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Energy Projects and Earthquake Potential

Vulnerability of the U.S. Electric Power Grid

Reforming the Juvenile Justice System

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

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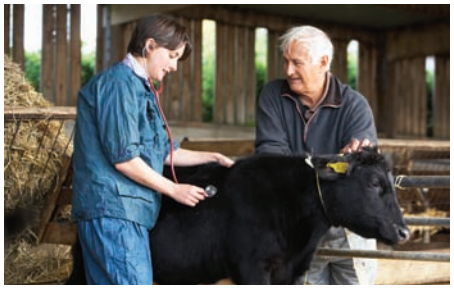

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Celebrating 150 Years of Service to the Nation

President Abraham Lincoln signed the congressional charter that established the National Academy of Sciences 150 years ago — in the midst of the Civil War and on the same day he authorized the first wartime draft in U.S. history. Despite the contentious times, the president and Congress clearly saw the need for a scientific advisory body that would "investigate, examine, experiment, and report upon any subject of science or art," as stated in the Academy's Act of Incorporation, whenever called upon to do so by any department of the government.

So began the Academy's long history of service to the nation. Some of our first studies, requested on behalf of the Navy Department, helped the war effort by improving the capabilities of the Union fleet. The Academy also studied the uniformity of weights, measures, and coins used for domestic and international commerce. In later decades, our advice led to the creation of a national forest service and the U.S. Geological Survey.

As science and technology began to play ever-increasing roles in national priorities and public life, the National Academy of Sciences eventually expanded in 1916, 1964, and 1970 to include the National Research Council, National Academy of Engineering, and Institute of Medicine. Then, as they do now, these nonprofit institutions drew on the knowledge of top scientists, engineers, and health professionals to provide the independent, expert advice that underpins many of the nation's most important milestones, from the national highway system to uniform nutritional guidelines to the United States' first earth-orbiting satellite.

One hundred years after the founding of the NAS, President John F. Kennedy noted in his address to the Academy's Centennial Convocation that NAS had helped bring about a "great change … in the relationship between science and public policy." Science, which once had been merely a "peripheral concern" of the government, was now government's "active partner." Kennedy said that scientific advice had become an "indispensable function of government."

That sentiment is just as relevant today. Our recent reports on strengthening U.S. economic competitiveness, formulating a national response to climate change, improving the nation's health, and educating future innovators have helped shape sound policies and inform public opinion. In the years to come, we will remain committed to excellence in science, engineering, and medicine for the benefit of the nation and the world.

In the heart of the country, concerns have amassed over a laboratory that would help protect public health and the U.S. livestock, dairy, and poultry industries.

A LOOK AT THE NATION'S
ANIMAL DISEASE RESEARCH NEEDS

The U.S. Department of Homeland Security plans to house the proposed National Bio- and Agro-Defense Facility (NBAF) on the picturesque campus of Kansas State University, Manhattan, to study foreign diseases dangerous to animals, including the highly contagious foot-and-mouth disease, and zoonotic diseases that are transmittable between animals and humans. It would serve as the only Biosafety Level 4 pathogen laboratory for large animals in the U.S. and replace the more than 50-year-old Plum Island Animal Disease Center in New York, which is currently the lone U.S. facility authorized to conduct foot-and-mouth disease research.

Although many agree that such a state-of-the-art laboratory is needed in the U.S., questions surround its $1.14 billion construction price tag, its location in the midst of cattle country, and the most recent risk assessment prepared by DHS for the facility. Two separate National Research Council committees examined some of these issues.

The committee that reviewed an updated risk assessment by DHS found that it is a substantial improvement over the agency's original 2010 assessment, but it has a number of deficiencies and inadequately characterizes the risks associated with operating the facility. For instance, information in the 2010 risk assessment implies that for the two most likely release scenarios there is nearly a 70 percent chance a release of foot-and-mouth disease could result in an infection outside of the laboratory over its projected 50-year lifetime. In contrast, the updated assessment concludes that for 142 possible events that could release a pathogen, the cumulative probability of a release

leading to an outside infection is 0.11 percent, or a 1 in 46,000 chance per year. The committee believed this was based on questionable and inappropriate assumptions that led to artificially lower estimates of the probabilities and amounts of pathogens released.

Many of the shortcomings from the previous assessment had been addressed in the latest version, but some of the risk analysis methods were misinterpreted and misapplied when executed. Overall, it underestimates the risk of an accidental pathogen release, inadequately characterizes the uncertainties in those risks, and does not include overall risks associated with the most dangerous pathogens, according to the committee.

A separate committee examined three options to meet the nation's animal disease research needs: construct NBAF as designed, build a scaled-back version, or maintain current operations on Plum Island while leveraging Biosafety Level 4 capacity for large animals through foreign laboratories. For the first option, the committee concluded that NBAF as currently designed has all the components of an ideal laboratory infrastructure in a single location and could meet future needs, but it has drawbacks including substantial costs and an inability to take advantage of the capabilities of other high-level biocontainment laboratories in the U.S.

A partnership between a scaled-down central national laboratory and a distributed laboratory network could help protect the U.S. from foreign animal and zoonotic diseases, save costs, reduce redundancies, increase efficiencies, and enhance the cohesiveness of a national system of biocontainment laboratories. However, the cost implications of reducing the scope and capacity of a central facility are unknown without further information and study.

Maintaining the Plum Island facility and leveraging foreign laboratories for large-animal Biosafety Level 4 needs would avoid the costs of constructing a new replacement facility, the committee said. Nevertheless, Plum Island does not meet current standards for high-level biocontainment, lacks large-animal Biosafety Level 4 capacity, and would have substantial costs associated with maintenance and operation over the long term. The committee emphasized that until NBAF is built as designed or a scaled-back version opens, Plum Island should remain in operation to address ongoing needs. — *Jennifer Walsh & Lorin Hancock*

Evaluation of the Updated Site-Specific Risk Assessment for the National Bio- and Agro-Defense Facility in Manhattan, Kansas. Committee on the Evaluation of the Updated Site-Specific Risk Assessment for the National Bio- and Agro-Defense Facility in Manhattan, Kansas; Board on Life Sciences and Board on Agriculture and Natural Resources; Division on Earth and Life Studies (2012, 111 pp.; ISBN 0-309-25782-4). The committee was chaired by **Gregory B. Baecher,** Glenn L. Martin Institute Professor of Engineering in the department of civil and environmental engineering at the University of Maryland, College Park.

Meeting Critical Laboratory Needs for Animal Agriculture: Examination of Three Options. Committee on an Analysis of the Requirements and Alternatives for Foreign Animal and Zoonotic Disease Research and Diagnostic Laboratory Capabilities; Board on Agriculture and Natural Resources and Board on Life Sciences; Division on Earth and Life Studies (2012, 166 pp.; ISBN 0-309-26129-5). The committee was chaired by **Terry F. McElwain,** professor and executive director of the animal disease diagnostic laboratory at the College of Veterinary Medicine at Washington State University, Pullman.

Both reports were sponsored by the U.S. Department of Homeland Security and are available from the National Academies Press, tel. 1-800-624-6242, and free to download on the Internet at <www.nap.edu>.

Rising Seas Along America's West Coast

A rise in sea levels is one of the most visible results of a warming planet. Higher temperatures cause ocean water to expand and cause glaciers and ice sheets to melt, adding water to the oceans. Ocean levels began to rise during the late 19th or early 20th century and are expected to continue to climb at an even higher rate during this century. Although the global trend is upward, seas don't rise evenly everywhere. Shifts in a particular place are influenced by factors such as patterns in ocean circulation, climate patterns such as El Niño, and the rise or fall of coastal land itself.

Concerned about sea-level rise along their 1,400 miles of coastline, the states of California, Oregon, and Washington, together with several federal agencies, asked the National Research Council to evaluate how much the ocean will rise along America's West Coast by 2030, 2050, and 2100.

The committee's report finds that the sea level for most of California's coast — the area south of Cape Mendocino — will rise slightly higher than the global average. Relative to the land, the sea is expected to rise about 1 meter over the next century. In northern California, Oregon, and Washington, however, the sea will rise less — about 60 centimeters — during the same period of time. There's even a chance these northern areas may see a slight drop in sea level during the next few decades, the report says. Although the water is rising, the land is rising along with it; the plate that forms the ocean floor is descending below the continental plate, pushing the coast upward.

However, extreme events such as a major earthquake could raise sea levels much higher than this estimate, and far more rapidly. An earthquake magnitude 8 or greater north of Cape Mendocino — which occurs in this area every several hundred to 1,000 years — could cause parts of the coast to descend immediately and the relative sea level to rise suddenly by a meter or more.

Even gradual increases in sea level are expected to magnify the impact of coastal flooding and erosion from storm surges and high waves. Such events are costly, given that much development on the West Coast — such as airports, freeways, and housing developments — has been built only a few feet above the highest tides. San Francisco International Airport, for example, could flood if the sea level rises even 40 centimeters, a number that could be reached within several decades.

— *Sara Frueh & Jennifer Walsh*

Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Committee on Sea Level Rise in California, Oregon, and Washington; Board on Earth Sciences and Resources and Ocean Studies Board; Division on Earth and Life Studies (2012, 201 pp.; ISBN 0-309- 25594-5; available from National Academies Press, tel. 1-800-624-6242; $54.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13389.html>).

The committee was chaired by **Robert Dalrymple,** Willard and Lillian Hackerman Professor of Civil Engineering, Whiting School of Engineering, Johns Hopkins University. The study was funded by the states of California, Washington, and Oregon; National Oceanic and Atmospheric Administration; U.S. Geological Survey; and U.S. Army Corps of Engineers.

Inherently Vulnerable

COMPLEXITY AND DIVERSITY OF THE ELECTRIC POWER SYSTEM COULD BE EASILY EXPLOITED

As much as modern life in the U.S. relies on electricity, we currently invest a "woefully inadequate" amount in upgrades and research and development to keep the system that supplies it operational, according to a report from the National Research Council. The system is incredibly complex and inherently vulnerable. While the report looked in particular at the potential for terrorist attacks to disrupt the grid — which could be disastrous — recent events have shown us just how vulnerable the system can be to severe weather events or simple malfunctions.

Behind the power that emerges from every wall outlet are hundreds of miles of transmission lines, substations, and large central generating stations. High-voltage transformers are a key component, increasing voltage for long distance transmission, and then reducing voltage for delivery to customers. These transformers are very expensive, difficult to move, and custom-built. Most are no longer made in the U.S., and replacing one can take months or years.

The complexity and diversity of the grid system is matched by that of its owners, managers, and operators. Some parts of

the system are provided by federal, state, or municipal governments; others are customer-owned cooperatives. And regulatory oversight varies by utility and location and is divided between federal, state, and local governments.

Terrorists could exploit grid vulnerability, the report says. While an attack would not immediately kill many people or make for spectacular television footage, it could deny large regions of the country access to power for weeks or months. An event of this magnitude and duration could serve terrorists' objectives by causing great hardship, widespread public anger, and an image of helplessness. In addition, such a blackout could entail costs of hundreds of billions of dollars.

The report, therefore, focuses on ways to make the power delivery system less vulnerable, strategies to restore power faster after an attack, and making sure the lights stay on for critical services like hospitals, even when delivery of conventional electric power is down. A promising solution is to develop, manufacture, and stockpile a family of universal recovery transformers that would be smaller and easier to move than the integral but cumbersome high-voltage transmitters. They would be less efficient than those normally operated and would only be for temporary use, but they could drastically reduce delays in restoring disabled electric power systems.

Although it is not reasonable to expect federal support for all local and regional planning efforts, the U.S. departments of Homeland Security and/or Energy should initiate and fund several model demonstration assessments to examine a region's vulnerability to extended power outages and develop cost-effective strategies to reduce or eventually eliminate them, the report says. Building on the results of these model assessments, DHS could then develop, test, and disseminate guidelines and tools to assist other cities, counties, states, and regions.

While the risk to the country as a whole warrants reducing vulnerability, the risk to any individual utility is small. Therefore they may need incentives such as grants or tax deductions to support incremental costs associated with building a better system. There are many technologies and strategies that could be employed to make the power system more robust in the face of terrorist attack, but research is needed to make these investments more affordable.

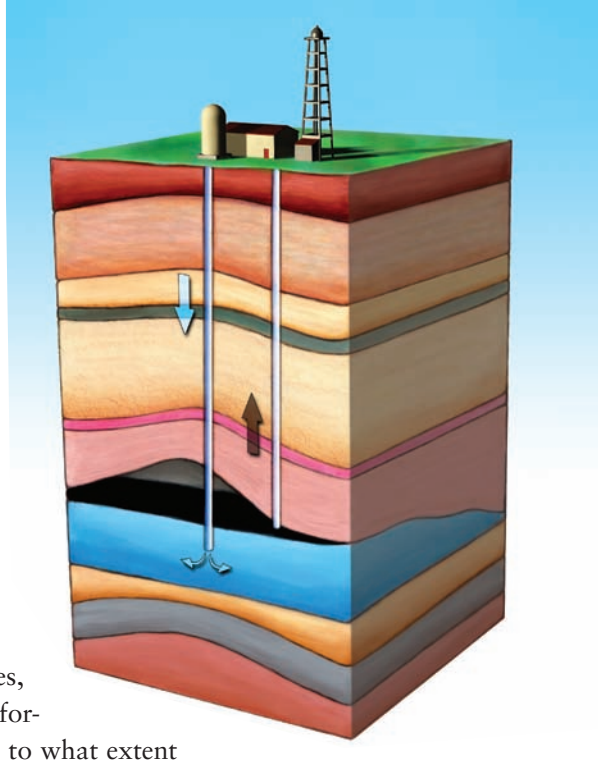
The report was completed in 2007, but the sponsoring agency decided at that time that the report would be classified in its entirety. After a formal request from the Research Council for an updated security classification review, the report was cleared for public release in fall 2012. A foreword to the report says that the key findings of the report remain "highly relevant."

— *Lorin Hancock*

Terrorism and the Electric Power Delivery System. Committee on Enhancing the Robustness and Resilience of Future Electrical Transmission and Distribution in the United States to Terrorist Attack, Board on Energy and Environmental Systems, Division on Engineering and Physical Sciences (2012, 146 pp.; ISBN 0-309-11404-7; available from 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/12050.html>).

M. Granger Morgan, University Professor and head, department of engineering and public policy, Carnegie Mellon University, Pittsburgh, chaired the committee. The study was funded by the U.S. Department of Homeland Security.

On **Shaky** Ground?



To produce much of the energy that powers our daily lives — from the natural gas that heats our homes to the petroleum that runs our cars — a step that injects or withdraws large volumes of liquid deep beneath the Earth's surface is often involved. One unfortunate side effect of this step is the possibility of causing an earthquake. In the past several years, earthquakes related to energy projects have drawn heightened public attention, particularly in areas where development is ongoing or planned. In response, Congress requested that the U.S. Department of Energy call upon the National Research Council to examine the issue.

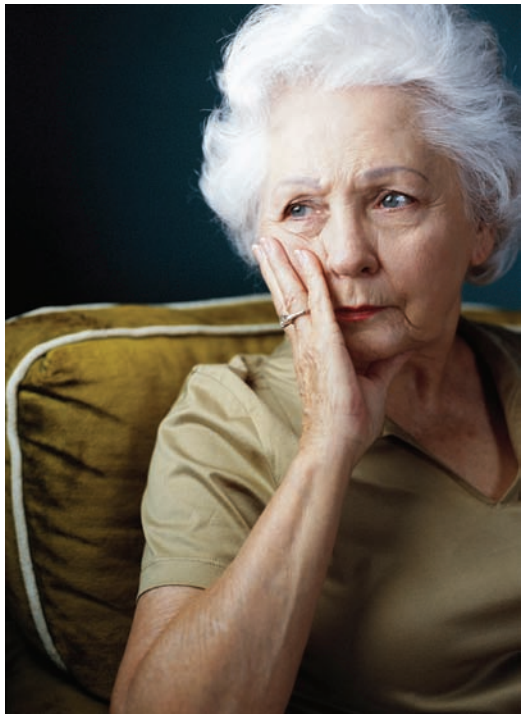
Hydraulic fracturing, carbon capture and storage, geothermal energy, and conventional oil and gas development all have components of production that involve underground fluid injection, while oil and gas development and geothermal energy production also withdraw fluid. Hydraulic fracturing, commonly known as fracking, pumps a chemical mixture into wells and results in natural gas flowing up the well along with wastewater. Although some of this wastewater can be recycled, it is often disposed of through deep underground injection at a location separate from the production site. Currently, commercial carbon capture and storage involves liquefying carbon dioxide produced at power plants and pumping small volumes of the mixture over long periods of time at high pressure deep underground for permanent storage.

The committee that examined the potential for man-made earthquakes that result from these activities found that hydraulic fracturing has a low risk for inducing earthquakes that can be felt by people, but the underground injection of wastewater produced from this and other energy technology processes has a higher risk of causing earthquakes. Furthermore, carbon capture and storage may cause earthquakes, but there is limited information to understand to what extent because no large-scale projects are in operation that can inject the large volumes necessary to reduce greenhouse gas emissions.

The factor most directly correlated with induced earthquakes is the total balance of fluid introduced or removed underground, the committee said. Because most of the energy technologies explored in the study involve net fluid injection or withdrawal, they all have the potential to cause an earthquake that could be felt by people. Technologies designed to maintain a fluid balance between those being injected and withdrawn — as is the case with most geothermal and oil and gas development — appear to produce fewer seismic events than technologies that do not balance the fluids. — *Jennifer Walsh*

Induced Seismicity Potential in Energy Technologies. Committee on Induced Seismicity Potential in Energy Technologies, Division on Earth and Life Studies (2012, approx. 300 pp.; ISBN 0-309-25367-5; available from the National Academies Press, tel. 1-800-624-6242; $57.00 plus $5.00 shipping for single copies; also free to download on the Internet at <www.nap.edu/catalog/13355.html>).

The committee was chaired by **Murray W. Hitzman,** Fogarty Professor of Economic Geology in the department of geology and geological engineering at the Colorado School of Mines in Golden. The study was sponsored by the U.S. Department of Energy.



Mental Health and Substance Abuse Care in Key Populations

Substance abuse and mental health disorders have taken a backseat to physical illnesses and injuries when it comes to coverage and care. Even with the passage of federal parity legislation in 2008, many individuals and families have struggled to get and maintain services for these disorders. Less than half of the 45.6 million adults with mental illness received help in 2011, according to the latest government survey.

Two reports released by the Institute of Medicine in 2012 examine the scope of these conditions among particular segments of the population: older Americans and military service members.

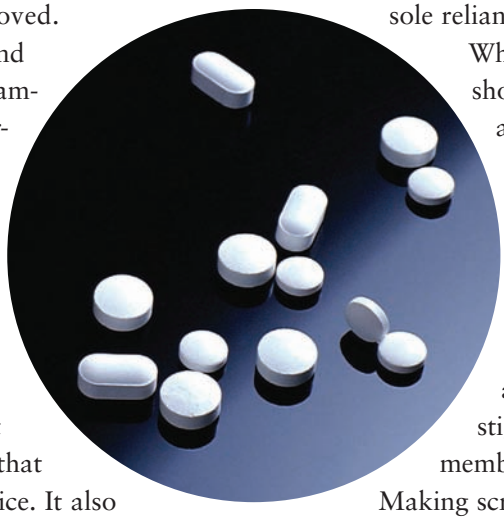
Aging baby boomers who need help for problems such as mood disorders, hoarding, medication addiction, and alcoholism could have a hard time finding services, says one of the reports. There are too few geriatric specialists, and most primary care providers have little or no knowledge about diagnosing and caring for these problems in older patients.

Nearly one in five older Americans experience at least one mental health condition or problem with the misuse or abuse of drugs. Inattention to these conditions can contribute to higher costs and greater suffering. For example, older people with untreated depression are less likely to properly take medicines for other ailments, and they are more likely to require repeated hospital stays.

Making sure there are enough providers able to handle the needs of older patients will take a combination of incentives and requirements, the report concludes. Organizations that accredit health and social service schools and license professionals should require all providers who will work with older patients to demonstrate basic knowledge and skills in recognizing the signs of mental health and substance abuse problems and providing at least basic care. The report supports the use of loan forgiveness programs and scholarships for people who train in geriatric mental health and substance abuse to increase the number of specialists.

Moreover, patients' ability to get care is too often hindered by Medicare and Medicaid payment restrictions. For example, Medicare does not pay for care

provided by nurses working without physician oversight and does not pay psychiatrists for supervisory services. These limitations need to be removed.



Similar restrictions and work-force shortages hamper care for military service members dealing with problems related to misuse or abuse of alcohol and drugs, another IOM report notes. TRICARE, the military's health insurance program, does not cover several therapies that are now standard practice. It also does not permit long-term use of certain medications for the treatment of addiction and covers care delivered only in specialized rehabilitation facilities, even though care in outpatient settings more effectively helps patients avoid relapses.

Prescription drug misuse is a growing concern among service members. Just 2 percent of active duty personnel reported misusing medication in 2002 compared with 11 percent in 2008. In addition, binge drinking increased from 35 percent in 1998 to 47 percent in 2008. Substance abuse frequently occurs along with conditions such as post-traumatic stress disorder, depression, and suicidal thoughts, which likewise are occurring more often among this population.

Military health care professionals at all levels need training to recognize patterns of substance abuse and misuse and clear guidelines for referring patients to specialists, the report says. The U.S. Department of Defense should promote team care by a range of providers, which is the most effective approach and would help alleviate the provider shortage created by the military's sole reliance on specialty clinics.

While the armed forces should move away from a permissive attitude toward alcohol by enforcing regulations on underage drinking and reducing the availability of alcohol on bases, they should also work to ease the stigma that deters service members from seeking care. Making screening and intervention services part of primary care would help achieve this goal and increase the number of places where service members and families can get basic care for these problems. — *Christine Stencel*

The Mental Health and Substance Use Workforce for Older Adults: In Whose Hands? Committee on the Mental Health Workforce for Geriatric Populations, Board on Health Care Services, Institute of Medicine (2012, 372 pp.; ISBN 0-309- 25665-8). The committee was chaired by **Dan G. Blazer,** J.P. Gibbons Professor of Psychiatry and Behavioral Sciences and vice chair for faculty development, Duke University Medical Center, Durham, N.C. The study was funded by the U.S. Department of Health and Human Services.

Substance Use Disorders in the U.S. Armed Forces. Committee on Prevention, Diagnosis, Treatment, and Management of Substance Use Disorders in the U.S. Armed Forces, Board on the Health of Select Populations, Institute of Medicine (2012, 410 pp.; ISBN 0-309- 26055-8). The committee was chaired by **Charles P. O'Brien,** Kenneth Appel Professor and vice chair, department of psychiatry, and director, Center for Studies of Addiction, Perelman School of Medicine at the University of Pennsylvania, Philadelphia. The study was funded by the U.S. Department of Defense.

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

Veterinarians Protect Humans Too

When it's time to take Fido to the doctor, pet owners in cities have many options — more than half of the 93,000 veterinarians in the U.S. serve companion animals like cats and dogs, and the majority of veterinary students seek training in pet medicine. It may come as a surprise, therefore, that a recent National Research Council report finds that other areas of veterinary medicine are failing to attract new candidates, leaving important areas of public health underserved.

Companion animal medicine has been a great success story for pets and their owners, but that success has come at the cost of veterinary fields that serve both animals and humans, such as infectious disease, food safety, and laboratory animal care. Veterinary schools have increasingly limited ability to hire faculty in all areas of veterinary medicine and to support graduate training required for some research positions.

The fields experiencing difficulty are vital to public health and human drug development. The report says without immediate action the academic veterinary community will fail to prepare the next generation of veterinarians for jobs in state diagnostic laboratories, federal research and regulatory agencies, and the pharmaceutical and biologics industry.

As fewer veterinarians become food-animal or mixed practitioners, the "critical mass" of expertise serving rural areas is being lost, placing both the food supply and companion animals at risk. If a serious animal-health crisis involving a highly contagious food-animal disease were to happen today, the veterinary profession would not be adequately equipped to meet such a challenge.

Another factor keeping students from pursuing veterinary careers in these industries is simple economics. Veterinary education is the most expensive of all the health sciences, around $66,000 per year. Students graduating from veterinary school in 2009 carried an average of nearly $130,000 in debt. Although most prospective students are drawn to veterinary medicine because of a love for animals, not a love of money, the disparity in potential income relative to debt is increasingly untenable.

Addressing these challenges depends on the cooperation and collaboration of professional veterinary organizations, academia, industry, and government to raise student awareness of all veterinary fields. The high cost of veterinary education should be confronted, the report says, with new or unconventional ideas like developing a consortium with shared curriculum. Students could also receive specialized training via novel partnerships. Overall, the report says a national investment to support veterinary capacity is needed, with federal support for education and greater investment in veterinary research. — *Lorin Hancock*

Workforce Needs in Veterinary Medicine. Committee to Assess the Current and Future Workforce Needs in Veterinary Medicine; Board on Agriculture and Natural Resources, Division on Earth and Life Studies, and Board on Higher Education and Workforce, Division on Policy and Global Affairs (2012, approx. 320 pp.; ISBN 0-309-25744-1; available from National Academies Press, tel. 1-800-624-6242; $59.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13413.html>).

Alan M. Kelly, professor of pathology and pathobiology (emeritus), School of Veterinary Medicine, University of Pennsylvania, Philadelphia, chaired the committee. The study was funded by the Association of American Veterinary Medical Colleges, American Animal Hospital Association, Bayer Animal Health, and the Burroughs Welcome Fund.

AGING AND THE **ECONOMY**

The Fiscal and Economic Challenges of an Older Population

The United States is getting older. People are living longer and having fewer children than previous generations, resulting in an increasingly greater proportion of the population that is over age 65. Although the baby boom bulge has drawn attention to the trend, this unprecedented demographic shift is likely to persist and will present the nation with new fiscal and economic challenges.

Many of the costs associated with population aging will be concentrated among government programs that support the elderly, particularly programs related to health. As the oldest of the baby boom generation begin to retire and draw benefits from Social Security, Medicare, and Medicaid, there will be relatively fewer workers contributing to support them. Many are concerned that these programs are already on unsustainable paths and, without changes, will be unable to meet the planned levels of support for future generations.

A recent National Research Council report concluded that the nation has several options for addressing these challenges. Restoring the fiscal balance of entitlement programs will require major structural changes, the report says, but the fundamental issue facing society is how to distribute

the costs across current and future workers and retirees. One strategy could be for workers to save more or pay higher taxes. Others include providing fewer benefits to retirees or increasing the number of years people stay in the work force.

Each of these strategies has different implications for the groups that will immediately bear the costs of any policy changes. Each of them also has longer-term economic consequences for personal savings rates and income security, national productivity and growth, and the solvency of federal and state entitlement programs. According to the report, a likely solution will consist of a combination of changes to government transfer programs, higher personal savings rates, and longer working lives.

The challenges to Social Security can be addressed through straightforward adjustments in benefit formulas or increased contributions, although different segments of society vary substantially in how well they could accommodate such changes. Medicare and Medicaid present more complex challenges. For decades, health care costs have grown substantially faster than per capita income; when combined with population aging, public health care expenditures are expected to soar.

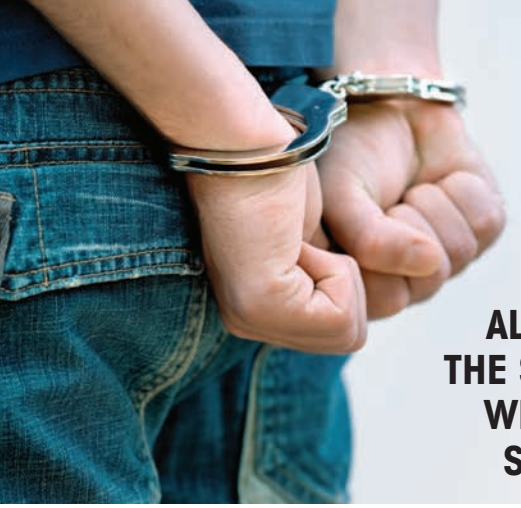
Not only will a growing number of people become eligible for these programs in the coming years, they will also draw benefits from them for longer. Many companies and employees still plan financially around the conventional retirement age of 65, even as the rise in longevity means that many people are enjoying more years away from the work force. Some measures show that as many as two-thirds of Americans have not saved enough for these extra years of retirement and they are likely to become heavily dependent on public transfer programs.

The report suggests that, for many Americans, extending working years beyond age 65 is both a realistic policy option and an available individual choice. People who choose to retire at 65 often do so in the interest of leisure or because of employer incentives, but generally not because of health issues that would prevent them from continuing to work. In addition, the report found no evidence that an older work force would stifle innovation, decrease productivity, or keep jobs away from younger workers. Longer working lives would also allow individuals to save longer, contribute more to national output, and delay payouts from pensions or entitlement programs.

The challenges of population aging are not insurmountable, the report says, but policies are needed sooner rather than later to give companies and households enough time to adapt and adjust their financial plans. Waiting to take action will increase the liability for future generations, and the solutions will become much more costly.
— *Lauren Rugani*

Aging and the Macroeconomy: Long-Term Implications of an Older Population. Committee on the Long-Run Macroeconomic Effects of the Aging U.S. Population; Board on Mathematical Sciences and Their Applications, Division on Engineering and Physical Sciences; Committee on Population, Division of Behavioral and Social Sciences and Education (2012, 256 pp.; ISBN 0-309-26196-1; available from 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/13465.html>).

The committee was co-chaired by **Roger W. Ferguson,** chief executive officer at TIAA-CREF, New York City, and **Ronald Lee,** professor of demography at the University of California, Berkeley. The study was funded by the U.S. Department of the Treasury and the National Institute on Aging.



Juvenile Justice Reform

ALIGNING THE SYSTEM WITH THE SCIENCE

Crimes committed by adolescents can often be attributed to the kind of risk-taking behavior that is a normal part of growing up. Adolescents generally lack self-regulation, are more sensitive to peer pressure and other outside influences, and have a poorer ability than adults to consider consequences when making decisions. The resulting actions can lead to adolescents' putting themselves or others in harm's way. But for most offenses, institutional confinement is not a punishment that fits the crime.

A recent National Research Council report says that while adolescents should be held responsible for their actions, accountability practices in the juvenile justice system shouldn't be modeled after criminal punishments for adults. Instead, states should design juvenile justice policies around the science on adolescent brains and behaviors.

Healthy adolescent development requires an involved parent figure, peer groups that value positive socialization and academic success, and activities that strengthen critical thinking skills. The juvenile justice system's current reliance on confinement and control deprives adolescents of these important resources. It can also undermine an adolescent's respect for the law and reinforce deviant behavior, undercutting the goals of promoting social maturity and preventing reoffending.

Community-based programs are more likely than institutional confinement to reach these goals, the report says. Juvenile offenders can take responsibility for their actions and make amends to individuals and society while participating in positive activities. Community programs can also steer youth away from the system by reducing risk factors, and they can be tailored to suit an individual's needs. Many such programs have the added benefit of being more cost-effective than confinement.

Juvenile offenders are more likely to accept responsibility for their actions if they believe the system is treating them fairly. Fairness includes being represented by trained counsel, participating in the process, perceiving that the system is nondiscriminatory, and being given the chance to understand the proceedings before any legal action is taken.

The juvenile justice system should also take steps to reduce racial disparities in its processes, the report says. Minorities are disproportionately represented, especially at the arrest and detention stages and for certain crimes, and are more likely to face harsh punishment and remain in the system longer than white youths for the same crimes.

The report also recommends that juvenile records remain confidential and not follow adolescent offenders into adulthood, giving them the opportunity to lead successful lives. — *Lauren Rugani*

Reforming Juvenile Justice: A Developmental Approach. Committee on Assessing Juvenile Justice Reform, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education (2012, approx. 420 pp.; ISBN 0-309-27890-2; available from National Academies Press, tel. 1-800-624-6242; $64.00 plus $5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/14685.html>).

The committee was chaired by **Robert Johnson,** dean, New Jersey Medical School, Newark. The study was funded by the U.S. Department of Justice.

Strong Research Universities and U.S. Prosperity

A New Report Identifies Critical Actions for Maintaining Highest-Quality U.S. Research Institutions

For more than a century, U.S. research universities have been the backbone of American prosperity and ingenuity. They have sown the seeds for some of the nation's greatest achievements, contributing significant benefits to our economy and quality of life. Research at these institutions has played an essential role in the development of game-changing inventions such as lasers, computers, and blood thinners. And graduates have created and propelled businesses that employ millions of Americans.

A recent report by the National Research Council warns, however, that U.S. research universities are on the brink of a crisis and in danger of serious decline. At an event to release the congressionally requested report, members of the authoring committee, which included industry CEOs, university presidents, a former U.S. senator, and a Nobel laureate, discussed 10 recommended actions that the nation should take to sustain top-quality U.S. research institutions so that they can continue to provide the knowledge, innovation, and talent for a robust economy and dynamic society.

By most measures, U.S. universities are still among the best in the world, and 35 to 40 of them consistently rank among the top 50 globally. However, these universities are facing critical challenges — magnified by the financial crisis — that threaten to erode the quality of research and education these institutions can provide, the report says. Federal funding for research has flattened or declined. State funding for research institutions has also dropped over the last decade — by 20 percent to as much as 50 percent in some cases. U.S. colleges have had to raise tuition, threatening to place higher education out of reach for many.

At the same time, other countries have increased R&D funding and are pouring significant resources into their own institutions. For instance, U.S. R&D expenditures, both public and private, have hovered between 2.5 percent and 2.8 percent of GDP over the last three decades, while Japan and South Korea increased their R&D expenditures to well over 3 percent of their respective GDPs in recent years.

U.S. institutions owe much of their success to forward-looking policies that established strong partnerships between government, industry, and universities. "We had a major step forward at the time of the Civil War and at the time of World War II in the relationships between universities and government," said Charles O. Holliday, chair of the committee that wrote the report and retired chairman and CEO of Dupont. "Now it's time for the third wave," which includes strong partnerships between the federal and state governments, companies, and universities. "When you put that all together, we can not only maintain our lead in the world, we can advance it." To renew that partnership, Congress

and the administration should fully fund the America COMPETES Act. This would double the level of basic research conducted by the National Science Foundation, U.S. Department of Energy, and National Institute of Standards and Technology.

States must maintain high-quality regional research institutions in order to compete in an increasingly knowledge- and innovation-driven economy, the report adds. As budgets recover from the recession, state governments should strive to restore and maintain per-student funding for higher education to levels equal to the period of 1987-2002, as adjusted for inflation. Federal programs aimed at stimulating innovation and work-force development at the state level should be accompanied by strong incentives to sustain state support for public universities.

The report calls on research universities to play their part by significantly increasing cost-effectiveness and productivity while raising graduation rates, reducing the time needed to complete degrees, and aligning doctoral programs with careers. In addition, reducing federal and state regulatory burdens on universities will help reduce their costs. These savings can be used to constrain tuition increases or to increase financial aid. The federal government should also invest in infrastructure — particularly cyberinfrastructure — that has the potential for improving productivity in administration, research, and academic programs.

Businesses, which have long relied on research universities for talent and technology, should also play a bigger part in ensuring their health, the report says. "Businesses are really dependent on universities to create a pipeline of talent," said

Padmasree Warrior, committee member and chief technology officer for Cisco Systems, in a video that accompanied the release of the report. "Without a pipeline of talent, businesses starve." Federal and state policies should encourage collaboration between U.S. national laboratories, businesses, and universities in order to enable large-scale, sustained research projects.

Several universities and business organizations around the country are organizing regional meetings to discuss how to implement the report's recommendations. Meetings are slated in Pittsburgh, Nashville, Tucson, Detroit, Dallas, and in California. — *Molly Galvin*

Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security. Committee on Research Universities, Board on Higher Education and Workforce, Division on Policy and Global Affairs (2012; 250 pp., ISBN 0-309-25639-9; available from National Academies Press, tel. 1-800-624-6242; $49.00 plus $5.00 shipping for single copies; also available on the Internet at <www.nap.edu/catalog/13396.html>).

The committee was chaired by **Charles O. Holliday Jr.,** retired chairman and CEO of Dupont. The study was sponsored by the Alfred P. Sloan Foundation, John D. and Catherine T. MacArthur Foundation, National Science Foundation, and the U.S. Department of Energy.

A Legacy in Radiation Health Effect Research

Important Findings of One of Our Oldest Ongoing Studies May Still Lie Ahead

On a lush hilltop overlooking the thriving city of Hiroshima, Japan, several half-moon shaped Quonset huts have perched over the city for more than 60 years. Nearly every day, several atomic bomb survivors journey to the buildings of the Radiation Effects Research Foundation (RERF) to undergo biannual health examinations. They give blood and go through various medical tests, which will not only monitor their health but also contribute to one of the largest and longest medical studies in history. The survivors' medical data compiled by RERF have served as the foundation for understanding how radiation impacts the human body and have helped establish radiation dose limits for protection standards as well as pave the way for the use of radiation in medical diagnoses and treatment.

Their contributions started in the early 1950s when President Truman turned to the National Academy of Sciences to study the long-term health effects of the atomic blast survivors in Hiroshima and Nagasaki and their future children. A cohort of about 120,000 residents selected from both cities has been followed, with about 35 percent of the survivors still alive today. The oldest is more than 100.

"The National Research Council was involved in the study from the beginning," said Evan Douple, the recently

retired associate chief of research at RERF. "Those in the cohort were chosen because they knew where they were when the bomb dropped and their radiation doses could be estimated."

Roy Shore, vice chairman and executive director of RERF, underscored that its current research is still highly relevant. "We are just learning that cardiovascular risk is increased by radiation, but we don't know the full aspects yet." There are also recent findings about cataracts; the International Commission on Radiological Protection reduced the allowable radiation dose by tenfold because RERF research found that vision-impairing cataracts developed at doses much lower than had formerly been believed. They also found that those who were young when they were exposed have the greatest risk of developing cataracts.

As important research continues, Douple emphasizes that some of RERF's biggest discoveries may lie ahead. "What is remarkable is that the long-term study is not just about radiation effects but also a study about aging. The cohort is still important to follow, especially now that some of the youngest survivors are entering their cancer-prone years. It will be important to know the risk of exposure as a child compared to risk as an adult."

Technology may help tear down some unknown barriers to forge breakthroughs. "With the next generations of DNA sequencers, we can scan the DNA of survivors' frozen blood samples and know every base pair. If a participant comes down with Parkinson's disease, for example, and we have his samples going back for as many as 52 years, it may become possible to identify

mechanisms of the disease process and signals of change," Douple said.

Beyond the findings, RERF's institutional knowledge of conducting such an immense and complex study has made contributions to the field, especially following the Fukushima nuclear accident. "Several research groups near Fukushima had a strong interest in mounting long-term studies, but had no experience. We had an advisory role on how to establish such studies," Shore explained.

Just as the research and dedication of the survivors has flourished over the years, so too has the relationship between two countries. What began as a U.S.-led endeavor has evolved into a joint U.S.-Japanese effort. Today, less than 10 of the more than 200 staff members at RERF are Americans from the National Academies. And they continue to look for the best labs and manpower to collaborate and find answers not only for the survivors, but for everyone. "Our next step is to apply the best science and medicine to better understand mechanisms of disease," Douple said. — *Jennifer Walsh*

The Radiation Effects Research Foundation is a project of the Division on Earth and Life Studies, administered through the Nuclear and Radiation Studies Board. Support for RERF is provided in a cooperative agreement between the U.S. Department of Energy and the National Academy of Sciences. RERF is managed by a binational board of directors consisting of resident directors with oversight provided by a board of councilors. Scientific research activities are carried out on the basis of recommendations of a binational, 10-member scientific council. On the web at <www.rerf.or.jp/> is RERF's semiannual newsletter Update, which contains institutional news, as well as recent publications and investigations.

The Science of Communicating Science

Scientists can run into difficulty communicating with the public about their work, whether it's explaining the scientific evidence for climate change or conveying what "theory" in evolutionary theory really means. But in figuring out how to improve their outreach to the public, scientists might find it helpful to first listen to other scientists — specifically, to social and cognitive researchers who have been studying how people

understand and come to accept or decide to ignore the information they hear.

That was the message of a 2012 Arthur M. Sackler Colloquium that drew 450 participants — both researchers and communications practitioners — and thousands of webcast viewers. Panels and presentations covered topics ranging from fields of science where future communication is likely to be challenging — such as nanotechnology and geoengineering — to the impact of new media technologies on science communication.

A recurrent theme was that communicating effectively about science does not mean simply delivering information and facts — a common but misguided assumption scientists often make, said Arthur Lupia of the University of Michigan: "We think that if we tell them what we know, they'll change what they do." But attempts to educate the public and policymakers about science often fail, he said, in large part because scientists often don't know their audience very well.

One of the challenges is the constant battle for peoples' attention, Lupia said. To win this battle, we have to speak to their core fears, values, and aspirations; what nonscientific audiences want is not a message that's been "dumbed down" but one that's close to their own lives. Making the message concrete and immediate is important, he added. "If you lead with abstractions, you'll lose your audience."

The colloquium also included a historic gathering of four presidential science advisers, who discussed some of the communications challenges they've faced while in office. And embedded in the colloquium was the annual Sackler Lecture,

delivered by Nobel prize-winning psychologist Daniel Kahneman.

The idea that doling out facts and appealing to reason isn't enough surfaced again and again. The last panel of the colloquium explored bold proposals for science communication. Valerie Reyna of Cornell University proposed that scientists focus on helping people develop "valid scientific intuitions, where they have a feel for the information and intuitions about what might be true beyond the limited number of facts that they learn." Because people don't tend to remember and act on facts, scientists need to extract and convey the "gist" of what they're saying — the bottom-line, meaningful message — if they want to compete with the coherent, compelling stories often told by those on the anti-science side of issues, she said.

Other bold proposals included harnessing the talent of Hollywood to make science education for kids more engaging — an idea that builds upon the NAS Science & Entertainment Exchange — and creating a National Partnership for Climate Communication.

Alan Leshner, chief executive officer of the American Association for the Advancement of Science, closed the colloquium by saying there's a message about the importance of science communication in the fact that so many people stayed for two days to discuss it. "Never in my adult life has the tension level between science and the rest of the society been as great as it is now," Leshner said. "And it's up to us — we the scientists and we the science communicators — to figure out how to balance our relationship between science and the rest of society."

The conference organizers are preparing a collection of papers based on the colloquium

to be published in the *Proceedings of the National Academy of Sciences*. The archived video webcast of the colloquium presentations can be found at <events.tvworldwide.com/Events/NAS120521.aspx>. Another conference is planned for fall 2013. — *Sara Frueh*

The Weight of the Nation

Time after time through a series of reports on preventing childhood obesity, the Institute of Medicine has called on media companies to do their part in fixing the nation's weight crisis. By the stories they tell and images they show, media help influence whether Americans pursue healthy eating habits and activities or succumb to overindulgence and couch-potato lifestyles.

Saying that media companies should step up to the plate is easy; it is a lot harder to craft shows and other fare that convey the benefits of healthy lifestyles and the risks associated with overeating and inactivity

in a compelling way. In 2012, IOM backed up its recommendations in a partnership with HBO Documentary Films and a broader group of scientific experts and supporters. Working together, they developed *The Weight of the Nation,* a four-part film series on America's weight crisis, along with a companion book to reinforce the series' messages, and a national campaign to spur action against the obesity epidemic.

The films and campaign debuted nationally in conjunction with the release of IOM's latest report on the obesity crisis, *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation.* While the films focus on the status, causes, and consequences of the obesity epidemic, IOM's report provides a comprehensive set of recommendations and strategies for accelerated change. The report emphasizes a key message: Curbing obesity requires across-the-board societal changes to make healthy foods and beverages and opportunities for physical activity easy, routine, and appealing aspects of daily life. It is a theme that also runs through the films and companion book.

Since the films' debut in May, they have attracted nearly 7 million viewers. In addition, the campaign website has drawn more than 1 million visitors as of mid-December, generated more than 49,000 commitments to take action, and delivered more than 25,000 film screening kits to community groups and organizations.

Other organizations shared their invaluable resources and expertise with the Weight of the Nation project, with the Centers for Disease Control and Prevention and the National Institutes of Health providing additional scientific expertise and Kaiser Permanente and the Michael & Susan Dell Foundation giving their support.

IOM offers a portal to the report, film series, companion book, and other campaign materials at <www.iom.edu/weightofthenation>. — *Christine Stencel*

A New Push to Build Disaster Resilience

Disasters are becoming more destructive, both in the United States and around the globe. In 2011 disasters cost the nation a record-breaking $55 billion, and the economic toll from 2012, while still being tallied, is expected to be even higher given Hurricane Sandy's staggering damages.

To help spur a national conversation about how to build the nation's resilience to disasters, the National Academies held a symposium in November that builds on a report released last summer, *Disaster Resilience: A National Imperative,* which recommended a shift in approach from one that relies heavily on responding to disasters after they occur to one focused on reducing vulnerabilities beforehand.

Keynote speakers included Richard Reed, deputy assistant to the president for homeland security, and former Coast Guard Commander Admiral Thad Allen, who stressed the need for "strategic intent at the national level" in building the country's resilience to disasters.

Three panel discussions followed, the first exploring what it means to have a culture of resilience. Stephen Flynn of the Kostas Research Institute emphasized that local leaders need to understand the risks their communities face and communicate them honestly to their citizens — a shift from past approaches, and not a popular or easy thing to do. "The changing conversation is the frank admission — and it has to come from our leaders — that says risk is a fact of life, there are no risk-free zones on the planet, and it is our capacity to deal with that that's going to be key to our success as a nation, as a company, as a community."

As part of a second panel exploring the practical aspects of building resilience, Linda Langston, county supervisor for Iowa's Linn County, emphasized the need to build strong community connections before disasters happen. "You have to build the relationships and the trust well prior to the difficult times," she said, noting that she often meets elected officials who haven't participated in a pre-disaster drill; a disaster would leave them meeting other emergency managers for the first time under the worst of circumstances.

During the final panel, four federal officials reflected on what can be learned from Hurricane Sandy. One point made repeatedly was the crucial importance of building social networks and lifelines to take care of vulnerable people during disasters, and the need to organize these lifelines before disasters strike.

An archived webcast of the symposium, the report, and other resources on resilience can be found at <nas-sites.org/resilience>. A summary of the symposium will be released this spring. — *Sara Frueh*

New Initiative Highlights Contributions of Behavioral and Social Sciences

In September the National Research Council's Division of Behavioral and Social Sciences and Education kicked off a new initiative, Social and Behavioral Sciences in Action, to draw attention to the value of these disciplines and their contributions to policy and society.

The symposium's keynote address, given by former National Science Foundation director Rita Colwell, illustrated the key role the social and behavioral sciences can play in life-saving health research. Colwell described a three-year study in which she and a team of other researchers evaluated a new way to combat cholera in Bangladesh: teaching women to use sari cloth to filter contaminants out of drinking water. Colwell and her colleagues found that the group that used the sari filters decreased their rate of cholera by 50 percent.

During the study, sociologists guided the team's introduction into the local culture and community and helped design the study's questionnaire to elicit the information needed. What would have happened had they not been on the team? "I wouldn't have had the entre to the villages on such a grand scale — 150,000 individuals in 50 villages," Colwell said. "And it would've been tragic, because this is an opportunity to take very advanced technology — science, engineering — and be able to take those findings in a very practical way to help people."

In another presentation, Lucian Leape of Harvard University highlighted the need for social scientists to tackle an intractable problem — medical errors, in which the hierarchical, siloed culture of medicine plays a large role. "Changing that culture has got to be the ultimate social science challenge," Leape said. Psychologist Robert Fein explained how his research illuminated the pre-attack behavior of assassins and school shooters, informing the way the Secret Service and others assess threats. And John Lee of the University of Wisconsin discussed the problem of distracted driving and how the social sciences can influence engineering to help "make the human-technology marriage work."

During a final panel discussion, NAS President Ralph Cicerone, NAE President Charles Vest, and IOM President Harvey Fineberg commented on the role of the behavioral and social sciences in meeting societal challenges. "The imperative of modern society demands more attention to the behavioral and social sciences," Cicerone said. "The ambition is there, the methods are getting better, the successes are there, but not many people are hearing about them." To make sure more people do, the initiative plans to continue its outreach through briefings to legislators, additional symposia, and other avenues. An archived webcast of the symposium and additional information on the initiative can be found at <sites.nas.edu/socialandbehavioralsciences>.

— *Sara Frueh*

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.

Accelerating the Development of New Drugs and Diagnostics: Maximizing the Impact of the Cures Acceleration Network — Workshop Summary
Board on Health Sciences Policy, Institute of Medicine (2012, 132 pp.; ISBN 0-309-26116-3; available from NAP).

Adapting Agricultural Extension to Peacebuilding — Report of a Workshop by the National Academy of Engineering and the United States Institute of Peace, Roundtable on Technology, Science, and Peacebuilding
National Academy of Engineering (2012, 51 pp.; ISBN 0-309-25967-3; available from NAP).

Assessment of Agent Monitoring Strategies for the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants
Board on Army Science and Technology, Division on Engineering and Physical Sciences (2012, 171 pp.; ISBN 0-309-25985-1; available from NAP).

Assuring a Future U.S.-Based Nuclear and Radiochemistry Expertise
Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2012, 200 pp.; ISBN 0-309-22534-5; available from NAP).

Assuring the U.S. Department of Defense a Strong Science, Technology, Engineering, and Mathematics (STEM) Workforce
Board on Higher Education and Workforce, Division on Policy and Global Affairs; Division on Engineering and Physical Sciences (2012, 139 pp.; ISBN 0-309-26213-5; available from NAP).

Best Care at Lower Cost: The Path to Continuously Learning Health Care in America
Institute of Medicine (2012, approx. 450 pp.; ISBN 0-309-26531-2; available from NAP).

Best Practices in Assessment of Research and Development Organizations
Laboratory Assessments Board, Division on Engineering and Physical Sciences (2012, 90 pp.; ISBN 0-309-26626-2; available from NAP).

Blueprint for the Future: Framing the Issues of Women in Science in a Global Context — Summary of a Workshop
Committee on Women in Science, Engineering, and Medicine, Division on Policy and Global Affairs (2012, 126 pp.; ISBN 0-309-22519-1; available from NAP).

Building Hawaii's Innovation Economy — Summary of a Symposium
Board on Science, Technology, and Economic Policy, Division on Policy and Global Affairs (2012, 186 pp.; ISBN 0-309-25663-1; available from NAP).

Building Public-Private Partnerships in Food and Nutrition — Workshop Summary
Food and Nutrition Board, Institute of Medicine (2012, 82 pp.; ISBN 0-309-25736-0; available from NAP).

Challenges in Chemistry Graduate Education — A Workshop Summary
Board on Chemical Sciences and Technology, Division on Earth and Life Studies (2012, 86 pp.; ISBN 0-309-25708-5; available from NAP).

Climate Change Education in Formal Settings, K-14 — A Workshop Summary
Board on Science Education, Division of Behavioral and Social Sciences and Education (2012, 108 pp.; ISBN 0-309-26016-7; available from NAP).

Clustering for 21st Century Prosperity — Summary of a Symposium
Board on Science, Technology, and Economic Policy, Division on Policy and Global Affairs (2012, 208 pp.; ISBN 0-309-26413-8; available from NAP).

Collecting Compensation Data From Employers
Committee on National Statistics, Division of Behavioral and Social Sciences and Education (2012, approx. 160 pp.; ISBN 0-309-26408-1; available from NAP).

Communications and Technology for Violence Prevention — Workshop Summary
Board on Global Health, Institute of Medicine (2012, 150 pp.; ISBN 0-309-25351-9; available from NAP).

Community Colleges in the Evolving STEM Education Landscape — Summary of a Summit
Board on Life Sciences, Division on Earth and Life Studies; Board on Science Education, Division of Behavioral and Social Sciences and Education; Board on Higher Education and Workforce, Division on Policy and Global Affairs;

National Academy of Engineering (2012, 156 pp.; ISBN 0-309-25654-2; available from NAP).

Computing Research for Sustainability
Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2012, 155 pp.; ISBN 0-309-25758-1; available from NAP).

Contagion of Violence — Workshop Summary
Board on Global Health, Institute of Medicine (2012, 171 pp.; ISBN 0-309-26364-6; available from NAP).

The Continuing Epidemiological Transition in Sub-Saharan Africa — A Workshop Summary
Committee on Population, Division of Behavioral and Social Science and Education (2012, 48 pp.; ISBN 0-309-26648-3; available from NAP).

Continuing Innovation in Information Technology
Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2012, 42 pp.; ISBN 0-309-25962-2; available from NAP).

Continuing Kepler's Quest: Assessing Air Force Space Command's Astrodynamics Standards
Aeronautics and Space Engineering Board, Division on Engineering and Physical Sciences (2012, 71 pp.; ISBN 0-309-26142-2; available from NAP).

Corps of Engineers Water Resources Infrastructure: Deterioration, Investment, or Divestment?
Water Science and Technology Board, Division on Earth and Life Studies (2012, approx. 108 pp.; ISBN 0-309-26476-6; available from NAP).

Dam and Levee Safety and Community Resilience: A Vision for Future Practice
Board on Earth Sciences and Resources, Division on Earth and Life Studies (2012, 155 pp.; ISBN 0-309-25614-3; available from NAP).

Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering
Board on Science Education, Division of Behavioral and Social Sciences and Education (2012, 263 pp.; ISBN 0-309-25411-6; available from NAP).

Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century
Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education (2012, 242 pp.; ISBN 0-309-25649-6; available from NAP).

Evaluating the Effectiveness of Offshore Safety and Environmental Management Systems —TRB Special Report 309
Transportation Research Board (2012, 106 pp.; available only online from NAP).

Evolution of Translational Omics: Lessons Learned and the Path Forward
Board on Health Care Services and Board on Health Sciences Policy, Institute of Medicine (2012, 354 pp.; ISBN 0-309-22418-7; available from NAP).

Export Control Challenges Associated With Securing the Homeland
Development, Security, and Cooperation, Division on Policy and Global Affairs (2012, 68 pp.; ISBN 0-309-25447-7; available from NAP).

Exposure Science in the 21st Century: A Vision and a Strategy
Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2012, 196 pp.; ISBN 0-309-26468-5; available from NAP).

Facing the Reality of Drug-Resistant Tuberculosis: Challenges and Potential Solutions in India — Summary of a Joint Workshop by the Institute of Medicine, the Indian National Science Academy, and the Indian Council of Medicine
Board on Health Sciences Policy, Institute of Medicine (2012, 165 pp.; ISBN 0-309-21966-3; available from NAP).

From Neurons to Neighborhoods: An Update — Workshop Summary
Board on Children, Youth, and Families, Institute of Medicine (2012, 55 pp.; ISBN 0-309-20978-1; available from NAP).

From Science to Business: Preparing Female Scientists and Engineers for Successful Transitions Into Entrepreneurship — Summary of a Workshop
Committee on Women in Science, Engineering, and Medicine, Division on Policy and Global Affairs (2012, 54 pp.; ISBN 0-309-25609-7; available from NAP).

Fueling Innovation and Discovery: The Mathematical Science in the 21st Century
Board on Mathematical Sciences and Their Applications,

Division on Engineering and Physical Sciences (2012, 57 pp.; ISBN 0-309-25473-6; available from NAP).

Future Uses of the Department of Defense Joint Pathology Center Biorepository
Board on the Health of Select Populations, Institute of Medicine (2012, 187 pp.; ISBN 0-309-26065-5; available from NAP).

Genome-Based Therapeutics: Targeted Drug Discovery and Development — Workshop Summary
Board on Health Sciences Policy, Institute of Medicine (2012, 89 pp.; ISBN 0-309-26024-8; available from NAP).

The Human Microbiome, Diet, and Health — Workshop Summary
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