public debate and the Science & Entertainment Exchange, which connects scientists with professionals in the television and film industry.

The thought of drinking water that once flowed through our toilets may make many people cringe. But with water shortages striking different regions of the country, alternatives such as reclaimed water are starting to be considered a viable option. In fact, a number of locations across the country already use reclaimed wastewater for potable and non-potable purposes.



Wastewater's Potential

TAPPING INTO RECLAIMED WATER FOR MULTIPLE USES

A new report from the National Research Council says that with recent advances in technology, treating wastewater and reusing it for drinking, irrigation, industry, and other applications could significantly increase the amount of water resources available to the nation, particularly in coastal areas that face shortages in clean water supplies. This is a significant recommendation given that a 1998 Research Council report found that reclaimed wastewater represented “an

option of last resort” to supplement drinking water sources and only after a thorough health and safety evaluation.

New analyses also suggest that the possible exposure to chemical contaminants and disease-causing microbes from wastewater reuse do not exceed, and in some case may be significantly lower than, the risks of existing water supplies, the report says.

“Wastewater reuse is poised to become a legitimate part of the nation’s water supply portfolio,” said R. Rhodes

Trussell, chair of the committee that wrote the report and president of Trussell Technologies. “Although reuse is not a panacea, the large quantity of wastewater discharged to the environment could eventually complement water from other sources and management strategies.”

While the notion of drinking reclaimed water may require people to overcome a certain “ick” factor, some may not realize that they are drinking it already. De facto reuse, also known as “unplanned” potable reuse, occurs when drinking water supplies contain a significant fraction of wastewater effluent, typically from upstream discharges, even though this supply of water is not formally recognized or permitted as a water reuse project. De facto reuse is thought to occur widely in the United States, although the last assessment of its extent occurred more than 30 years ago. The report recommends another analysis be carried out to quantify the current degree of de facto reuse.

Nevertheless, the committee found that many communities have already implemented potable and non-potable water reuse projects that are well-established and generally accepted. Examples of non-potable applications include irrigating golf courses and parks or providing industrial cooling water in locations near wastewater reclamation plants.

The report outlines engineered and natural treatment processes that would limit chemical and microbial contaminants in the water and meet the quality requirements of intended reuse applications. The committee emphasized the need for process reliability and careful monitoring to ensure that all reclaimed water meets the appropriate quality objectives for its use.

Although technology and processes are available to start considering the use of wastewater to augment future water supplies, the cost may be a key determinant for municipalities considering reclaimed as an option. Costs for potable and non-potable applications vary widely because they depend on site-specific factors.

The report urges water authorities to consider other costs and benefits in addition to monetary expenditures when assessing reuse projects. For example, water reuse systems used in conjunction with a water conservation program could be effective in reducing seasonal peak demands on the drinking water system. Depending on the specific designs and pumping requirements, reuse projects could also have a larger or smaller carbon footprint than existing supply alternatives or reduce water flows to downstream users and ecosystems.

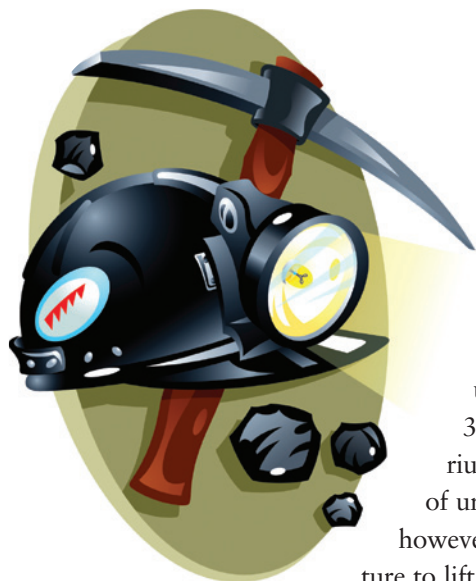
Water reuse regulations differ by state and are generally not based on risk-assessment methods. Adjustments to the federal regulatory framework could help ensure a high level of public health protection, provide a consistent minimum level of protection across the nation, and increase public confidence in potable and non-potable water reuse, the report says.

— *Jennifer Walsh & Solmaz Spence*

■ Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater.

Committee on the Assessment of Water Reuse as an Approach for Meeting Future Water Supply Needs, Water Science and Technology Board, Division on Earth and Life Studies (2012, approx. 200 pp.; ISBN 0-309-25749-2; 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/13303.html>).

The committee was chaired by **R. Rhodes Trussell**, president, Trussell Technologies, Pasadena, Calif. The study was sponsored by the U.S. Environmental Protection Agency.



URANIUM MINING IN VIRGINIA

One of the largest uranium deposits in the United States is located at Coles Hill in southern Virginia, but this deposit has remained untapped due to a nearly 30-year statewide moratorium on mining and processing of uranium ore. In recent years, however, calls for the state legislature to lift the ban have grown stronger.

To help inform deliberations on the possibility of future uranium mining in Virginia, the state legislature asked the National Research Council to examine the scientific, environmental, human health and safety, and regulatory aspects of mining and processing Virginia's uranium resources.

The resulting report found that a number of health and environmental issues and related risks would need to be addressed for uranium mining to be undertaken safely. By implementing modern, internationally accepted best practices in the field, including timely and meaningful public participation, many of these risks could be mitigated. Nevertheless, many unknowns exist, and "steep hurdles" would need to be surmounted before uranium mining and processing could take place within a regulatory setting that appropriately protects workers, the public, and the environment.

The committee that wrote the report noted that of the 55 occurrences of uranium in Virginia, only the Coles Hill deposit has sufficient ore of high-enough grade to have the potential to be economically viable. To determine the most appropriate mining and processing methods for the

deposit, and the particular risks that might be associated with exploitation at the site, an extensive site-specific evaluation would be required, which the committee was not tasked to undertake.

The report notes that uranium deposits in Virginia are likely found in hard rock, rather than "soft" rock like coal, so many of the technical aspects of uranium mining would be essentially the same as for other types of hard rock mining. However, uranium mining carries the additional risk of exposure to ionizing radiation from uranium and its decay products. The committee also noted that Virginia is susceptible to extreme natural events, including heavy precipitation and earthquakes, which would need to be taken into account when evaluating any site's suitability for mining and processing.

Virginia Governor Bob McDonnell said that the moratorium on uranium mining should remain in place in 2012 until the state is able to thoroughly review the Research Council report and three other commissioned studies on the topic.

— *Jennifer Walsh*

■ **Uranium Mining in Virginia: Scientific, Technical, Environmental, Human Health and Safety, and Regulatory Aspects of Uranium Mining and Processing in Virginia.** Committee on Uranium Mining in Virginia, Board on Earth Sciences and Resources, Division on Earth and Life Studies (2012, approx. 370 pp.; ISBN 0-309-22087-4; available from the National Academies Press, tel. 1-800-624-6242; \$63.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13266.html>).

The study was chaired by **Paul Locke**, associate professor, Johns Hopkins Bloomberg School of Public Health, Baltimore. The study questions were provided by the Commonwealth of Virginia. The study was funded under a contract between the National Research Council and the Virginia Polytechnic Institute and State University. Funding was provided to the university by Virginia Uranium Inc.



A Final Word on Unintended **ACCELERATION**

Reports of sudden, unintended acceleration in Toyota vehicles in 2009 and 2010 captured the attention of the media and the public. While complaints of vehicles exhibiting such behavior have been made for decades, the recent Toyota reports were complicated by the prevalence of electronic throttle controls. Although experts consider these technologies to be simple and well-proven, several consumer advocacy groups expressed concerns about their reliability.

The National Highway Traffic Safety Administration, the government agency responsible for identifying and mandating solutions for automotive safety defects, concluded that the 2009-2010 instances of unintended acceleration were due to drivers

pressing the gas pedal by mistake and two other mechanical issues: pedals sticking or becoming entrapped by floor mats. NHTSA ruled out errant electronic throttle control systems as a plausible cause.

Despite NHTSA's conclusion, public concern continued even after Toyota instituted recalls intended to fix the pedal issues. Faced with persistent questions about its decision to close the investigation of the electronic throttle controls, NHTSA commissioned two further studies: one from NASA released in 2011, and one from the National Research Council released early this year. NASA's report supported NHTSA's conclusion that electronic throttle controls were not a plausible cause of unintended acceleration.

The Research Council's report similarly found NHTSA's decision to close its investigation justified on the basis of the agency's initial defect investigations. However, the report stated, "It is troubling that the concerns associated with unintended acceleration evolved into questions about electronics safety that NHTSA could not answer convincingly."

In addition to weighing in on the acceleration issue, the Research Council's report



presents a forward-looking plan for NHTSA to authoritatively handle future questions about the safety of vehicle electronics — questions the report says are bound to occur with greater frequency as these electronics systems become more complex, interconnected, and capable. NHTSA will need to become more familiar with how manufacturers design safety and security into electronics systems, to identify and investigate system faults that may leave no physical trace, and to respond convincingly when system-safety matters arise.

To guide the agency's fulfillment of these critical responsibilities, the report recommended NHTSA step back and take an in-depth strategic view of the safety challenges arising from the proliferation of automotive electronics, and to assess how

the scope, direction, and resources of regulatory, research, and defects investigation programs will need to be aligned to meet these challenges.

NHTSA will also require additional specialized technical expertise. "It's unrealistic to expect NHTSA to hire and maintain personnel who have all of the specialized technical and design knowledge relevant to this constantly evolving field," said Louis Lanzerotti, Distinguished Research Professor at the New Jersey Institute of Technology and chair of the committee that wrote the report. "A standing advisory committee is one way NHTSA can interact with industry and with technical experts in electronics to keep abreast of these technologies and oversee their safety."

Electronic systems are critical to nearly all vehicle functions, including fuel economy, emissions control, comfort, convenience, and safety. The number of systems is expected to grow and provide substantial benefits to the driving public. The systems will also bring new challenges that NHTSA must face with confidence and expertise to avoid the recurrence of something similar to the unintended acceleration controversy.

— *Lorin Hancock*

■ **The Safety Challenge and Promise of Automotive Electronics: Insights From Unintended Acceleration—Special Report 308.** Committee on Electronic Vehicle Controls and Unintended Acceleration; Board on Energy and Environmental Systems and Computer Science and Telecommunications Board, Division of Engineering and Physical Sciences; and Transportation Research Board (2012, approx. 157 pp.; ISBN 0-309-22304-1; available from the Transportation Research Board, tel. 202-334-3213; also on the Internet at <www.nap.edu/catalog/13342.html>).

The committee was chaired by **Louis J. Lanzerotti**, Distinguished Research Professor, Department of Physics, New Jersey Institute of Technology, Newark. The study was funded by the U.S. Department of Transportation's National Highway Traffic Safety Administration.



LESSONS FROM THE DEEPWATER HORIZON

Before April 20, 2010, most Americans had little understanding of the complexities of offshore oil and gas drilling. But that changed rapidly after the Deepwater Horizon explosion and oil spill. Suddenly, the inherently risky business of offshore drilling came under intense scrutiny, and terms such as “blowout preventer” and “hydrocarbon zone” were no longer simply industry jargon. Several different investigations were launched to determine what went wrong, including an analysis by an expert committee of the National Academy of Engineering and the National Research Council.

The committee’s analysis found that multiple flawed decisions led to the blowout of the well and the subsequent explosion, indicating a lack of effective safety management among the companies involved. The committee’s final report provides an integrated technical perspective on the event and makes recommendations to reduce the risk of such a catastrophe occurring again.

Above all, companies need to adopt a “systems safety” approach to anticipating and managing possible dangers at every level of operation in offshore drilling — from ensuring the integrity of wells to designing blowout preventers that function under all foreseeable conditions, the report says. “One of the reasons why we focused so much on a safety culture is to make sure that the type of sensitivity, attention, and care that is being employed by the industry since the accident is maintained in the long term,” said Donald C. Winter, former secretary of the Navy, professor of engineering practice

at the University of Michigan, and chair of the committee that wrote the report.

In addition, both industry and regulators had a “misplaced trust” in the ability of blowout preventer systems to act as fail-safe mechanisms in the event of a well blowout, the report says, despite numerous past warnings of potential dangers. These systems should be redesigned, rigorously tested, and maintained to operate reliably.

The U.S. Department of the Interior is requiring offshore drilling companies to develop and follow procedures for meeting explicit health, safety, and environmental protection goals, which the report says is a good first step toward an enhanced regulatory approach. The DOI regulatory program should be expanded to a goal-oriented risk management system that incorporates explicit regulatory review and approval of the safety-critical points in the drilling operation. And the U.S. should make a single government agency responsible for integrating system safety for all offshore drilling activities. — *Molly Galvin*

■ **Macondo Well-Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety.** Committee on the Analysis of Causes of the Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future, Transportation Research Board, Division on Earth and Life Studies, and National Academy of Engineering (2011, 196 pp.; ISBN 0-309-22138-2; available from National Academies Press, tel. 1-800-624-6242; \$47.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13273.html>).

The committee was chaired by **Donald C. Winter**, professor of engineering practice, department of naval architecture and marine engineering, University of Michigan, Ann Arbor. The study was sponsored by the U.S. Department of the Interior.



A Universal Rating System Could Make It Easier to Spot Healthier Choices

Many shoppers navigating the bewildering array of foods and drinks in the typical American supermarket or convenience store have longed for a simple way to make healthy choices. Despite a desire to purchase healthier items, people often do not have the time or inclination to examine the detailed nutritional information printed in the Nutrition Facts panels on the back of food packages.

The food industry and health organizations have responded by developing an assortment of symbols, such as check marks, traffic lights, or numbers, designed to convey nutritional information on package

fronts. Some, like Walmart's new "Great for You" system, use a single symbol to indicate that a product meets a range of nutritional criteria. Others, such as the "Nutrition Keys" developed by industry trade groups, display calories and the amount of various nutrients in a product.

Unfortunately, the proliferation of such symbols and numbers has led to as much confusion as clarity. In addition, consumers' trust in these nutrition rating systems has been marred by incidents such as high-sugar breakfast cereal earning one system's stamp of approval.

Last year the Institute of Medicine sought to cut through the confusion by proposing

nutrition rating criteria based on sound science and a simple set of icons to convey the healthiness of products at a glance.

All foods and beverages should have to show calories per serving on the front of their packaging, IOM said in its report. And rather than numbers or symbols representing a gamut of nutrients, packages should be limited to displaying a set of three icons that represent saturated and trans fats, sodium, and added sugars. These are the nutritional components of greatest concern given their association with chronic diseases.

The icons shown would indicate instantly how healthy a food or beverage is, with more icons signaling a healthier choice. A food or beverage could earn up to three symbols, one each for having sodium, added sugars, and saturated and trans fats below designated amounts. For example, 100 percent whole wheat bread could display three icons while graham crackers might show two for acceptable levels of sodium and unhealthy fats, and a breakfast bar may earn only one for sodium or none if it exceeds all thresholds.

Foods and beverages should be disqualified from displaying any symbols, however, if they have excessive amounts of even one of these nutrients, the report added. For example, sugar-sweetened soda contains very little sodium and no unhealthy fats, but exorbitant amounts of added sugars and calories per serving would prevent it from making the grade as a healthier choice.

Some people question whether limiting rating systems to calories and unhealthy food components means that shoppers will be deprived of useful information about essential nutrients such as fiber and iron.

On the other hand, displaying a wide variety of numbers or icons does not offer at-a-glance simplicity and could mislead consumers about the overall healthfulness of products, the report shows. Moreover, the IOM system would not preclude claims such as “good source of fiber” that regulations permit food producers to put on package fronts.

The report was written at the request of the regulatory agencies that oversee the content of food labels. Many individuals and groups are clamoring for the agencies to complete their efforts to develop a front-of-package nutrition rating system soon, especially since the number of competing symbols is increasing. IOM urges that a single, universal system ultimately take the place of all others to eliminate the clutter and confusion. And one day busy shoppers may be able to zip through store aisles with greater confidence that their choices are the healthiest for their families.

— *Christine Stencel*

■ **Front-of-Package Nutrition Rating Systems and Symbols: Promoting Healthier Choices.** Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols, Food and Nutrition Board, Institute of Medicine (2011, 250 pp.; ISBN 0-309-21823-3; 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/13221.html>).

The committee was chaired by **Ellen A. Wartella**, Sheikh Hamad bin Khalifa Al-Thani Professor of Communication, professor of psychology, and director, Center on Media and Human Development, School of Communication, Northwestern University, Evanston, Ill. The study was funded by the Centers for Disease Control and Prevention, Food and Drug Administration, and U.S. Department of Agriculture Center for Nutrition Policy and Promotion.



Are Chimps Necessary for Research?

In the summer of 2010, the National Institutes of Health ignited a fierce debate over animal rights with a decision to transfer 186 chimpanzees from the primate facility where they were living in retirement to a center that is actively engaged in biomedical research. The ensuing discussion expanded to the ethical and scientific issues of using any chimpanzees in studies and led to a review by the Institute of Medicine and National Research Council.

NIH director Francis Collins cut short the debate in 2012 by declaring a moratorium on funding for new research involving chimpanzees until the recommendations from the review committee could be implemented.

The committee's report concludes that chimpanzees' use as biomedical or behavioral research subjects should be allowed only under stringent conditions, including the absence of any other suitable model and inability to ethically perform the research on people. The report does not endorse an outright ban on chimpanzees in research, but instead proposes restrictive criteria that would govern decisions about whether to permit their use. And it encourages NIH to establish an independent oversight committee that would assess the necessity of chimpanzees in grant renewals and new research proposals using the new criteria.

At the heart of the review were the questions of whether these primates offer a research model so unique that no other animals or tools could take their place, and whether research on needed therapies or important behavioral problems would languish without them. As the report notes, many areas of research in which

chimpanzees were once used are proceeding well with other animals and tools thanks to technological advances. The committee found only two cases in which chimpanzees may still be needed: development of a limited number of monoclonal antibody therapies already in the pipeline, and development of a vaccine that would prevent infection by hepatitis C virus. Even here, the committee members' debate about the vaccine illustrates the uncertainty of the animals' absolute necessity.

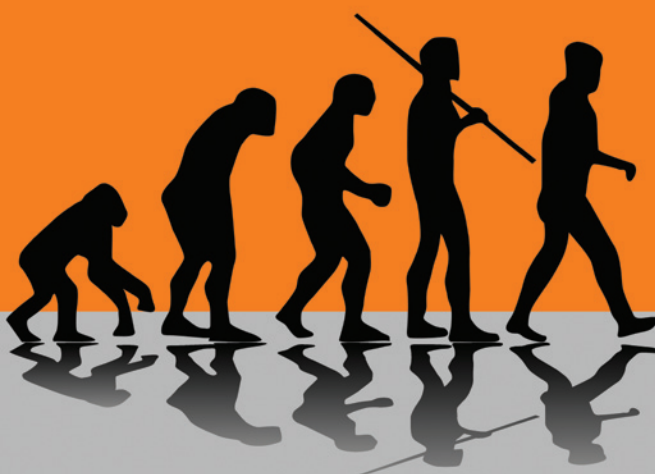
From the study's outset, animal rights supporters expressed dismay that the committee's charge left out reference to the morality of using these intelligent, emotional animals as research tools. While the committee did not delve into the ethics, it noted that chimpanzees' and humans' nearly identical DNA and the resulting biological and behavioral traits of that genetic proximity inherently demand greater justification for using them as subjects even as it makes them a unique model for certain kinds of studies. The report's criteria provide the needed parameters to make such decisions going forward. — *Christine Stencel*

■ **Chimpanzees in Biomedical and Behavioral Research: Assessing the Necessity.** Committee on the Use of Chimpanzees in Biomedical and Behavioral Research, Board on Health Sciences Policy, Institute of Medicine, and Board on Life Sciences, Division on Earth and Life Studies (2011, 200 pp.; ISBN 0-309-22039-4; 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/13257.html>).

The committee was chaired by **Jeffrey P. Kahn**, senior faculty member, Johns Hopkins Berman Institute of Bioethics, Baltimore. The study was funded by the National Institutes of Health.

Helping Teachers and Students

'THINK EVOLUTIONARILY'



A new initiative from the National Academy of Sciences and National Research Council is trying to engage the life sciences community in finding ways to teach evolution across the life sciences in upper-level high school and

introductory college biology classes.

The aim is to help students understand that evolution isn't just a single, isolated subject but a fundamental and integrating principle of modern life science. As biologist Theodosius Dobzhansky famously wrote in 1973, "Nothing in biology makes sense except in the light of evolution." The initiative kicked off with a colloquium held last October.

Right now, evolution is often treated in curricula and public debate as a discrete topic that can be segregated and even plucked right out of the curriculum. Robert Pennock from the University of Michigan, who presented at the fall colloquium, cited an instance of a school superintendent who decided to remove a scientific explanation of the beginnings of the universe by gluing two

pages of a textbook together so that the section couldn't be read.

That technique of eliminating a controversial topic shouldn't be possible with evolution if it is taught correctly, said Pennock. "[Evolution] should be seen everywhere, it shouldn't be relegated to a particular section that can be glued together." Evolution is relevant to a host of subjects, from medicine to pest management to forensic science,

he said, and explaining that can help hook students and get them to understand evolution's broad reach.

How can instructors get students to “think evolutionarily”? Presenter Gordon Uno said that when students are presented with a new structure or process in biology, teachers should ask questions that might frame the content in a different way: “How did that evolve?” for example, and “Is that the same in all organisms?” Evidence about evolution can be presented at the same time that other content is presented.

Since the convocation, a working group has been planned with the goal of creating a web database of materials to help biology teachers integrate evolution into their courses. The initiative also hopes to offer guidance to authors and publishers of

biology textbooks and curricula, to help them integrate evolutionary principles in their products.

Presentations and more information about the fall conference can be found at nas-sites.org/thinkingevolutionarily.

— *Sara Frueh*

Thinking Evolutionarily: Evolution Education Across the Life Sciences — Summary of a Convocation.

Planning Committee on Thinking Evolutionarily: Making Biology Education Make Sense, Board on Life Sciences, Division on Earth and Life Studies (2012, 86 pp.; ISBN 0-309-25689-6; available from National Academies Press, tel. 1-800-624-6242; \$36.00 plus \$5.00 shipping for single copies; also on the Internet at www.nap.edu/catalog/13403.html).

The chair of the committee was **Cynthia M. Beall**, S. Idell Pyle Professor of Anthropology, Case Western Reserve University, Cleveland. The study was supported by the National Academy of Sciences, and grants from the Burroughs Wellcome Foundation, Christian A. Johnson Endeavor Foundation, a grant from the National Science Foundation to Oklahoma University, and the Carnegie Institution for Science.



IMMIGRATION ENFORCEMENT

Better Planning Could Lead to Better Performance

While illegal immigration across the southwest U.S. border has dropped dramatically over the past decade, the legal consequences for immigration-related offenses have skyrocketed because of more stringent enforcement policies. Decisions, mainly by the U.S. Department of Homeland Security, to allow fewer immigrants to return home voluntarily without legal action have put considerable demands on the U.S. Department of Justice, the agency responsible for overseeing civil and criminal immigration proceedings.

Despite much fewer apprehensions, immigration case filings increased 138 percent, and bookings for immigration-related offenses jumped 241 percent between 2001 and 2010. Yet evidence suggests that stricter enforcement tactics have had little deterrent effect on immigration; rather, the decline is likely due to economic factors. Thus, with resources already stretched thin, it is unclear how the system could handle higher volumes of activity if future illegal immigration increases to previous levels.

A National Research Council report examines the current immigration enforcement system, which is spread across DOJ, DHS, and the courts, and recommends changes in the way the agencies develop their budgets. Those changes would contribute to more cost-effective use of appropriated resources.

In the enforcement system, both national and local administrators adjust their operations to the level of resources that are available. In Tucson, for example, immigration hearings are capped at 70 cases per day,



while in San Diego the number of prosecutions is determined by the number of beds available in detention facilities. Because immigration patterns and enforcement policies differ by location and change frequently, often with little warning, DOJ has found it a challenge to accurately estimate future resource needs.

The committee that wrote the report recommended that DHS and DOJ specify the expected goals of enforcement policies and set corresponding targets to measure the results. The committee recommended tracking individual case histories as a basis for analyzing how both costs and results of enforcement activities vary and highlight how local and national resource constraints and decisions affect how cases are handled. Better data on policy performance would contribute to better decisions about the cost-effective use of resources, the committee said.

The report also recommends that the two agencies coordinate their policy development, planning, and budgeting processes to ensure that the policies and strategies chosen to achieve specified goals match resources and increase their effective use. — *Lauren Rugani*

■ **Budgeting for Immigration Enforcement: A Path to Better Performance.** Committee on Estimating Costs of Immigration Enforcement in the Department of Justice, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education (2011, 125 pp.; ISBN 0-309-22122-6; available from National Academies Press, tel. 1-800-624-6242; \$44.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13271.html>).

The committee was chaired by **Peter Reuter**, professor in the School of Public Affairs and in the department of criminology at the University of Maryland, College Park. The study was funded by the U.S. Department of Justice.

Interactive Video Game Puts Science in Students' Hands

Learning by doing is an essential part of a strong science education, but turning abstract scientific concepts into hands-on, engaging lessons for students can be a real challenge. Enter *Science in Motion*, a new video game under development that may soon allow science students across

"This is an ambitious project in terms of both content and collaboration," said GameDesk CEO Lucien Vattel. "The Science & Entertainment Exchange award will help us prove that you can create a highly entertaining and academically respected experience that will be embraced as core instruction."

the country to see for themselves how earthquakes are caused and mountains are formed. Through the National Academy of Sciences' Science & Entertainment Exchange, a \$250,000 grant has been awarded to the GameDesk Institute to develop the game.

Billed as a "textbook of the future," *Science in Motion* merges high-quality

characterization, storytelling, and game design from LucasArts Entertainment with assessment-driven game-learning methodology from GameDesk. A module of the educational geoscience game, for example, will allow students to control the passage of time and slice through layers of the Earth to explore how shifting lithospheric plates cause earthquakes or volcanic eruptions.

Since 2008, the Science & Entertainment Exchange has connected top scientists with screenwriters, directors, and producers to craft engaging storylines rooted in sound science and to portray science more accurately in film and television. The idea for *Science in Motion* was sparked by a summit held by the Exchange that brought together leading scientists and engineers, creative talent from the movie, television, and gaming industry, and dozens of teachers and students to discuss new ways to use entertainment as a science learning tool.

The *Science in Motion* project was selected because of its creative approach to science education and its potential appeal to students as a learning tool. The Gordon and Betty Moore Foundation sponsored the summit and also provided funding for the new grant, intended to support projects that leverage entertainment media to improve science learning. — *Molly Galvin*

Visit www.scienceandentertainmentexchange.org/ to learn more about the Science & Entertainment Exchange and its work.

Publications

For documents shown as available from the National Academies Press (NAP), write to 500 Fifth St., N.W., Room 360, Washington, D.C. 20001; 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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