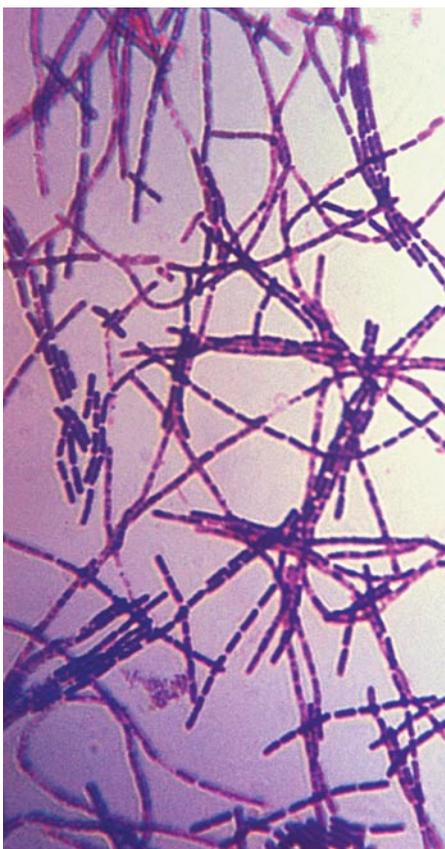
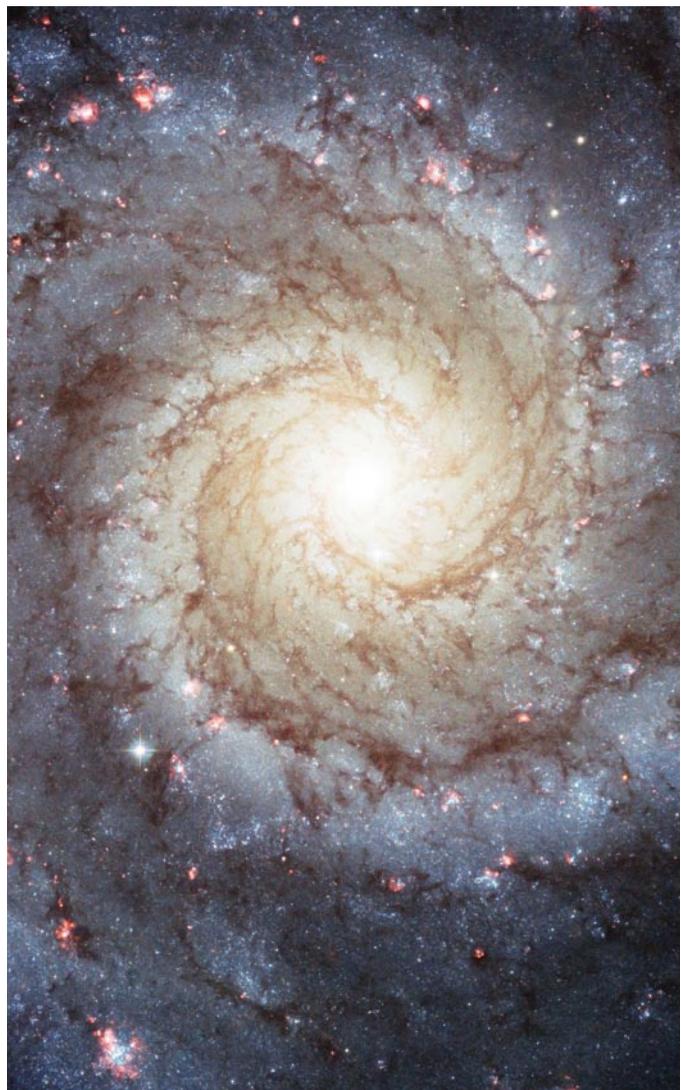


THE NATIONAL ACADEMIES **IN FOCUS**

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Improving Food Safety in America

New Horizons in Astronomy

Oversight of Biological Agents

Fall/Winter 2010

vol. 10 number 3

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

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Page 17: Participants at the sixth annual conference of the African Science Academy Development Initiative, held in South Africa, photos by Bill Kearney

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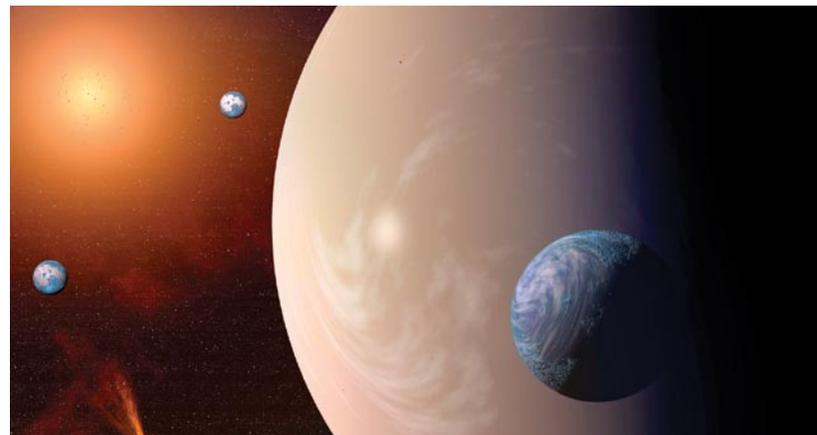
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Rethinking Africa's Challenges

Africa's economic and social challenges are as vast as its geography and natural beauty. One of sub-Saharan Africa's most serious public health problems is HIV/AIDS. In 2008, two-thirds of the 33 million people infected with HIV worldwide were Africans. More than 90 percent of the 2.7 million new infections that year occurred there. Yet only half of Africans who should have been receiving lifesaving antiretroviral therapy were actually in treatment. By 2020, the number of infected in Africa is projected to grow to more than 30 million people.



What can Africa and we in the developed world do to stop, slow, or even adequately treat this seemingly relentless wave of new infections? On the occasion of World AIDS Day 2010, the Institute of Medicine released *Preparing for the Future of HIV/AIDS in Africa: A Shared Responsibility*, which called for an important change in how we approach this epidemic in Africa long term.

The U.S. President's Emergency Plan for AIDS Relief (PEPFAR) so far has provided approximately \$32 billion to HIV/AIDS-related programs in Africa. Combined with private philanthropy, this has been an impressive demonstration of international support. But IOM's new study calls on African public health authorities to develop 20-year road maps for combating the epidemic, including larger investments and a greater emphasis on finding and implementing effective prevention methods that will work in Africa. To do that, African countries will need to assess and meet their national health care work force requirements and adopt more efficient models of care and treatment. Countries like the United States can contribute by supporting — and helping to build — national and institutional partnerships so that Africa can lead the way toward its own sustainable and a healthier future.

None of this will be easy. As you will learn in this issue of *In Focus*, sub-Saharan Africa faces another daunting and immediate challenge: a lack of access to electric power. Seventy percent of the population there lives without electricity, a fact that has a multitude of health implications. Such massive challenges call out to all of us — and to African nations themselves — to work in determined ways to invent new, effective approaches to serve a continent and its people.

A handwritten signature in black ink that reads "Harvey V. Fineberg". The signature is fluid and cursive, with a prominent flourish at the end.

HARVEY V. FINEBERG
President, Institute of Medicine



A Sea Change

The devastating tsunami that swelled in the Indian Ocean in 2004 killing approximately 200,000 people was a wake-up call to the dangers of a similar event striking U.S. shores. Often thought of as massive tidal waves, tsunamis are series of waves created by seafloor displacements that move rapidly onshore and can cause extensive flooding of coastal communities.

A recent report from the National Research Council found that the nation’s ability to detect and forecast tsunamis has improved in the last six years, but many U.S. coastal areas still remain at great risk, especially for tsunamis that leave little time for warning and evacuation.

In recorded U.S. history, tsunamis have taken lives in Hawaii, Alaska, Puerto Rico, American Samoa, the Virgin Islands, California, and Oregon. They can be triggered by a variety of geologic events, most commonly by earthquakes and landslides,

Is U.S. Prepared for a Major TSUNAMI?

but volcanic eruptions or meteorite impacts can also cause them. The threat of a potentially catastrophic tsunami on U.S. soil looms large particularly in seismically active regions.

“If a large earthquake near shore triggers a tsunami, it could reach the coast within minutes, allowing hardly any time to disseminate warnings and for the public to react,” said John Orcutt, chair of the committee that wrote the report. “Education and preparation are necessary to ensure that people know how to recognize natural cues — such as earthquake tremors or receding of the waterline — and take appropriate action, even if they do not receive an official warning.”

The report finds many enhancements have been made due to U.S. tsunami-related efforts, including an increase in the amount and quality of hazard and evacuation maps and the expansion of the Deep-Ocean Assessment and Reporting of Tsunamis

(DART) sensor network that estimates the size of tsunamis. Improvements have also been made in coastal sea-level stations and the Global Seismic Network operated and maintained by the U.S. Geological Survey and the National Science Foundation. Moreover, various states have evaluated select tsunami-prone communities and initiated several education and awareness efforts.

However, in addition to improving detection and forecasting networks, the committee stressed that a comprehensive tsunami program also requires risk assessments, public education, and a well-coordinated response — areas where more progress in the U.S. program will be needed. To gauge how to prioritize such efforts, the report recommends completing a national tsunami risk assessment that characterizes the hazards, inventories the threatened populations and assets, measures the preparedness and ability of individuals and communities to evacuate, and estimates expected losses.

The report also calls for improving communications and coordination among the two federal Tsunami Warning Centers (TWCs) in the Pacific, emergency managers, media, and the public. The TWCs monitor seismic activity and sea levels to detect tsunamis and warn emergency managers.

Although the TWCs are designed as backups for each another, the organizational model of two centers is problematic. The separate warnings have conflicted, causing confusion among the media, local officials, and the public. For example, in June 2005 the Pacific Northwest received seemingly contradictory messages from the two centers. Those in northern California who received both messages thought the all-clear message from the Hawaii center canceled

the tsunami warning from the Alaska center. The committee recommended that message content be improved or the two TWCs release one message that includes information for all areas under their responsibility.

Additionally, the report proposes that the TWC organizational structure be evaluated — including deciding whether multiple



TWCs should issue a single message or a single, centrally managed center should be created, similar to the National Hurricane Center. — *Jennifer Walsh*

■ **Tsunami Warning and Preparedness: An Assessment of the U.S. Tsunami Program and the Nation's Preparedness Efforts.** Committee on the Review of the Tsunami Warning and Forecast System and Overview of the Nation's Tsunami Preparedness, Ocean Studies Board, Division on Earth and Life Studies (2010, approx. 350 pp.; ISBN 0-309-13753-5; available from the 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/12628.html>).

The committee was chaired by **John A. Orcutt**, professor, Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics, Scripps Institution of Oceanography, La Jolla, Calif.; and vice chaired by **Martha A. Grabowski**, professor and director of the information systems program, Le Moyne College, Syracuse, N.Y., and Research Professor of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, Troy, N.Y. The study was funded by the National Oceanic and Atmospheric Administration; University of Alaska, Fairbanks; and National Academy of Sciences.



A Brighter Line for **OVERSIGHT**

Research in the life sciences has led to medical advancements and improvements in the nation's defense against biological threats like smallpox and anthrax. Yet, such research raises fears about its possible misuse to commit acts of bioterrorism or to create new or more deadly biological weapons.

One particular area of concern is research involving a group of bacteria, viruses, toxins, and fungi designated as "Select Agents" that pose the greatest threat to public health and safety. Several universities, institutions, and government agencies maintain stocks of these agents, and federal regulations are in place to prevent their loss, theft, or misuse.

However, with continually evolving technologies, the line between what should and should not be classified a Select Agent is becoming fuzzier. Technologies that can generate or "synthesize" any DNA sequence make it easier and less expensive for researchers, industry scientists, and amateur users to modify various organisms. This leads to questions about the potential to assemble or modify a Select Agent — or produce a new and more dangerous one — from fragments of DNA sequences bought from different companies.

Amid these concerns, the National Research Council investigated the practicability of replacing the current Select Agent list with an oversight system that could predict whether a particular DNA sequence

could be used to produce an organism that should be regulated as a Select Agent.

The resulting report finds that such a predictive system is not feasible right now. For the foreseeable future, any threat stemming from synthetic biology is far more likely to come from assembling or modifying Select Agents, rather than constructing previously unknown ones. Therefore, modernizing the regulations to define Select Agents by their gene sequences is a better way to go, the committee said, calling this approach "sequence-based classification."

The system could be used to determine if a DNA sequence might be close enough to that of a listed Select Agent to raise a cautionary alert or "yellow flag." For instance, a DNA synthesis company might use the system's database to screen orders and investigate who placed a questionable one and why.

This system would not be regulatory in nature but intended to serve as a resource for information sharing instead. Although it may improve the current practice, the system does have limitations, the committee noted, and emphasized that its potential benefits should be considered and weighed against the cost and complexity of implementation. — *Jennifer Walsh*

■ **Sequence-Based Classification of Select Agents:**

A Brighter Line. Committee on Scientific Milestones for the Development of a Gene Sequence-Based Classification System for Oversight of Select Agents, Board on Life Sciences, Division on Earth and Life Studies (2010, 234 pp.; ISBN 0-309-15904-0; available from the National Academies Press, tel. 1-800-624-6242; \$50.50 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12970.html>).

The committee was chaired by **James W. LeDuc**, professor of microbiology and immunology, and director of the Galveston National Laboratory and program on global health, Institute for Human Infections and Immunity, University of Texas Medical Branch, Galveston. The study was funded by the National Institutes of Health.



NEW HORIZONS

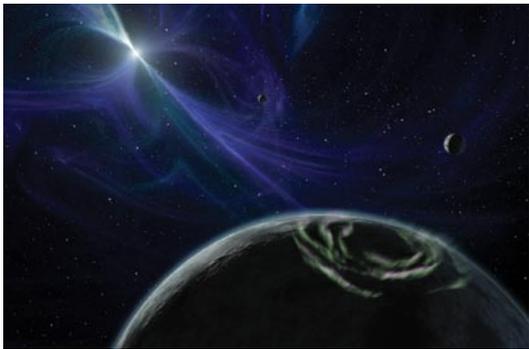
Decadal Survey Identifies Top Priorities for Astronomy and Astrophysics

In the last few decades, astronomers have discovered hundreds of planets orbiting distant suns, determined the size, shape, and age of the universe, and learned that its expansion is accelerating in unexpected ways.

These recent discoveries, combined with powerful new ways to observe the universe and bold ideas to understand it, create unprecedented scientific opportunities. However, choosing the best ways to capitalize on these advances in a time of tight budgets and limited resources presents a huge challenge for the nation.

For more than 50 years, the National Research Council's influential decadal surveys of astronomy and astrophysics have provided recommendations on the highest-priority research activities. The latest of these surveys does the same, but for the first time it also takes into account factors such as risks in technical readiness, schedule, and cost. The recommendations are motivated by three science objectives: deepening understanding of how the first stars, galaxies, and black holes formed; locating the closest habitable Earth-like planets beyond the solar system for detailed study; and using astronomical measurements to unravel the mysteries of gravity and probe fundamental physics.

The survey identifies space- and ground-based research activities in three categories: large, midsize, and small. For large space activities costing more than \$1 billion, an observatory called Wide-Field Infrared Survey Telescope (WFIRST) should be the top priority. The proposed telescope would help settle fundamental questions about the nature of dark energy, determine the likelihood of other Earth-like planets over a wide range of orbital parameters, and survey our galaxy and others. Other priorities in the large-scale space category include an augmentation to the Explorer program to



support small- and medium-sized missions that provide high scientific returns; the Laser Interferometer Space Antenna (LISA), which could enable

detection of long gravitational waves or “ripples in space-time”; and the International X-Ray Observatory, a large-area X-ray telescope that could transform understanding of stars, galaxies, and black holes in all evolutionary stages.

For large, ground-based research activities with budgets that exceed \$135 million, the first priority should be the Large Synoptic Survey Telescope (LSST), a wide-field optical survey telescope that would observe more than half the sky every four nights and be used to address diverse areas of study such as dark energy, supernovae, and time-variable phenomena. Other recommendations in this category include the formation of a Midscale Innovations

Program within the National Science Foundation to fill a funding gap for compelling research activities that cost between \$4 million and \$135 million. The survey also recommends participation in the U.S.-led international Giant Segmented Mirror Telescope, a next-generation large optical telescope that is vital for continuing the long record of U.S. leadership in ground-based optical astronomy.

The committee that conducted the survey selected research priorities after an extensive review that included input from nine expert panels, six study groups, and a broad survey of the astronomy and astrophysics community. Alongside newly proposed projects, it reassessed projects that were recommended in past surveys but not formally started.

Research in astronomy offers significant benefits to the nation beyond discoveries by capturing the public’s imagination and promoting general science literacy and proficiency, the committee said. This research can also serve as a gateway to science, technology, engineering, and mathematics careers, and spark important and often unexpected technological breakthroughs.

— *Molly Galvin*

■ ***New Worlds, New Horizons in Astronomy and Astrophysics.*** Committee on the Decadal Survey of Astronomy and Astrophysics; Board on Physics and Astronomy and Space Studies Board; Division on Engineering and Physical Sciences (2010; approx. 270 pp.; ISBN 0-309-15799-4 available from the National Academies Press; tel. 1-800-624-6242; \$43.95 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12951.html>).

The committee was chaired by **Roger Blandford**, Luke Blossom Professor in the School of Humanities and Sciences, Stanford University, Stanford, Calif. The study was funded by NASA, National Science Foundation, U.S. Department of Energy, and a contribution from the Vesto Slipher bequest to the Academies.

Reality **Check**

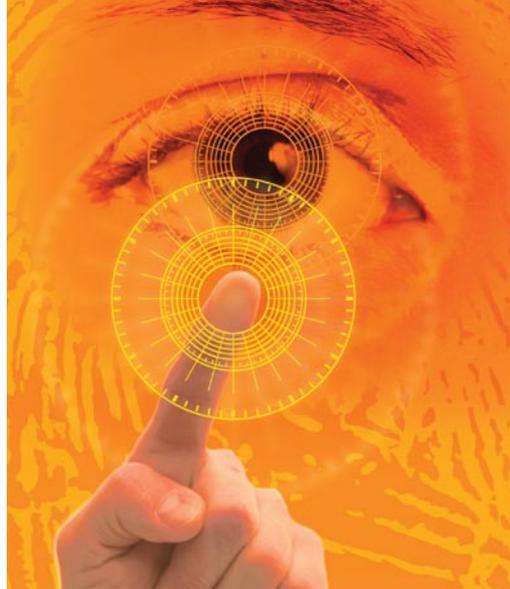
BIOMETRIC RECOGNITION SYSTEMS NOT AS INFALLIBLE AS MANY BELIEVE

Popular movies and TV shows often portray advanced fingerprint, voice, or retina recognition systems as a fool-proof means of identification. In fact, governments increasingly are looking to biometric technologies as a better way to track terrorists at borders. And some companies have started using biometrics to control access to buildings or information. What does the scientific evidence say about the effectiveness of these systems for security or surveillance?

A report by a committee of the National Research Council that reviewed the available data cautions that biometric systems designed to recognize individuals based on biological or behavioral traits are “inherently fallible,” and confidence in results must be tempered by an understanding of this fallibility. Although the systems can be useful in many circumstances, more research is needed to gain a complete knowledge of their strengths and limitations.

No single biological or behavioral trait has been identified that is stable and distinctive across all people, the report notes, and many sources of uncertainty need to be considered as systems are developed and put into place. For example, biometric characteristics may vary over an individual’s lifetime due to age, stress, disease, or other factors. Technical issues regarding calibration of sensors, degradation of data, and security breaches also contribute to variability in these systems.

The report says that careful consideration is required when using biometric recognition as a component of an overall security system. When the likelihood of an imposter is rare, even systems with very



accurate sensors and matching capabilities can have a high false-alarm rate. This could become costly or even dangerous in systems designed to provide heightened security; for example, operators could become lax about dealing with potential threats.

Any biometric system selected for security purposes should undergo thorough threat assessments to determine its vulnerabilities to deliberate attacks, the report recommends. Unlike other security systems, biometric systems cannot rely on secrecy of data, since fingerprints, palm prints, and other traits can be easily accessed and are publicly known.

Effectiveness of these systems depends as much on factors such as the competence of human operators as it does on the underlying technology, engineering, and testing regimes, the report says. Secondary screening procedures that are used in the event of a system failure should be just as well-designed as primary systems. — *Molly Galvin*

■ **Biometric Recognition: Challenges and Opportunities.** Wither Biometrics Committee, Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences (2010; 182 pp.; ISBN 0-309-14207-5; available from the National Academies Press; tel. 1-800-624-6242; \$41.50 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12720.html>).

The committee was chaired by **Joseph N. Pato**, distinguished technologist at Hewlett-Packard’s HP Laboratories, Palo Alto, Calif. The study was funded by the Defense Advanced Research Projects Agency, Central Intelligence Agency, and U.S. Department of Homeland Security, with assistance from the National Science Foundation.

Food Safety IN AMERICA



A Better Approach to Reducing Foodborne Illness

A new report from the Institute of Medicine and National Research Council offers a blueprint for enhancing the U.S. Food and Drug Administration's food safety role and for establishing the authority and central coordination currently missing in the nation's food surveillance and response system.

In Upton Sinclair's 1906 novel *The Jungle*, animals, garbage, and worse were indiscriminately processed into meat products. A century later, the graphic reports of unsanitary conditions at two egg production facilities involved in a nationwide salmonella outbreak might lead people to wonder how far we have come. Foodborne illnesses kill roughly 5,000 people every year and sicken another 300,000 severely enough to require hospitalization, according to the Centers for Disease Control and Prevention. Many of the laws that shape the government's powers to respond to food threats date back to the early 1900s, spurring some to ask whether new regulations or

a new agency focused exclusively on food safety is needed.

Many people are surprised to learn that FDA cannot force product recalls or shut down facilities with violations. The report recommends a congressional examination of ways to more clearly spell out FDA's authority to register food facilities, issue mandatory recalls, ban imports, and other powers. A bill to update the nation's antiquated food safety regulatory powers has been passed by the House of Representatives and is awaiting Senate consideration.

With oversight of about 80 percent of the nation's food supply, FDA is the most visible agency responsible for food safety, but it is not the sole authority. The U.S. Department of Agriculture oversees meat, poultry, and egg products, and at least five other federal agencies have roles as well. In addition, state and local departments share in conducting inspections, surveillance, and outbreak investigations. One of the overriding challenges is the overlap and occasional disconnect between the many different groups involved, as illustrated by the lack of communication among officials who visited the egg facilities.

Since much of the work that goes into protecting the food supply depends on data collection and sharing, the report calls on the federal government to establish a centralized food safety data center separate from the responsible agencies. It should collect information and conduct rapid, sophisticated assessments of food safety risks and potential interventions. This center would reduce interagency competition for resources, and it could serve as an intermediate step toward consolidating food safety activities within a single

agency, whose creation many individuals and organizations have demanded.

Data is also crucial for efficiently marshalling limited resources. FDA has been criticized for not adequately monitoring food suppliers and distributors. Given that the agency is responsible for 150,000-plus food facilities, more than 1 million restaurants and 2 million farms, and millions of tons of imports, however, there are not enough resources to consistently monitor the entire food supply, the report notes.

To more effectively use its finite resources, FDA should shift to a risk-based approach that would give the agency's officials the strategic vision needed to evaluate and plan for food safety concerns. They would then be able to steer resources to higher-risk areas rather than tackling problems on a case-by-case basis as they occur. FDA uses some risk assessment and management tactics, but it lacks a systematic focus on prevention.

To further enhance its efficiency, FDA should explore delegating food facility inspections to the states given that roughly 60 percent of inspections are already conducted by state inspectors. The agency could establish national standards for inspections, train and certify inspectors, and supervise their work. — *Christine Stencel*

■ **Enhancing Food Safety: The Role of the Food and Drug Administration.** Committee on the Review of Food and Drug Administration's Role in Ensuring Safe Food, Institute of Medicine and National Research Council (2010, 360 pp.; ISBN 0-309-15273-9; available from the National Academies Press, tel. 1-800-624-6242; \$71.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12892.html>).

The committee was chaired by **Robert B. Wallace**, professor, College of Public Health, University of Iowa, Iowa City. The study was sponsored by the U.S. Food and Drug Administration.

A Progress Report on Women's Health Research

Just 25 years ago, one would have been hard-pressed to find clinical trials for colon cancer or a new diabetes drug in which women participated as study volunteers. In fact, until the mid-1980s, most clinical research was conducted with men because of the potential risks to fetuses of testing drugs and other materials on women of childbearing age. Women also undergo more frequent hormonal fluctuations than men, which can complicate a study. The conventional thinking ran that results of studies on males could easily be applied to females.

As the lag in the use of new therapies such as beta blockers and stents to treat heart disease in female patients has shown, results were not being readily extrapolated to women. In addition, fewer women in studies also meant less research on health issues more prevalent in or unique to women.

A federal report in 1985 brought this inequity in clinical research to light and galvanized an effort to enroll women and boost research on women's health problems. How much progress has this initiative achieved in decreasing the burden of disease and number of deaths during the past two decades?

Quite a bit in some areas, says a new report from the Institute of Medicine. The greatest gains have been made in the fights against heart disease, breast cancer, and cervical cancer, and less — though still significant — progress in reducing the effects of depression, HIV/AIDS, and osteoporosis on women. These achievements reflect the impact of federal requirements for studies



to include women, an influx of resources, and multifaceted approaches that tackled the conditions from several fronts for a fuller understanding of each condition, the report concludes.

But when it comes to lessening the burden associated with several other health outcomes — including lung cancer, autoimmune diseases, unintended pregnancies, and

dementia — research to date has produced little or no advances. Conditions that profoundly affect women's quality of life, such as rheumatoid arthritis and addiction, have generally seen less progress than major killers like breast cancer. The report urges researchers to give equal weight to improving quality of life as to reducing death rates when making decisions about where to direct resources. And they need to take into account both biologically determined sex differences and socially determined gender differences as a routine part of conducting research. The report also points out that even where there has been major progress, it has not extended to all groups of women. Efforts should be made to overcome these disparities. — *Christine Stencel*

■ **Women's Health Research: Progress, Pitfalls, and Promise.** Committee on Women's Health Research, Board on Population Health and Public Health Practice, Institute of Medicine (2010, 420 pp.; ISBN 0-309-15389-1; available from the National Academies Press, tel. 1-800-624-6242; \$66.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12908.html>).

The committee was chaired by **Nancy E. Adler**, professor of medical psychology and director of the Center for Health and Community, University of California, San Francisco. The study was funded by the U.S. Department of Health and Human Services.

The science and engineering workforce is expected to grow faster than any other sector of the U.S. labor market in coming years, according to the U.S. Bureau of Labor Statistics, but where this tide of employees will come from is an unknown. In recent years international students, particularly those from China and India, have accounted for almost all growth in doctoral degrees awarded in science, engineering, technology, and mathematics. But relying on non-U.S. citizens for this nation's science and engineering needs is an uncertain path, as many of these students may choose to return to their home countries, says a new report from the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine.

Meanwhile, the talents of a huge slice of the U.S. population are going unused. African-Americans, Hispanics, and Native Americans made up 28.5 percent of the American population in 2006 — and are its fastest-growing segment — but they made up only about 9 percent of college-educated Americans in science and engineering occupations. Increasing the participation and success of underrepresented minority students would contribute to the nation's competitive health and security by expanding the talent pool, the report says.

It isn't a problem of generating student interest; data show that underrepresented minorities aspire to major in science and engineering fields at the same rate as their white and Asian-American peers. But minority students complete degrees in these fields at lower rates and change majors at higher ones. What can be done to keep these students in the science and engineering pipeline?

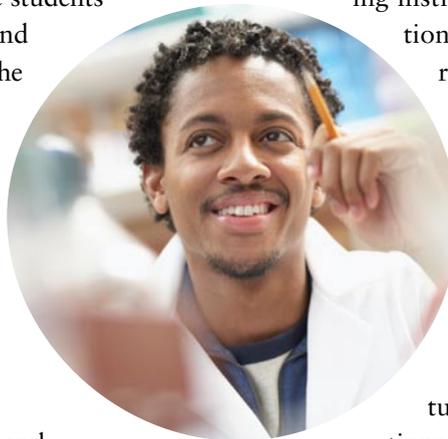
Tapping a Reservoir of S&T Talent



Students' persistence is strongly correlated with having financial assistance that meets their needs, the report notes. Providing financial support targeted to minority students in science and engineering fields will enable these students to focus on their studies and boost completion rates. The programs needed would cost approximately \$150 million annually, eventually rising to about \$600 million per year as more students are included, the report estimates.

But financial support alone is not enough. Research shows that such aid is more successful when coupled with academic support and social integration, the report says, and it's here that universities and colleges must take the lead. Institutions can take practical steps to increase completion rates, such as identifying "choke points" like lack of course availability that may cause students to fall off these paths, tracking student achievement, and ensuring that courses are structured to properly support students. Institutions also need to create a climate where minority students feel included and self-confident in science and engineering. For example, university leadership should be more aggressive in developing a more diverse pool of faculty and administrators and cultivating role models and leaders for these students.

Different types of institutions may need to use different strategies. For universities with mainly white student bodies, the report says, the best way to retain



minority science and engineering majors is to replicate programs that have proved successful on a wider scale, particularly at minority-serving and flagship state universities. Traditionally minority-serving institutions could, with additional support, enhance their recruitment and retention of these students, particularly at a baccalaureate level. And community colleges could help more students in science and engineering make successful transitions to four-year institutions through interventions such as summer bridge programs, mentoring, and efforts to encourage undergraduate research.

As programs at colleges and universities begin to increase the number of minority students who stay in science and engineering, they could generate a kind of snowball effect, the report foresees. More incoming minority students may see their older peers thriving in science and engineering and consider pursuing majors in these fields themselves. — *Sara Frueh & Molly Galvin*

■ **Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads.** Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (2010, approx. 286 pp.; ISBN 0-309-15968-7; available from the National Academies Press, tel. 1-800-624-6242; \$40.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12984.html>).

The study was chaired by **Freeman Hrabowski**, president, University of Maryland, Baltimore County. The study was funded by the National Science Foundation, National Institutes of Health, NASA, Carnegie Corporation of New York, and the Haas Foundation.

INVENTIONS GREAT AND SMALL PAY OFF

Many of the products and devices that make our daily lives healthier and easier got their start in a university laboratory. University research led to drugs to reduce the risk of blood clots and pills that combine many HIV medicines, for example, making treatment easier. Other advances big and small include sensors that help children avoid airbag injuries, allergy pills that make us less drowsy, and cat food that reduces hairballs.

The trip from university lab to marketplace got easier after the University and Small Business Patent Procedures Act — better known as the Bayh-Dole Act — was passed in 1980. Before that, if federal agencies funded research at universities, the agencies generally retained ownership of any technologies or discoveries that resulted. And at least in theory, they could license this intellectual property to companies to develop it into products and services. In reality, though, most of these discoveries languished for lack of marketing effort; only 5 percent of the 30,000 patents accumulated by agencies prior to 1980 were ever licensed to companies.

Bayh-Dole changed this, giving universities ownership of most of the intellectual property resulting from research they conducted with public funds. A recent report from the National Research Council says the new system has been more effective than the previous one at helping inventions make the leap to public use.

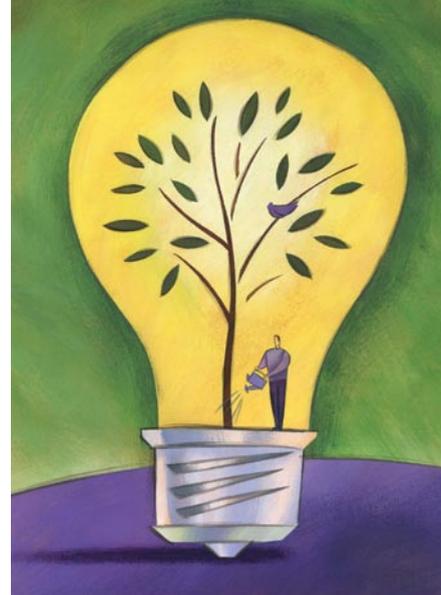
But the system created by Bayh-Dole has not gone uncriticized. Some have argued that the prospect of financial rewards from inventions has subtly affected universities' priorities, shifting them away from curiosity-driven inquiry and toward more potentially

lucrative research. Others make the case that individual faculty have been unfairly cut out of the loop on the management of their own inventions, and argue for a system where researchers manage their own discoveries.

The report concludes that Bayh-Dole has not seriously undermined university standards of uninhibited inquiry, however, and that a persuasive case hasn't been made for switching to a system of faculty ownership. But it also cautions that the current system has room for improvement. Universities need to articulate a clear mission for managing intellectual property — one that doesn't predicate licensing on the goal of raising significant revenue. Moreover, faculty who believe their inventions are being mishandled by technology transfer offices should be able to appeal to an independent oversight committee within their institution. More oversight is also needed on a federal level, the report adds, recommending that such responsibilities be assigned clearly among agencies. — *Sara Frueh*

■ **Managing University Intellectual Property in the Public Interest.** Committee on Management of University Intellectual Property: Lessons from a Generation of Experience, Research, and Dialogue; Board on Science, Technology, and Economic Policy and Committee on Science, Technology, and Law; Division on Policy and Global Affairs (2010, approx. 128 pp.; ISBN 0-309-16243-2; available from the National Academies Press, tel. 1-800-624-6242; \$29.50 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/13001.html>).

The study was chaired by **Mark S. Wrighton**, chancellor and professor of chemistry, Washington University, St. Louis. The study was funded by the Andrew W. Mellon Foundation, John D. and Catherine T. MacArthur Foundation, Robertson Foundation, Ewing Marion Kauffman Foundation, Burroughs Wellcome Fund, an anonymous foundation, FasterCures Center, Milken Institute, HighQ Foundation, Myelin Repair Foundation, and the Doris Duke Charitable Foundation.



Academies Take Aim at Africa's Afflictions

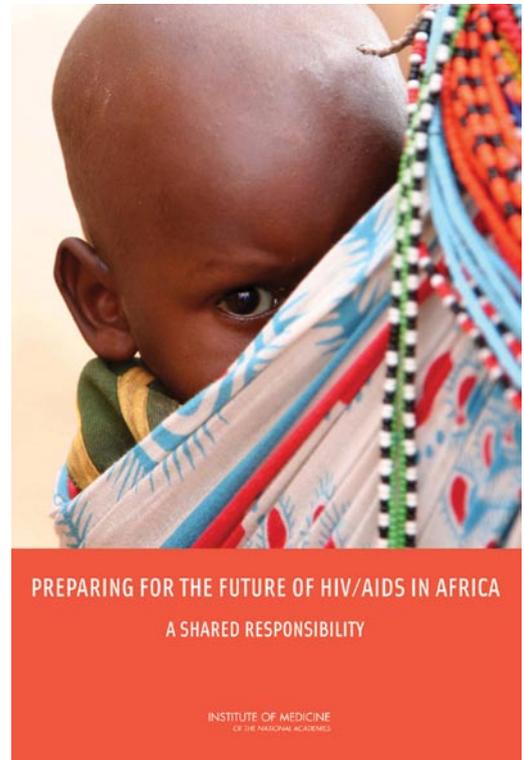
The commitment of the U.S. National Academies to address issues beyond its own national borders was highlighted by activities last fall that targeted two of the most daunting and distressing challenges in sub-Saharan Africa: access to energy and the fight against HIV/AIDS.

The energy issue was the focus of the sixth annual conference of the African Science Academy Development Initiative (ASADI), a collaboration administered by the U.S. National Academies aimed at boosting the capacity of several African science academies to inform policymaking through evidence-based advice. The Academy of Science of South Africa, which hosted the November conference outside of Cape Town, unveiled a new report at the meeting that illuminates how much of sub-Saharan Africa is still in the dark. Almost 600 million people — about 70 percent of the population — live without access to electricity; in fact, the entire installed power capacity of sub-Saharan Africa is equal to about that of Spain.

The report, prepared with input from several African science academies, calls for energy access to be added to the list of the U.N. Millennium Development Goals, noting that none of the current goals is achievable without greater availability of energy. The report says that achieving universal electricity access will require an extension of national grids and installation of mini-grids and off-grid isolated systems. More investment will also be needed to take advantage of energy solutions that can

be provided by science, especially renewable energy ideas. In a keynote address, the South African minister of science and technology, Naledi Pandor, applauded the report and conference for “improving the synergy between scientific research and policy implementation.”

Advice from the scientific community will also be critical for policymakers in sub-Saharan Africa who will have to make tough decisions about who can receive lifesaving antiretroviral therapy as the pace of newly infected HIV/AIDS patients there far outstrips the capacity to treat them, according to projections in a new report by the U.S. Institute of Medicine. The report estimates that the number of Africans with HIV/AIDS will climb by about a third to more than 30 million by 2020. Twelve



million of them will require antiretroviral therapy, but there will only be sufficient resources to treat 7 million. Given that only a fraction can be treated, a stronger emphasis needs to be placed on prevention, the report says.

The lack of treatment capacity is about more than just the availability of drugs, the report emphasizes. There are not enough trained health workers in many African countries to deliver treatment even when the drugs are on hand. “Health centers are increasingly turning away patients who need these drugs to survive,” said David Serwadda, professor and former dean of the School of Public Health at Makerere University, Kampala, Uganda, and co-chair of the committee that wrote the report. The committee included experts from the U.S. and Africa, who urged their respective governments to share responsibility in the fight against HIV/AIDS by collaborating on long-term planning and entering into contracts with incentives that spur investments in effective interventions. Work-force training, health care infrastructure, and ethical decision making need to be part of the plans, the committee said.

— William Kearney

*More information on ASADI and the report **Turning Science On: Improving Access to Energy in Sub-Saharan Africa** are available at <national-academies.org/asadi>. ASADI is sponsored by the Bill & Melinda Gates Foundation.*

■ **Preparing for the Future of HIV/AIDS in Africa: A Shared Responsibility.** Committee on Envisioning a Strategy to Prepare for the Long-Term Burden of HIV/AIDS: African Needs and U.S. Interests, Board on Global Health, Institute of Medicine (2010, 220 pp.; ISBN 0-309-16018-9; available from the National Academies Press, tel. 1-800-624-6242; \$48.00 plus \$5.00 shipping for single copies; also on the Internet at <www.nap.edu/catalog/12991.html>).



The committee was co-chaired by **Serwadda** and **Thomas C. Quinn**, associate director for international research at the National Institute of Allergies and Infectious Diseases of the U.S. National Institutes of Health, and director, Center for Global Health, Johns Hopkins University, Baltimore. The study was sponsored by the Doris Duke Charitable Foundation; Atlantic Philanthropies; (BD) Becton, Dickinson, and Co.; Bill & Melinda Gates Foundation; Carnegie Corporation of New York; Ford Foundation; Institute of International Education; Johnson & Johnson Services; Merck; Pfizer; and the Rockefeller Foundation.

Science and Engineering Festival Inspires and Entertains



Tens of thousands of people flocked to Washington, D.C., in October for the first USA Science and Engineering Festival and Expo, whose mission is to stimulate young people's interest in science, technology, engineering, and math. With tents and stages spanning the National Mall and beyond, many families made their way past dancing robots, a space capsule of the future, and mobile laboratories to the NAS-NAE-IOM tent, dubbed "Because Dreams Need Doing," where they rode a

"light-cycle" into the digital world of a Hollywood movie, became virtual brain surgeons, and learned about evolution.

The National Academy of Engineering partnered with Disney to bring "TRON: Legacy" to the festival. The popular exhibit "was well worth the 20-minute wait," said a 9-year-old exiting the booth. The concept behind the exhibit was to blend themes from the movie with the NAE's Grand Challenges — "game changing" engineering goals for the 21st century. Performing



surgery on a computer-generated image of a real brain, and 3-D laser scanning and light painting were all part of an interactive experience designed to demonstrate how movie fantasy is intersecting with the real world.

Secretary of Transportation Ray LaHood also paid a visit to the tent, specifically its driving-simulator exhibit “Stayin’ Alive.” The simulator allowed “drivers” to safely experience distractions such as phone calls and texting and see the dangers they pose on the road. LaHood spoke to the crowd about the Department of Transportation’s campaign to stop distracted driving, offered tips for safe driving etiquette, and shook the hands of many eager kids.

Fascinating talks by Nobel Prize winners along with many others were the centerpiece of the tent’s activities. NPR’s Joe Palca interviewed Nobelists John Mather and Peter Agre, both members of the National Academy of Sciences; Agre is a member of the Institute of Medicine as well. Mather spoke of his childhood and education and what inspired him to learn more about the universe. When asked what makes a good scientist, Mather replied, “Persistence is essential.” He added that curiosity and alertness are also important: “The nature of science is that something might turn up that you didn’t expect.” Also on the tent’s stage were talks about the chemistry of food, forensic anthropology, and separating fact from fiction on the TV show “CSI: Miami” in which writers from the show analyzed scenes.

Noise from games and challenges for kids rang throughout the tent for two



days. “Animal, Vegetable, or Mineral: 20 Questions” allowed kids to learn about pollinators, plants, and minerals, and win a prize. “Take the Energy Challenge” taught kids about energy sources and choices. The “Evolution Thought Trail” encouraged kids to discuss inherited variations, natural selection, and geological changes as they travelled to six different booths. And NAS Cultural Programs teamed up with media artist Lee Boot on “Youreka! See Intuit,” which explored what intuition is and how it works.

While inspiring kids to become scientists or engineers may take more than one tent at one event, the Academies’ efforts reached more than 11,000 people and might motivate some of them to make their dreams reality. — *Maureen O’Leary*

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

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Board on Health Sciences Policy, Institute of Medicine (2010, approx. 160 pp.; ISBN 0-309-16021-9; available from NAP).

Achieving Traffic Safety Goals in the United States: Lessons From Other Nations

Transportation Research Board (2010, approx. 185 pp.; available from the board and NAP).

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Board on Environmental Studies and Toxicology, Division on Earth and Life Studies (2010, 462 pp.; ISBN 0-309-15944-X; available from NAP).

Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies — Workshop Summary

Board on Global Health, Institute of Medicine (2010,

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