

Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



Volume 18,3 / Fall 2003

Activities of the Academy

Following is a list of the most recent major reports of the Academy. Reports are available for a nominal fee from the Academy office or web site; executive summaries of the most recent reports are available on the Academy web site at www.ctcase.org.

"Study Update: Bus Propulsion Technologies Applicable in Connecticut" (2003)

"A Study of Fuel Cell Systems" (2002)

"A Study of Bus Propulsion Technologies Applicable in Connecticut" (2001)

"Study of Radiation Exposure from the Connecticut Yankee Nuclear Power Plant" (2000)

"Efficacy of the Connecticut Motor Vehicle Emissions Testing Program" (2000)

"Indoor Air Quality in Connecticut Schools" (2000)

"Efficacy of MTBE Use in Connecticut" (1999)

"Radon in Connecticut: Quantitative Perspectives about Effects on Public Health" (1998)

"Building Agricultural Biotechnology in Connecticut" (1997)

"Status of Connecticut Critical Technologies" (1997)

"Evaluation of Critical Technology Centers" (1996)

"Science and Technology Policy: Lessons from Six American States" (1994)

THE AIDS PANDEMIC: HOW DID IT HAPPEN, AND IS SARS NEXT?

It is the most devastating pandemic in recorded history, promising to be far worse than the bubonic plague of the Middle Ages. Globally, as of the end of 2002, 28 million people had died of AIDS, 70 million had been infected with the AIDS virus, 42 million were living with HIV/AIDS, and there were 15,000 new infections daily.

Speaking to an audience of more than 200 at the 28th Annual Meeting of the Connecticut Academy of Science and Engineering on May 21, 2003, Academy member Michael Merson, the Anna M. R. Lauder



**Michael Merson,
Dean of Public Health,
Yale University**

Professor of Public Health, Chairman of the Department of Epidemiology and Public Health, and Dean of Public Health at Yale University, pointed out that in sub-Saharan Africa, one-third of young adults in many countries are infected with AIDS and 13 million children have been orphaned. AIDS has devastated the workforce; it is expected that one-fifth of all skilled laborers in South Africa will have HIV by 2015, and in some African countries as many as 30 percent of teachers are infected.

And Africa is not alone; currently, Russia and Eastern Europe have the most rapidly growing rates of AIDS infection, and they will soon be surpassed by India, which could have as many as 20 to 25 million

(See AIDS page 2)

News from the National Academies

The following is excerpted from press releases of the National Academies and from *Infocus Magazine*, a news resource of the National Academies, which can be found at www.infocusmagazine.org

◆ Electronic Health Records

As part of a national effort to encourage the adoption of computer-based health records, a committee of the Institute of Medicine of the National Academies has identified a set of eight core functions that electronic health records (EHRs) should be capable of performing in order to promote greater safety, quality, and efficiency in health care delivery. This list of key capabilities, outlined in a new report, will be used by Health Level Seven (HL7), one of the world's leading developers of health care standards, to devise a common industry standard for EHRs that will guide the efforts of software developers.

While a number of health care organizations have established EHR systems, most providers continue to write orders for services and maintain patient records on paper. Most also practice without computer-aided decision supports, such as prompts to check a diabetic patient's blood glucose or alerts that indicate drug interactions.

The eight core functions were selected on the basis of their ability to improve patient safety, support effective care, assist in the management of chronic disease, and improve efficiency. All EHRs must protect patient privacy and confidentiality, and comply with the standards for security, storage and exchange of data required by the Health Insurance Portability and Accountability Act (HIPAA). The committee also considered the time frame in which it would be feasible to implement each capability. By 2010, com-

(See National Academies, page 7)

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AIDS (continued from page one)

cases by 2010. How did this happen? Merson asked. "The short answer," he said, "is that world leaders—all of us—let it happen. In the past 20 years, the global response to AIDS for the most part has been delayed, fragmented, inconsistent, and grossly inefficient."

One reason for the inadequate response was the nature of the disease itself, Merson pointed out. HIV infection is transmitted sexually and through injecting drug use, both difficult subjects for political leaders, community leaders, and parents to talk about. Early on, the disease was associated with stigmatized and marginalized groups—initially gay men, and also sex workers and drug users—which engendered moralistic and discriminatory responses that have consistently failed. And the long period between initial infection and emergence of full-blown AIDS—seven to ten years—inhibited timely and decisive action.

Equally important, the reaction to AIDS was tardy and inadequate because of "the international community's inability to provide a consistent, coordinated, and unified response," Merson said. "There were turf battles between UN agencies for resources and influence, and denial by rich governments who saw AIDS as primarily an African problem." In addition, the emergence of triple therapy for AIDS greatly prolonged life and diminished the sense of urgency for dealing with the disease.

But there is cause for hope, Merson believes. Some countries—notably Uganda, Thailand, Senegal, and Brazil—have "turned national epidemics around," through effective political leadership, responses from local communities ("communities are key, since AIDS is spread by intimate behavior") appropriate prevention strategies, and the application of national resources and commitment. Internationally, the United Nations has established UNAIDS to provide a common strategic framework and fundraising strategy across the UN system. The first International AIDS conference to be held in a heavily infected country, in July 2000 in Durban, South Africa, reported on the pandemic with intensive media coverage, bringing the consequences of AIDS to the attention of wealthy nations. In July 2001, the UN General Assembly, meeting for the first time on a public health problem, adopted a Declaration of Commitment that set specific goals for national and international responses to AIDS. And not least of all, Merson pointed out, pharmaceutical companies "finally realized that the high prices imposed on anti-retroviral drugs would raise questions about the ethics of their pricing in resource-poor countries." In the course of one year, the price of triple therapy dropped from \$15,000 to as low as \$300 a year as a result of differential pricing and the availability of generics.

"Can we slow the pandemic?" Yes, Merson said, if we apply sound prevention activities shown to be effective through scientific studies, including the comprehensive ABC (abstinence, be faithful, and use condoms) approach, and if researchers continue to seek an AIDS vaccine. Twenty-nine vaccine can-

(See AIDS, page 8)

IN BRIEF

Science and Engineering Notes from Around Connecticut



Business & Industry

JOINT DEGREES. An increasing number of medical students are studying for M.B.A. degrees at the same time that they're pursuing their M.D., according to a study led by **Howard P. Forman**, a faculty member at the **Yale School of Management**. Forman's team looked at 125 US medical schools, examining each joint M.D./M.B.A degree program. The study found that the number of M.D./M.B.A. programs increased from 6 to 33 between 1993 and 2001. When all 33 programs reach capacity, they will graduate over 100 students a year. According to the study's authors, medical professionals suggest that management techniques can improve patient safety, health care quality, organizational design and effectiveness, and clinical decision making.

HIGH RANKING. With the masses of information on the internet, the key to getting a website noticed is making sure it shows up at the top of search engine results. **SEOMatrix**, a web search optimization company makes that happen. The company was founded by former **Yale University School of Management** student **Brian Ortiz**, who taught himself to alter the code on websites so that they appear among the first search engine listings. Ortiz says that he can double the traffic to a site with 10,000 visitors a day within six months. The company, which was started a year ago, has 25 clients.

BIOSCIENCE SECTOR GROWS. Even in the current tough economic climate, Connecticut's bioscience sector continued to grow, according to a report released by **Connecticut United for Research Excellence (CURE)**. The study found that biotechnology and pharmaceutical companies increased research and development spending by nearly 6% last year, with companies investing \$3.82 billion in 2002, compared to \$3.61 in 2001. Sector companies also increased their laboratory space by 4.2%, for a total of 5.78 million square feet. About half of that increase can be attributed to expansion of academic research facilities, said the report.



Communication

FREE INTERNET. **Middletown** could be the first Connecticut city to offer free wireless internet connections to the public throughout its downtown. The Wi-Fi, or wireless fidelity, would be available to anyone with a laptop computer and a Wi-Fi card. The connection would be provided through transponders, which would be distributed throughout downtown Middletown; anyone within a few hundred feet of any of these beacons could use them to get online. The project could cost as little as \$5,000, according to **Mark Masselli**, who proposed the idea. Masselli, who is a member of the **Middlesex County Chamber of Commerce** technology committee, hopes local businesses will contribute to the cost of the project.

KEEPING TRACK. A digital tracking system known as GEM helps protect firemen in **Ansonia**, **Derby**, and **Seymour** by constantly monitoring their location while they're inside burning buildings. The GEM system consists of transmitters, one of which is worn by each firefighter, and a laptop-style receiver. The location of each firefighter can be viewed on the laptop screen. The system also comes with an alarm component. If a firefighter remains motionless for 25 to 30 seconds, an alert is sounded, and the firefighter's name appears on the screen. **Ansonia Fire Chief Robert Caruso**

hopes to provide the city's emergency medical service personnel and police with the tracking devices, as well.

TALKING TO TOWN HALL. Now, residents of several towns in Connecticut can complain to their city officials twenty-four hours a day. Using **CivicRADAR**, a program developed by the **Connecticut Policy and Economic Council**, people in participating towns can make requests of their government over the internet at www.CivicRADAR.com. CivicRADAR takes care of notifying the appropriate town official, and the official's response is posted on the website. If the problem can't be resolved immediately, residents can use CivicRADAR to follow the status of their request. The program is financed by a two-year, \$550,000 grant from the Alfred P. Sloan Foundation, awarded in 2001. Currently the program is provided free to towns that sign up for it, but it's expected to be self-supporting in five years. **Wethersfield** and **Weston** are participating towns.



Education & Cognition

READING BETTER. In a discovery that has important implications for improving reading levels, researchers at Yale have identified two types of reading disabilities. "Compensated" poor readers are those with higher cognitive abilities who are able to overcome some of their disability, learning on their own to read more accurately and with better understanding. "Persistently" poor readers, who often attend disadvantaged schools, continued to have problems as they matured. Using functional magnetic resonance imaging, a team headed by Yale professor **Sally Shaywitz** showed that in compensated readers, brain activation patterns showed a disruption in the neural systems. In persistently poor readers, the neural circuitry for reading was present, but it had not been properly activated. This shows, says Shaywitz, that early intervention would help disadvantaged youngsters at risk for reading problems.

MATH AND MUSIC. With an \$8,000 grant from Toyota for using mathematics in innovative ways, **Milford** second-grade teacher **Jill Bracksieck** will use a keyboard to teach kids mathematical concepts. Bracksieck's project was one of just 35 proposals from across the nation to win a grant. The award, which will be used to buy keyboards and software, will allow Bracksieck to give her students weekly keyboard lessons for two years. Concepts such as whole numbers, fractions, and patterns will be incorporated into the lessons. "There is a growing body of research that indicates that students who have had piano instruction score higher on math tests," said Bracksieck.

NASA IN CONNECTICUT. **Sheridan Communications and Technology Middle School**, in New Haven, is the first in the state to be chosen as a NASA Explorer School. The coveted designation will provide it with NASA resources intended to improve the teaching of math, science and technology. Elements of the space program will be used in lessons, and, as part of the project, six teachers can attend a summer program at Goddard Space Center in Maryland. Sheridan principal **Bob Canelli** hopes to arrange for students to speak with astronauts in space. "It's these programs

Items that appear in the In Brief section are compiled from previously published sources including newspaper accounts and press releases. For more information about any In Brief item, please call the Academy at (860) 527-2161, write the editors at 179 Allyn St., Suite 512, Hartford, CT 06103-1422, or email us at acad@ix.netcom.com

IN BRIEF

Science and Engineering Notes from Around Connecticut

that many times hook a student that was just sort of drifting along, not knowing where he or she was going," says NASA aerospace education specialist Vern Smith.



Energy

ENERGY CONSERVATION. Energy conservation programs in Connecticut saved 246 million kilowatt-hours last year, enough to power more than 31,000 homes, according to the Energy Conservation and Load Management Fund. The programs were funded in part by the customers of **Connecticut Light and Power Co.** and **United Illuminating Co. (UI)**, who contributed \$87 million through a 0.3 cent per kilowatt-hour surcharge on their electrical bills. The increases in energy efficiency are expected to reduce the amount of pollutants such as sodium dioxide and nitrogen oxide. Energy conservation also helps reduce carbon dioxide emissions. "The carbon dioxide benefit is equivalent to planting more than 70,000 acres of trees," said **Anthony Marone**, director of client services for UI in New Haven.

COSTLY, BUT CLEAN. **Yale University** plans to reduce emissions at one of its power plants by using a cleaner fuel oil than the kind required by the state of Connecticut. While regulatory requirements permit the university to use No. 6 fuel oil at its Sterling Power Plant, which provides energy for **Yale School of Medicine**, Yale plans to switch to the cleaner No. 2 fuel. The switch is expected to increase Yale's cost by more than \$1 million a year. The university also plans to install new, more efficient boilers in the power plant, which will decrease emissions even more.

MERCURY LIMITS. A recently passed state law restricts mercury emissions from coal-fired power plants; Connecticut is the first state in the nation to institute such limits. The bill, which requires power plants to install mercury control equipment, takes effect in 2008. It is expected to reduce emissions of organic mercury compounds within the state by 92%. To comply with the law, plants must reduce emissions to 0.6 pounds of mercury per 1 trillion Btu's, or use a 90% efficient technology to control the emissions. They can also switch to oil- or gas-fired generators. Mercury is a neurotoxin that has already contaminated many of the state's fresh water fish. Coal-fired power generators are the largest source of this pollutant; such generators provide about half of the nation's electrical power.

FUEL STORAGE. The federal Department of Energy has spent about \$13.8 million to design three different canisters that can temporarily store spent nuclear fuel, including the waste from the **Connecticut Yankee** nuclear plant at **Haddam Neck**. Canisters of varying sizes are needed because of the requirements of the fuel itself. Eventually, spent nuclear fuel from around the country is expected to be stored at the Yucca Mountain site in Nevada, which is scheduled to open in 2010. At Connecticut Yankee, spent fuel is being held in an indoor pool. It will be moved to an outdoor storage complex and held there until it can be moved to Yucca Mountain.

POWER UPGRADE. Construction of a 20-mile high-voltage power transmission line, intended to help with power congestion problems in **Fairfield County**, is expected to begin next year. The line will run partly above ground, but it will be buried in some areas. While overhead lines can be unsightly, they tend to carry power more reliably: they can be damaged by storms and other problems, but problems in overhead lines are usually easy to find and correct. Underground lines are less prone to storm damage,

but when problems do occur, they are more difficult to correct, since the line must be uncovered. Buried lines are also more likely to overheat. Construction of the new line should be completed by May 2005. It is the first phase of a project to upgrade power transmission for southwestern Connecticut; the next phase will involve a 69-mile line that runs from **Middletown** to **Norwalk**.



Environment

INSECT KILLER. Most people kill mosquitoes with a quick slap. But Academy and CT Intel Science Talent Search award winner **Michael H. Nyberg**, of Old Lyme, uses sound waves. As a high school student, Nyberg discovered that sound waves at the correct frequency can destroy mosquitoes by rupturing an air bladder located just below the head of the insect in its larva stage. Based on this discovery, Nyberg developed a mosquito-killing Larvasonic unit, which, in laboratory tests, has killed mosquitoes four and a half feet away. Nyberg's device may provide a way to control the disease-carrying insects without pesticides; the sound waves themselves do not harm any other animals or insects. The unit has been approved for use in Canada, and will be tested in California, New Jersey, Colorado, Utah, and Connecticut. Nyberg is continuing to develop his device; he has received a \$75,000 grant from the US Department of Agriculture to determine whether the Larvasonic unit can be used to kill mosquito larvae in rice paddies.

FINDING THE BUGS. During the annual **BioBlitz** run by the **Connecticut State Museum of Natural History**, participants located and identified nearly 1,700 species of organisms in just three city-owned parks in **New London**. During the event, which lasted just 24 hours, participants found creatures ranging from an unusual colony of two-lined salamanders with hundreds of eggs, to black lichen, to a trap-jaw ant believed to be a new find in the state, to a bacteria from Brazil which was found floating in a pond, to 84 photosynthetic protists. Over 750 people attended the event, said **Leanne Harty**, interim director of the Museum, who organized the event.

BIOCONTROL FOR LOOSESTRIFE... At several sites in Connecticut, imported beetles are achieving some success in controlling the invasive plant purple loosestrife. The biological control project, which is part of a nationwide program, was started in Connecticut in 1996: since then, the insects, which feed specifically on purple loosestrife, have been released at 40 sites in the state. The project is now yielding significant results. "You have to be patient with biocontrol," says **Donna Ellis**, an extension educator at the **University of Connecticut**, who raises the beetles. The goal, Ellis says, is not to eliminate the loosestrife, but to control it, and to prevent it from aggressively crowding out other plants.

... AND FOR ALGAE. The **Department of Environmental Protection (DEP)** has been stocking Connecticut walleye fish, which can grow up to 30 inches in length, and northern pike, which can reach over 40 inches, in Connecticut lakes. These large predator fish, which can provide exciting fishing for sports fishermen, also improve water quality by thinning out smaller, "forage" fish like yellow perch, sunfish, and landlocked alewife. When the overcrowding is eliminated, the remaining forage fish can grow larger. But, just as important, the forage fish feed on small algae-eating crustaceans known as zooplankton. When the forage fish are thinned out, the zooplankton become more abundant, consuming more algae, which improves both water clarity and quality. The DEP began experimenting with stocking large predator fish

IN BRIEF

Science and Engineering Notes from Around Connecticut

in the 1970s; based on the success of the program, the DEP, water companies, lake associations, and municipalities have begun to introduce the fish into increasing numbers of lakes.

HIGH FLYING. The cloud ceiling over the Northeastern states has been rising for the past thirty years, and this may cause changes in the forests of the northern Appalachian mountains, according to scientists at the **Yale School of Forestry and Environmental Studies**. By examining data from 24 airports, the researchers found that in the 18 most northerly airports, the clouds climbed an average of 20 feet per year, or about 600 feet since 1973. The change could enable broad-leafed deciduous lower-elevation trees, like sugar maple and yellow birch, to replace the conifers, like red spruce and balsam fir, which grow higher up. The rising cloud base could also reduce rainfall, resulting in drier habitats that could affect the habitat of moisture-dependent forest amphibians, like toads and salamanders. Researchers cannot explain why the change is taking place. It may, they say, be related to the cleaner air resulting from the Clean Air Act, or from urbanization, or from atmospheric alterations relating to large-scale global climate change.



Food & Agriculture

LOCALLY GROWN. Connecticut residents would prefer to purchase food grown on local farms, according to a survey done at the **University of Connecticut (UConn)**. But, the survey found, they have trouble locating and identifying those products. While 75% wanted local produce, less than half of those interviewed said they could identify homegrown items when shopping. Most would be willing to pay more for these products, which they perceive to be of higher quality. Sixty percent of those surveyed said they would pay up to 20 cents more per gallon of milk if it would help support local dairy farmers, but only 13% of those surveyed even knew that milk was produced in Connecticut. "There's a perception and awareness issue that needs to be worked on," said **Christopher Barnes**, an associate director at the **UConn Center for Survey Research and Awareness**.

LOW CARB DIETS. Reducing carbohydrates does not by itself make a diet more effective, according to a study done at **Yale** and **Stanford**. The scientists looked at 107 research articles published between 1966 and 2003. The articles reported on 3,268 patients, 663 of whom were following low-carbohydrate diets. "We found that calorie content and how long you're on the diet are the factors that predict weight loss," said co-author **Dawn Bravata**, an assistant professor at the **Yale School of Medicine**. The low-carb diets did not have a negative impact on cholesterol levels, fasting blood sugar, insulin, or blood pressure.

SAFE FOOD. Finding food-borne pathogens like *E. coli* has always been a problem: detectors are cumbersome and expensive, and often the testing cannot be done on site. **Jay Glasel**, professor emeritus at the **University of Connecticut Health Center**, is working on a device that can easily and inexpensively detect bacterial contamination in food. Glasel is developing polymers—chains of molecules—to which bacteria will attach. Eventually, Glasel and his colleagues hope to produce a plastic strip containing a variety of polymers, each of which would detect a different pathogen. The strip would be placed inside a package of food, and, if contamination were present, the polymers would give out a signal. Glasel's device could also be used to help protect the nation's food supply from bioterrorism. He hopes to have a prototype available in two years.

A CONNECTICUT CONNECTION FOR GIANT SEQUOIA.

When President Clinton proclaimed the Giant Sequoia National Monument in April 2000, he required a Scientific Advisory Board to guide the Forest Service's development of the first management plan for the new Monument. Accordingly the Secretary of Agriculture, in consultation with the National Academy of Sciences, appointed eight scientists. Although most of the scientists were from the West, CT Academy member **Paul Waggoner**, of the **Connecticut Agricultural Experiment Station** was elected chairman. After two years of the public deliberation required by the Federal Advisory Committee Act and with myriad concerns including continuity of the giants and ecology, forest products and recreation, fire safety and air quality, the Advisory Board submitted 27 Advisories and its Final Report. Before publication, they can be read at <http://www.fs.fed.us/r5/sequoia/gsnm/sab.html>.



Health

WEST NILE VACCINE. A new vaccine against West Nile virus is being developed by researchers at the **University of Connecticut** and **Yale**. Unlike an earlier vaccine, which was made of whole dead virus, the new version uses only certain proteins from the virus. This makes it safer to use, because it cannot inadvertently cause the disease. Because it's safer, it could form the basis of a vaccine that can treat humans. A Yale-based incubator company, **L2 Diagnostics**, hopes to license the vaccine and distribute it to the public.

USE IT OR LOSE IT. Decreased activity in the elderly is an important warning of functional decline, rather than just a normal consequence of growing old, according to a study done at **Yale University**. The researchers surveyed nearly 700 **New Haven** residents who were at least 70 years old, asking them about their daily activities and overall health. They found that for each month of restricted activity, the disability ranking of each participant grew worse by 11.2%. Restricted activity was defined as staying in bed for at least half a day, or being unable to perform activities because of some physical problem like illness or injury.

PROTEINS THAT MUST BE DESTROYED. In adult mammals, damaged nerve cells typically do not regenerate. This means, for example, that spinal cord injuries are considered permanent. But a team lead by **Yale** neurology professor **Stephen Strittmatter** has found that in mice bred to lack certain proteins, damaged nerve cells do exhibit new growth. The proteins, Nogo/A and Nogo/B, are a component of the myelin nerve cell sheathing that prevents nerve cell regeneration. Mice that lacked these proteins appeared normal, but, said Strittmatter, "the central nervous system responds to injury in a unique fashion with robust axonal sprouting and long distance growth. The axons grew in the tail end of the spinal cord." The mice also showed an improved ability to move. This discovery could eventually provide a way to heal those paralyzed by a spinal cord injury.

A WAY TO DESTROY PROTEINS. Proteins in the wrong place at the wrong time cause a host of human ills: cancer, heart disease, arthritis. Researchers at **Yale** and at the California Institute of Technology have developed a technique that could destroy these out-of-control proteins. The new technology, known as Proteolysis Targeting Chimera (Protacs), is able to target proteins within intact cells. It works by utilizing the cell's own natural protein-destroying machinery. Essentially, Protacs is a designed compound that binds to both the target protein and the cell's

IN BRIEF

Science and Engineering Notes from Around Connecticut

destructive machinery. By bringing these two into close proximity, Protacs increases the chances that the protein will be destroyed. This technique, said **Craig Crews**, associate professor at the **Yale School of Medicine**, has enormous potential as a therapeutic tool.

HEART-STOPPING. Radiation therapy is commonly used to treat cancer. But, in a new application available at the **University of Connecticut Health Center**, it can also be used to treat patients with coronary artery disease, or clogged arteries. In such patients, a tube, known as a stent, is often inserted into the artery to prop it open. However, in about 20% of the cases, the stent itself will become clogged. Using radiotherapy, a doctor can direct a carefully controlled dose of radiation to the site of the new blockage. The radiation slows, and in some cases, stops, additional blockage from taking place. Computers control and guide the radiation exposure; the technology allows doctors to treat a small amount of tissue very precisely without exposing other areas of the body to significant amounts of radiation.

TINY RNA. A newly discovered type of RNA known as microRNA has been shown to regulate an important developmental control gene, according to a study done at **Yale**. MicroRNAs exist in organisms from weeds to humans, and seem to control many aspects of gene function, from development, to stem cells, to cell death, to genome stability. However, although hundreds exist in human cells, they have remained undetected until recently. "Our study reveals that a gene long known for its important role in controlling development is itself controlled by microRNAs," said Yale assistant professor **Frank Slack**, senior author of the study, and a co-discoverer of one of the first microRNAs. Slack said that his work may lead to the ability to turn genes on or off at will.



High Technology

HERCULEAN EFFORT. Using an underseas robot that sends live images in real time, explorer and Academy member **Robert D. Ballard**, who is based at the **Mystic Aquarium and Institute for Exploration**, will investigate a site at the bottom of the Black Sea. Under Ballard's guidance, the 7-foot-high robot, known as Hercules, will explore artifacts on the ocean floor, and, at the same time, images of the artifacts will be transmitted via satellite to the Internet2, a high-speed experimental network used by universities and other institutions. This will provide real-time images to researchers around the world. The next step, says Ballard, is to replace Hercules, a 'tethered' robot, which must be monitored and controlled, with an untethered robot, capable of guiding itself.

MAN'S (NEW) BEST FRIEND. Under the guidance of **Yale** engineering professor **Natalie Jeremijenko**, students from the Bronx River Art Center modified toy robotic dogs so that the toys could track down pollutants. The toy dogs, which are available commercially, were disassembled and rebuilt: the students installed data collection sensors, and new programming that directed the robots to sniff out the contaminants. They also redesigned the toys so that they could travel through outdoor terrain. The project is intended to teach the students mechanical, electronic and computing skills, and to raise their awareness of the environment. Similar programs are being conducted at other brown-field sites, including one at the **English Power Station**, in **New Haven**.

STAR GAZING. Astronomers at **Yale** have joined with colleagues at Indiana University to add a giant electronic camera to a telescope already in place at Palomar observatory, in California.

The new camera contains an array of large electronic chips, known as "charge-coupled devices," or CCDs, which are used to detect light. With 112 CCDs, the equivalent of a 161-megapixel camera, the camera has one of the largest CCD arrays ever assembled. In earlier work, the QUEST team located the small planet known as Huya, which exists beyond Pluto in the band of objects known as the Kuiper Belt. The team will use the new camera to search for quasars, at the centers of distant galaxies.

TRACKING ICE. The year has been a busy one for icebergs—the **US Coast Guard International Ice Patrol**, based at the **University of Connecticut's Avery Point** campus, has tracked 925 icebergs that have floated into shipping lanes this year, compared to 877 last year. The count included some of the biggest icebergs recorded in twenty years, including two "ice islands," one of which was the size of 30 football fields. In attempt to learn more, the Patrol tagged an ice island by dropping a transponder on it from a reconnaissance plane. The transponder allowed the ice island to be tracked for 14 days, providing data that helps computer models to predict the way icebergs drift. The Ice Patrol was established in 1912, after the sinking of the Titanic.

POT HUNTERS. State forensic scientists are in the process of compiling a vast database of pot DNA that they hope will allow them to reconstruct the nationwide networks through which marijuana is distributed. They can use DNA to track the networks because large-scale marijuana dealers grow their plants from cuttings that have been taken from their most potent variety. That means that each plant is a clone, genetically identical to others produced by the same operation, which makes dealer networks easier to trace. The state project has been financed by a \$340,000 federal grant.



Transportation

ROLLING RIGHT ALONG. A device that can warn SUV drivers of impending rollovers has been developed by **Competitive Technologies Inc.**, of Fairfield. The system is the first of its kind in the nation, according to **Scott Bechtel**, a company official. The self-contained unit, which fits onto the vehicle's rearview mirror, contains a semiconductor chip that measures gravity, acceleration, and other types of forces. If these forces reach a dangerous level, the device beeps to alert the driver. The device costs less than \$20. According to the National Highway and Safety Administration, rollovers accounted for 32% of passenger-vehicle occupant fatalities in 2001.

LESS POLLUTION. Diesel engine pollution will be dramatically cut under new state guidelines issued by the **Connecticut Clean Air Construction Initiative**. The recently adopted rules are aimed at controlling the pollution produced by diesel engines during road construction, and they will reduce the emissions of carbon monoxide, hydrocarbons, nitrogen oxides, and particle matter. The engines will be required to use either low-emission fuels, or to be fitted with catalytic converters. The converters will cut hydrocarbons in half, carbon monoxide by 40%, and particulates by 20%. While these devices can cost up to \$2,000 to purchase and install, they are still cheaper than switching to clean-burning diesel fuels, according to a manager with **Cummins Metropower**, in Rocky Hill, which sells large diesel engines. Similar regulations have already been implemented in Massachusetts and California.

—Compiled and Edited by Karen Miller

News from the National Academies (continued from page 1)

prehensive EHR systems will be available and implemented in many health systems and regions, the report predicts.

The eight core capabilities that EHRs should possess are:

- *Health information and data* (having immediate access to key information);
- *Result management* (the ability for all providers participating in the care of a patient in multiple settings to quickly access new and past test results);
- *Order management* (the ability to enter and store orders for prescriptions, tests, and other services in a computer-based system);
- *Decision support* (using reminders, prompts, and alerts, computerized decision-support systems);
- *Electronic communication and connectivity* (efficient, secure, and readily accessible communication among providers and patients);
- *Patient support* (tools that give patients access to their health records, provide interactive patient education, and help them carry out home-monitoring and self-testing);
- *Administrative processes* (computerized administrative tools, such as scheduling systems).
- *Reporting* (electronic data storage that employs uniform data standards).

[<http://www.nap.edu/books/NI000427/html>]

◆ Atmospheric Models for First Responders

Atmospheric scientists have developed computer models that can help predict how hazardous agents disperse in the air. These models, used to track pollution or accidental releases from industrial sites, are also available to emergency personnel in the event of a chemical, biological, or radiological attack, when it would be critical to be able to determine how a plume of hazardous material might fan out, or a virus might spread, through a population.

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

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

[<http://www.nap.edu/books/0309089263/html>]

◆ A New National Vaccine Strategy

In order to achieve more widespread immunization and to sustain the development and production of vaccines in the

future, the nation needs a new approach to financing and distributing vaccines, according to a new report from the Institute of Medicine. A new insurance mandate, combined with a government subsidy and voucher plan to administer all recommended vaccines, should be implemented, the report states — a recommendation that would effectively transform the government's role from buying vaccines to assuring immunization.

While high levels of immunization have been achieved in the United States, especially in young children, significant disparities remain in access to vaccines across geographic and demographic populations. According to the report, these disparities result, at least in part, from a fragmented public-private health care system in which 10.5% of children lack insurance coverage for immunization. Unprecedented vaccine shortages in 2001 and 2002 further limited access. The government's purchasing policy seeks to curb expenditures and decrease the cost of vaccines, leaving little financial incentive for commercial firms to develop new vaccines. While more than 25 companies produced vaccines for the US market 30 years ago, only five companies do so today.

[<http://www.nap.edu/books/0309089794/html>]

◆ New Smallpox Vaccination Recommendations

Citing the potential risks associated with the smallpox vaccine for recipients as well as the people with whom they have close contact, a new report from the Institute of Medicine recommends that members of the general public not receive the smallpox vaccine except as part of a research study or other equally stringent clinical arrangement that meets the basic requirements of medical and public health ethics.

In a recommendation that expands upon the current guidelines on bioterrorism preparedness from the federal Centers for Disease Control and Prevention (CDC), the report urges the creation of registries of health care workers and others who have been vaccinated and trained in smallpox response, as part of plans to quickly mobilize and coordinate these personnel in the event of an outbreak. Current CDC guidelines call upon states to develop registries of all public health, health care, security, and other personnel whose occupations put them at greater risk of exposure and in greater need for vaccination in the event of a smallpox release.

Noting that sporadic inoculations of the public could further strain health agencies' budgets and staff, the committee recommended that CDC pursue a multi-step approach to accommodating the general public's wishes. The first step should be conducting surveys to determine public demand for smallpox vaccine. Second, CDC should determine the funding and other resources that would be required to meet demand. Because the smallpox vaccine carries greater risks than other vaccines, CDC and the state public health agencies should then refer individuals to existing or planned smallpox vaccine trials or other similarly well-structured and monitored clinical arrangements.

The committee urged that a baseline standard of preparedness be established at the national level. Based on this standard, CDC should facilitate the development of various hypothetical scenarios that states could use to test and improve their response plans and capabilities.

[<http://www.nap.edu/books/NI000429/html/>]

AIDS (continued from page 2)

didates are currently in development, but it may not be easy to find one that is effective, since it is a characteristic of HIV that it incorporates into the genetic material of the infected cell, which then becomes the source of transmission. That makes it very difficult for the immune system, which would be stimulated by vaccine, to maintain control of the virus.

AIDS and SARS

There are both similarities and differences between the AIDS pandemic and the recent outbreak of Severe Acute Respiratory Syndrome (SARS), Merson pointed out in his presentation.

Both are new diseases caused by an infectious agent that most likely existed in animal species and mutated to cause infection in humans. And both provoked irrational fears, represented in the case of SARS by the face masks worn in public places, which in fact do not protect one from being infected with the coronavirus that causes SARS. But the two illnesses differ greatly in their incidence, with 8,000 reported cases of SARS in total, as compared with 15,000 new cases daily of HIV infection.

The SARS outbreak highlights two aspects of globalization, Merson noted. For one thing, the fact that the Chinese government did not report SARS cases for four months allowed the illnesses to spread to many other nations through air travel.

“In the past 20 years, the global response to AIDS for the most part has been delayed, fragmented, inconsistent, and grossly inefficient.”

But globalization has had dramatic positive results as well—research in laboratories internationally identified the cause of SARS by March 12, 2003; the coronavirus was isolated two weeks later; and just two weeks after that, the virus’s genes were sequenced and on the Internet. This is an unprecedented triumph for global science, Merson said.

As to whether SARS will, like AIDS, become a global pandemic, Merson said we do not yet know. Reasons a pandemic is unlikely include the fact that SARS is hard to spread—“If it were not, we would have 8 million cases by now, not 8,000.” Control approaches, including isolation of patients and quarantine of close contacts, appear to have worked. We do not know if SARS will emerge in force again when the weather becomes cold, as many other respiratory diseases do. But the public health system can take considerable hope, Merson said, from the fact that it confronted a regional outbreak of a new and deadly pathogen, which threatened to become a global pandemic but now has a chance of being controlled through global cooperation. — **Virginia Robinson**

[Virginia Robinson is a freelance journalist who has written extensively about HIV, AIDS, and SARS.]

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