

# Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

Volume 17,2 / Summer 2002



## Activities of the Academy

Following is a list of major recent reports of the Academy. Reports are available for a nominal fee from the Academy office or website; executive summaries of the most recent reports are available on the Academy website at [www.ctcase.org](http://www.ctcase.org).

"Study of Radiation Exposure from the Connecticut Yankee Nuclear Power Plant" (2001)

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

"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)

"A State Science and Technology Policy" (1992)

"Electromagnetic Field Health Effects" (1992)

"Economic Impact of AIDS Health Care in Connecticut" (1990)

## Advances in Stem Cell Research Hold Promise for Disease Therapies

Over the course of the next year, hundreds of people will walk through the doors of the Yale Cancer Center in New Haven. Of those, about 100 fall into a special category: they'll be suffering from a variety of more serious cancers — and part of their treatment will include stem cells.

Although these unique cells have captured the attention of the public only recently, they're hardly a new discovery: they've been studied and even used, in some form, for about fifty years.

There are two kinds of stem cells: embryonic, which can give rise to all cell types, and adult, which, researchers had assumed, can produce only a few types of cells.

### *At Yale, an Unexpected Finding*

But Yale biologist Diane Krause has found that at least one kind of adult stem cell possesses a flexibility far more extensive than anyone had anticipated.

Krause works with bone marrow stem cells, which have been used to give new blood systems to cancer patients.

In a study of female mice that had received bone marrow implants from male mice, Krause and her colleagues found some liver cells that contained Y chromosomes. This meant that those liver

*(See Stem Cells, page 2)*

A longer version of this article appears on our website at [www.ctcase.org](http://www.ctcase.org)

## 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](http://www.infocusmagazine.org)

### ◆ Smallpox Recommendations

The Advisory Committee on Immunization Practices (ACIP) of the Institute of Medicine has approved draft supplemental recommendations that call for isolation of confirmed smallpox cases and targeted vaccination of only those who have been in contact with infected individuals, with a mass vaccination effort to take place only if the initial vaccination and quarantine methods are unsuccessful.

Drafted at the request of the CDC, which asked the ACIP, in the wake of September 11, to review its recommendations of June 2001 regarding use of smallpox (vaccinia) vaccine for smallpox vaccination, the supplemental recommendations update earlier ones with respect to vaccination of the general population and persons designated to respond or care for a suspected or confirmed case of smallpox. They also clarify and expand the primary strategy for control and containment in the event of an outbreak.

[See [http://www.cdc.gov/nip/smallpox/supp\\_rec.htm](http://www.cdc.gov/nip/smallpox/supp_rec.htm)]

### ◆ A Blueprint for Saving Lives

In a terrorist attack, the number of lives saved may depend on how well a building can withstand a blast. Since the mid-1990s, a defense department agency called the Defense Threat Reduction Agency (DTRA) has conducted research and testing on build-

*(See National Academies, page 7)*

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The Academy wishes to express its sincere thanks to all of its sponsors, whose support makes the important work of the Academy, including this publication, possible.

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The *BULLETIN* of the Connecticut Academy of Science and Engineering is published by the Connecticut Academy of Science and Engineering, Inc., 179 Allyn Street, Suite 512, Hartford, CT 06103-1422. Telephone and fax: (860) 527-2161. E-mail: acad@ix.netcom.com. WWW: www.ctcase.org. To subscribe to the Bulletin, contact us by phone, email or subscribe online at our website at www.ctcase.org.

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## Stem Cells (continued from page 1)

cells had been generated by stem cells that came from the male mice. Previously, researchers believed that bone marrow stem cells could produce only blood and muscle cells.

This finding led Krause and her colleagues to look further. They examined slides from female mice into which just one single male bone marrow stem cell had been transplanted. By looking at mice which had received just one stem cell, the researchers were able to eliminate the possibility that bone marrow contained more than one type of stem cell, and to show that one adult stem cell did indeed have the ability to make all these cell types.

Astonishingly, the researchers found cells with Y chromosomes in the esophagus, the stomach, the bowel, the lungs, the liver, and the skin. This was, says Krause, the first evidence of the extreme plasticity of bone marrow stem cells.

The debate that Krause's discovery sparked is this: can these unexpectedly plastic adult stem cells be substituted for embryonic stem cells? But it would be a mistake, emphasizes Krause, to assume that, just because both types of cells happen to be labeled "stem cells," they can do the same things.

For some therapeutic purposes, embryonic stem cells will be the way to go, while for others, adult stem cells will be better, she says. "We can't close off either route."

### At UConn, the Focus is on Cloning

For Xiangzhong "Jerry" Yang, who heads the Transgenic Animal Facility at the University of Connecticut, the focus is on cloning and the therapeutic use of embryonic stem cells.

Yang was the first to show that clones could be generated from skin cells, as well as from female reproductive tissue. "When we first started using skin cells," he explains, "we talked about how much simpler and less invasive it was to obtain these cells."

But it turns out that skin cells have another advantage: they can be cultured very easily, for long periods of time. This process, Yang has found, makes cells better at producing healthy clones.

Working with cells that had been cultivated for one, two and three months, Yang found that embryos derived from skin cells that had been cultured longer developed as well as clones produced from the much younger fetal or embryonic cells, and better than clones produced from adult skin cells that had been cultured for a short time.

"We don't really know why long-term culture helps developmental competence," says Yang. But he believes that the answer may be what he calls "reprogramming phenomena."

Every cell in your body contains exactly the same genes, explains Yang. The reason a skin cell is different than a nerve

(See *Stem Cells*, back page)

# IN BRIEF

## Science and Engineering Notes from Around Connecticut



### Communication

**BIRDS AND WORDS.** Unlike healthy people, patients suffering from schizophrenia can remember meaningless sounds like birds songs nearly as well as they can remember actual words, according to research done at **Yale**. In the study, subjects with and without schizophrenia listened to brief recordings of three bird songs, and then were asked to listen to just one song and describe where in the original sequence it was played. Later, a similar experiment was performed using sounds like a dog barking or a telephone ringing, to which the subjects could attach a verbal label. The ability to use words improved the performance of the healthy participants from 69% to 93%, but the performance of the schizophrenics improved only slightly, from 61% to 63%. It's not yet clear why this disability is associated with the disease, but, says **Yale School of Medicine** professor **Bruce Wexler**, "it shows how profound the effects of the illness can be... the use of internal language mechanisms to enhance cognition is an essential aspect of a wide range of normal human brain functions."

**PHONE HOME.** Forty percent of 911 emergency calls are made from cell phones—and that's a problem. When emergency calls are made from a conventional phone, the dispatcher sees the caller's home address on a computer screen, making it easy to send police or an ambulance to the correct location. Now, the state **Department of Public Safety** is requiring wireless phone providers to begin supplying that same information. The systems, says **George Pohorilak**, director of the **Office of Statewide Telecommunications**, will show the latitude and longitude of the cell phone. Various methods can be used to pinpoint location: one, for example, relies on a network approach, using triangulation to locate the caller—a method that works particularly well in densely populated areas with many cell sites.

**HIGHER UPS.** In an attempt to make cell phone towers both ubiquitous and inconspicuous, companies are lacing forests with fake trees, known as monopines, which serve as cell phone towers. Perfectly straight, with tufts of evergreen sprouting from the top, these artificial trees can reach over 100 feet. The monopines need to be in the right setting, according to **Ronald C. Clark**, manager of real estate operations for Nextel. The antennae need to be located above the canopy of trees; typically the camouflaged towers are located in places where they are considerably higher than the surrounding trees. "If it's got to be here, this is the way to go," says **Michael O'Leary**, town planner in **Hebron**, home to one of the state's monopines. Monopines can also be found in **Sharon**, **Barkhamsted**, and **Mystic**, according to Clark.

**HOSPITAL DRAMA.** To educate patients and minimize hospital liability, a new interactive television system is being installed at **John Dempsey Hospital** in the **University of Connecticut Health Center**. The new system will help the hospital comply with federal regulations about patient education, and its interactive capabilities can help hospitals document that they have informed patients of the risks associated with a procedure. For example, a patient about to undergo a heart procedure can watch a program explaining the operation. At the end of the program, the computer asks the patient questions to test the patient's comprehension. The computer keeps a log of the interaction, in order to satisfy government requirements, and, if the patient does not seem to understand, the computer notifies hospital staff, so that they can help explain. "We expect it to be a major cost savings for the institution," says **Bill Hengstenberg**, director of the Health Center's video communications.



### Education & Cognition

**READING AND TYPING.** Motor skills and reading abilities are connected, according to research done by **University of Connecticut** psychology professor **Claudia Carello**. While previous work, she explains, had looked at the reading-coordination connection in troubled populations, such as children with dyslexia, hers is the first to examine the link in "relatively unimpaired people." Carello and her colleagues found that the reading skills of 50 undergraduates were related to their ability to accurately tap a series of computer keys. One possible link, she suggests, is that children with motor coordination difficulties often have trouble controlling their tongue and lips. If a child can't make sounds clearly, Carello points out, it's harder to make the connection between the written word and its sound, a problem that might make it more difficult for a child to read.

**SCIENCE FAIR WINNER.** A Presidential Award for Excellence in Science, Math, and Engineering Mentoring has been given to the **Olin-Yale-Bayer New Haven Public School Science Fair**; this is the first time that the national award has been given to a school science fair. The award, which is given to institutions and individuals who help to guide women, minorities, and the disabled into scientific and engineering careers, includes a \$10,000 grant. The New Haven program received the honor because of its emphasis on mentoring; the project pairs city students with working scientists and college students, who meet with the youngsters for at least an hour a week over a three-month period. Last year, over 5,000 city students participated in the program.

**VIRAL DAMAGE.** Some types of brain damage, including the kind responsible for some psychiatric disorders, could result from viruses that pass through the brain, damaging cells permanently even though the viruses themselves vanish without a trace. The research, conducted by **Yale** neurosurgery professor **Anthony Van den Pol** and his colleagues, studied the behavior of VSV, a common laboratory virus, as it travels through the brains of rodents. In young animals, the virus destroys neurons responsible for producing much of the serotonin in the brain; rodents exposed to the virus show learning and attention deficits. "A hypothesis we are addressing with this model," says Van den Pol, "is that some [psychiatric and neurologic disorders] could be caused by short-term infections of the brain by viruses that leave behind no molecular footprint but generate a subtle trail of cell loss in discrete regions of the brain."

**SARA'S ASTEROID.** A science project that looked at the way pesticides affected animals like worms and slugs has earned Hamden ninth grader **Sara Kosmaczewski** the honor of having an asteroid named after her. The youngster, along with her teacher, participated in the third annual Discovery Young Scientist Challenge, a national science contest; her project, which involved testing the animals with pesticides similar to those used to combat West Nile Disease, found that the amount of the chemical sprayed was more important than the particular type. Fewer than 10,000 people have asteroids named after them; scientists at the Massachusetts Institute of Technology (MIT) suggested naming asteroids after Sara, the other contest participants, and their teachers.

*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 e-mail us at [acad@ix.netcom.com](mailto:acad@ix.netcom.com)*



# IN BRIEF

## Science and Engineering Notes from Around Connecticut



### Energy

**LESS FAT, LESS OIL.** A fuel cell scheduled for installation at the **New Haven Water Pollution Control Authority** provides so much energy that it will not only power the plant, it will also more than double the amount of grease, fats and oils that the plant is able to process each day. The project is among the eight chosen for funding by the **Connecticut Clean Energy Fund**, which hopes to encourage growth in the state's fuel cell industry. **Nxegen Inc.**, a Middletown energy services firm, will head the project, which is expected to cost \$2.5 million; it will use a fuel cell made by South Windsor-based UTC Fuel Cells.

**SUSTAINABLE SCHOOL.** With a recently awarded \$3.5 million challenge grant from the state, **Eastern Connecticut State College** will further develop alternative energy technologies at its **Institute for Sustainable Energy**. The two-year-old Institute, which provides help with sustainable energy projects, will develop an energy park featuring a planned fuel cell, solar collectors, green energy-efficient buildings, microturbines, and possibly a windmill. "Eastern is definitely trying to carve out a niche for itself to become a leader for energy awareness and the development of sustainable energy projects," says Institute executive director **Joel Rinebold**. The college campus includes a 9-story residence hall cooled by a geothermal system.

**FUEL SCHOOL.** While at the **University of Connecticut (UConn)**, federal and state agencies, along with private industry, are investing \$14.5 million to create the **Connecticut Global Fuel Cell Center**, which will include six endowed chairs, two fuel cell power plants, and a new state-of-the-art facility. While about a dozen other institutions are conducting fuel cell research, each is focusing on a particular area, such as powering cars. The UConn Center will take an interdisciplinary, whole-system approach that is expected to influence the entire field of fuel cell research. Fuel cells have become increasingly popular as a possible alternative to conventional electrical power, because they produce little pollution, and because their variable size potentially allows them to provide energy for an astonishing variety of tools, from buildings to hearing aids. The Center will work in collaboration with the state's three existing fuel cell companies **FuelCell Energy**, **UTC Fuel Cells** of South Windsor, and **Proton Energy Systems** of Rocky Hill.

**POWER TO THE POWERFUL.** By persuading heavy power users in southwestern Connecticut to use less power or generate their own, utility officials hope to prevent a summer power shortage in the region. While New England is expected to have sufficient power, southwestern Connecticut has a shortage of transmission lines, making it difficult to move large amounts of electricity in when needed. Utility officials will pay participating companies to reduce their power usage, and will partially reimburse chosen companies for installing new generators. The goal is to have available an additional 80 megawatts through a combination of conservation and new power; that would be enough to provide electricity to 80,000 homes, according to **Stephen G. Whitley**, chief operating officer of **ISO New England**.



### Environment

**WEST NILE VIRUS.** The State Mosquito Program coordinated by the **Department of Environmental Protection (DEP)** announced that it has detected five crows infected by West Nile virus (WNV)

during April and May of 2002. Two were found in **New Haven**, two in **West Hartford** and one in **Rocky Hill**. As of June 17, 32 birds had been tested for WNV. The Department of Public Health (DPH), DEP and the **University of Connecticut** participate in the surveillance of birds. Every 10 days on a regular rotation, **The Connecticut Agricultural Experiment Station** traps mosquitoes from 91 sites statewide. As of June 18, 6,916 had been trapped, tested and found negative. The first three weeks of mosquito trapping showed the number of mosquitoes in 2002 below the five-year average and below last year's numbers.

**SAVE THE BIRDS.** As part of a conservation effort to protect birds, the state Audubon Society has named eight Connecticut locations as "Important Bird Areas," and of those, three have been nominated as "Global Important Bird Areas," in recognition of their impact on birds worldwide. To qualify, the site must support a threatened species or an unusually large or diverse bird population, and it must provide an essential habitat. One site, for example, **Faulkner's Island**, off the coast of Guilford, shelters 3% of North America's nesting population of endangered roseate terns, while another, the **McKinney Salt Meadow Unit** in Westbrook, provides a critical migratory stopover and foraging area for neotropical migrant land birds, including many songbird species. The new designations will tie the sites into a network that enables researchers around the world to share their conservation expertise.

**INVADERS.** By comparing chloroplast DNA sequences from modern Phragmites with sequences from leaves collected in the eighteenth century, **Yale** graduate student **Kristin Saltonstall** has shown that invasive versions of the common roadside reed have almost entirely replaced the native species. Saltonstall was able to identify 11 different native North American types, all of which were once widespread. But by the 1940s, in Connecticut and Massachusetts, only invasive types could be found. The invasive version grows as a dense monoculture, crowding out plants and animals like ducks, which cannot migrate through the reeds' dense foliage. Saltonstall believes that the foreign plants, which were used as packing material on ships in the 1800s, could have been accidentally introduced into the country at that time.

**MIGRANT SWIMMERS.** After a long decline, harbour seals are again thriving in the Northeast. The animals, which are about five feet long and weigh about 200 pounds, summer on the coasts of Canada, Maine, and Cape Cod, but, each winter, about 3,000 seals migrate into Long Island Sound. The increased seal population, according to researchers, probably results from a combination of factors: the Marine Mammal Protection Act of 1972, which made it illegal to kill seals; improved water quality, which has fostered the populations of alewives and herring on which the seals feed; and the increasing number of "fishways," built to allow fish to bypass dams and move up the rivers to spawn. According to **Amy Ferland**, a harbour seals census researcher at the **Maritime Aquarium in Norwalk**, seals have been seen swimming up the Connecticut River as far as Massachusetts, possibly following schools of fish.



### Food & Agriculture

**GREEN AND PLANTY.** With over 4,000 varieties in its collection, the **University of Connecticut's (UConn)** ecology and evolutionary greenhouse represents plants from every continent except Antarctica. To make it easier for scientists to locate each plant, the entire greenhouse inventory went online in 1994, one of the first collections to do so. This accessibility makes UConn a primary source of materials, even to researchers from other facilities. Each

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plant has a barcode, which can be used to track the material being borrowed. “We are teaching people about plants, and doing basic research into why plants demonstrate particular behavior,” says greenhouse manager **Clinton Morse**. About 30% of the collection is used for research, with the rest allocated to teaching and outreach.

**BIG BUSINESS UNDERFOOT.** Grass is big business, according to **Karl Guillard**, head of the turf grass science program at the **University of Connecticut**. There are, for example, 17,000 golf courses in the United States, totaling an area equal to Rhode Island and Delaware combined—and another 500 golf courses are added each year. But golf courses are just a small part of the total turf grass business: turf is used in erosion control, municipal parks and grounds, and, increasingly, on athletic fields, as a replacement for the once-lauded artificial grass. Guillard is currently researching ways to reduce nitrogen leaching, a response to concerns that nitrogen fertilizers used on grasses may be leaching into nearby aquifers.

**ARTICHOKES LOVE MILD WINTER.** At Lockwood Farm in Hamden, **David Hill of The Connecticut Agricultural Experiment Station** tests new crops for Connecticut farmers. Since 1985, he has experimented with artichokes, a relative of the thistle. ‘Chokes are generally grown as perennial over several years in California. In the Connecticut climate, producing ‘chokes requires special treatment. First artichokes must be started in a greenhouse and then, being a biennial, chilled or vernalized to imitate a mild winter. ‘Chokes are then produced for a single season. The mild winter of 2001-2, however, brought a bonus. Fully 80% of the plants of 2001 survived and began bearing marketable ‘chokes by June 2002.

**CANCER PROTECTION.** While research firmly links diet and cancer risk, the precise connections between the two are often hard to identify. With a \$170,000 grant from the National Cancer Institute, scientists from the **University of Connecticut Health Center**, the **University of Connecticut**, and **Yale** will spend six months developing a plan to decipher the ways in which nutrition influences cancer development. “We want to determine why a nutrient may prevent cancer in one situation yet trigger it in another,” says principal investigator **Daniel Rosenberg**, of the Health Center. With a focus on breast and colon cancer, the scientists will look at the cellular effects of oxidants and antioxidants.



### Health

**FIBROID RELIEF.** Hysterectomies could be avoided through a procedure newly offered at **University of Connecticut Health Center’s John Dempsey Hospital**. The surgery, known as uterine artery embolization, provides an alternative treatment for uterine fibroids, the benign but sometimes painful tumors that occur in about 20 to 25% of women of childbearing age. This treatment is far less invasive than a hysterectomy, and, importantly, does not always end a woman’s chance of becoming pregnant. It involves using bits of plastic gelatin sponge to block the arteries that supply the fibroids with blood; when the blood flow stops, the tumors simply break down and are reabsorbed by the body. The treatment provides relief in 78 to 94% of patients.

**GREEK MEDICINE.** The ancient Greeks had it right: bile affects mood. In a recent study, **Yale** psychiatry professor **Dan Oren** found that nighttime levels of bilirubin, a bile pigment, were lower than normal in patients suffering from a form of depression known as Seasonal Affective Disorder (SAD). Oren’s was the first

study to look at the way circadian rhythms affect bilirubin levels in depressed patients; typically, bilirubin levels rise during the night, and decrease during the day. In further research, Oren hopes to determine whether low bilirubin levels cause SAD, or are merely a marker for it. Bilirubin, which is found in the blood, is sensitive to light, which is usually used to treat the disorder. SAD, which strikes sufferers in the winter, affects up to 10% of the people in the northern United States.

**LIGHTER SIDE.** The light treatment that’s been so effective for SAD may succeed in helping chronically depressed patients, according to research done at **Wesleyan**. Psychology professor **Namni Goel** has found that light therapy, in which the patients are exposed to bright lights for an hour a day, significantly reduced symptoms in more than half of study participants. Results showed that the light boxes worked as well as, or better than, common antidepressant drugs. And, they worked more than twice as quickly, showing results in just one to two weeks. While no one is sure why the treatment is so helpful, one theory is that exposing patients to bright light every morning resets the body’s circadian rhythms, somehow elevating mood.

**SLEEP BABY SLEEP.** Tests are underway for a new insomnia treatment that doesn’t leave patients groggy in the morning. Under development by **Neurogen Corp.**, of Branford, in conjunction with **Pfizer**, the drug, called NGD 96-3, is designed to eliminate the side effects common to most insomnia medications, including next-day sedative effects, and memory loss. Currently in Phase I drug safety trials, NGD 96-3 works by selectively modulating receptors of the gamma aminobutyric (GABAA) neurotransmitter system, a central mechanism in the control of sleep. The companies are in the process of developing similar GABAA-based drugs to treat Alzheimer’s, anxiety, and depression.

**MALE HORMONES.** A study at the **University of Connecticut (UConn) Health Center** will look at whether hormone treatments can mitigate the effects of aging in men. The five-year study, headed by **Anne Kenny**, a professor in the **UConn Center on Aging**, will examine possible benefits of testosterone replacement, including bone retention, improved brain function, and muscle strength. According to Kenny, about 70% of men over 70 who have hip fractures are also testosterone deficient. Testosterone replacement, says Kerry, may be the male equivalent of estrogen replacement therapy.



### High Technology

**SLEEP TIGHT.** Total-care beds recently purchased by **Yale-New Haven Hospital** can perform many of the routine tasks commonly performed by nurses—and more easily and more safely, at that. The beds are designed to prevent many of the health problems that arise because patients are immobilized. Special modules inserted into the headboard can turn a patient from side to side, preventing bed sores. The frame can also tilt and pulsate a patient, helping to clear secretions from the lungs. The bed also turns into a chair: typically, it takes two nurses to lift a patient into a chair. Forty-seven percent of nursing injuries occur when nurses attempt to move patients, according to a spokeswoman from Hill-Rom, the company that manufactures the beds.

**PRESCRIPTION PACKAGE.** Robots may be dispensing medication in state prisons as part of a new system designed to save time and money and improve safety and security. The new system, a partnership between the **University of Connecticut Health Center** and state **Department of Corrections**, is expected to save

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\$200,000 annually in the cost of drugs and administration alone. Each robot is a metal cabinet about 5 feet long, 6 feet high, and 4 feet wide. It contains 520 cells, each of which holds up to several thousand pills. When a prescription request comes in, the robot dispenses a single dose of medication into a plastic bag, which is then sealed; a week's worth of individual dosages are prepared at a time and shipped to the prison facility, where they are distributed to inmates. Officials in Massachusetts, New York and Rhode Island have expressed interest in the system.

**LISTENING GUIDE.** Guidance systems based on echolocation techniques used by bats and dolphins could help the elderly manage their electric wheelchairs, according to **Yale** electrical engineering professor **Roman Kuc**. Kuc's devices consist of transducers that emit sound waves that bounce off objects, and rotating "ears" that detect the reflected sound waves. Working with students, Kuc is testing whether motorized wheelchairs can successfully use these echolocation systems to avoid real world obstacles like people, walls, stairs, and benches. In addition to aiding the elderly and other handicapped individuals, such as the blind, such sonar systems could eventually be used to improve traffic safety.

**CRIMINALLY EASY.** A hand-held device that uses reflected ultraviolet light can locate and record fingerprints up to fifteen feet away with far less damage to property than traditional methods. "It's no longer [investigation] through just throwing dust at stuff and hoping you can find out who did it," said **Howard Harris**, of the **University of New Haven**, where students will be trained. The **Krimesite Imager**, recently purchased by the **Orange Police Department**, is one of only two in the state. Able to sweep a full room or small object easily, the lightweight device can detect prints on walls, plastic, glass, and most other non-porous surfaces, and it allows officers to locate fingerprints that might not otherwise be found. An attached digital camera records a digital image that can be loaded into a computer and checked against prints already stored in databases.



### Industry & Business

**BIOSCIENCE EXPANSION.** The bioscience sector in Connecticut grew 18% in 2001, according to the annual economic survey released by the bioscience advocacy group **CURE (Connecticut United for Research Excellence)**. According to the survey, bioscience spending grew to \$3.6 billion, compared to \$3.1 billion the year before. The bulk of the increase came from the state's pharmaceutical companies, with pharmaceutical spending reaching \$2.9 billion in 2001, a 19% increase. Biotechnology companies grew by 23%, spending a total of \$277.2 million. CURE reported that the bioscience sector supports 16,500 jobs directly, but an analysis done by **Mark Thompson** of the **Quinnipiac University School of Business** showed that an additional 52,000 jobs are affected indirectly.

**9/11.** **Yale** architecture professor **Alexander Garvin** has been chosen to design a plan for the former site of the **World Trade Center's Twin Towers**. Garvin will be working with his former students, **Yale** architecture school graduates **Andrew Winters** and **Christopher Glaisek**. While ideas for the site are still under consideration, a "meaningful memorial for the victims" must be part of the plan, says Glaisek. Transportation, also, he feels, must be made "a real presence" on the site. "There never was a real sense of arrival there," Glaisek says. He believes, too, that the original site acted as a separate enclave, and was never integrated properly with the

city. Garvin, who serves on the New York City Planning Commission, was selected by the Lower Manhattan Development Corporation to serve as vice president for planning, design, and development on the project.

**UNIVERSITY BUSINESS.** Research by **University of Connecticut (UConn)** professors could lead to substantial revenue for the departments, the university, and the professors themselves. A revitalized **University of Connecticut Research and Development Corporation** will evaluate and support the transformation of new technologies into businesses. The corporation reviews nearly 100 invention disclosures each year. The university will provide, among other support, incubator space, which will be developed at all campuses. Licensing revenues at UConn have grown from \$432,579 in 1996 to a projected \$650,000 this year, says **Bruce Carlson**, interim president of the corporation.



### Transportation

**HIDE AND SEEK.** Target tracking algorithms developed by **University of Connecticut** engineering professor and Academy member **Yaakov Bar-Shalom** can monitor moving objects as diverse as speeding airplanes and swirling cells, and his work is already being used by Boston's Logan Airport ground traffic monitoring system, by the Navy, and in Israeli and US missile defense systems. To track an object, a computer must learn to do something that, for it, is not easy: it must learn to be flexible. While a computer can easily calculate a path for a moving object, in practice, objects often veer into unpredicted paths, and a tracking system must still be able to find them. Bar-Shalom's algorithms teach computers to account for the unexpected, instructing the computer to make a "window" around the object's predicted position. This allows the computer to find the object, even if the object is off course, and to recalculate its trajectory. The window is based on the reliability of the sensor and the regularity of the object's motions.

**JUST CHECKING.** A newly established radar facility at the mouth of Long Island Sound is among the resources needed to protect Connecticut's coastline from terrorists; with ports in **New London**, **New Haven** and **Bridgeport**, a Navy submarine base in **Groton**, and the **Millstone** nuclear power plant in **Waterford**, the state offers a number of potential targets. The radar installation, said **Rear Adm. George Naccara**, commander of the Coast Guard forces from Maine to New Jersey, would be a vital aid to identifying vessels attempting to enter the Sound without authorization. Another improvement, said Naccara, would be expanding an existing system for fitting vessels with transponders that allow vehicles to be tracked by satellite.

**BREATHE EASY.** Next year, the youngsters in **Norwich** will breathe cleaner air when they ride on school buses. Norwich is the site of a Connecticut **Department of Environmental Protection** pilot program aimed at reducing the diesel emissions to which millions of school children are exposed. Through the **Clean School Bus Program**, Norwich buses will be retrofitted over the summer to use low-sulfur fuels. They'll also be equipped with oxidation catalysts and particulate filters. Portable air monitors will test air quality as students ride, enter and exit the buses, as well as while the youngsters are in the classrooms. Diesel exhaust levels can also affect classrooms, which may be close to bus loading areas. These changes are expected to reduce hydrocarbons and carbon monoxide by approximately 70%, and fine particulates by as much as 90%.

—Compiled and edited by Karen Miller



## National Academies *(continued from page 1)*

ing attributes and the effects of bomb blasts. Until now, this research has been largely applied to protecting buildings used for military purposes.

In a recent review of DTRA's blast-effects research program, a National Research Council committee urged the agency to increase its efforts to share research findings and building innovations with the civilian design and building community. By developing and distributing assessment tools and design guides, DTRA can help architects and engineers evaluate a proposed or existing building's risks and include features that could minimize damage. The costs of blast-resistant features could be reduced by incorporating them into a strategy that protects against a variety of hazards, the committee noted.

The committee also urged that data collection be intensified, and suggested that the federal government set up rapid-response teams to gather medical and bomb-blast effects information following an attack. Such information could help medical personnel, search-and-rescue teams, and builders prevent and respond to future attacks.

[See <http://www.nap.edu/books/0309082862/html/>]

### ◆ Racial, Ethnic Disparities in Special, Gifted Ed

Federal law requires all schools to meet the learning needs of disabled students, but disproportionately large numbers of children in some racial and ethnic groups are being identified with disability labels and placed in special ed programs. To ensure that minority students are not assigned to special education simply because they are poorly prepared for school, educators should first provide them with high-quality instruction and social support in a regular setting before determining whether special services are needed, says a new report from the National Research Council.

States also should strengthen training requirements for prospective and current teachers so they can better meet the needs of atypical learners, and government officials should improve and expand early childhood services, including universal screening and intervention strategies in the areas of reading and behavior, two of the most common reasons for special ed placement, the report says. It also calls for rigorous research on identifying students who have special gifts and talents. Historically, disproportionately low numbers of African-Americans, Hispanics, and American Indians have been placed in K-12 gifted classes.

[See <http://www.nap.edu/books/0309074398/html/>]

### ◆ Ratings and Rollovers

More than 10,000 people are killed and another 27,000 are seriously injured each year in the United States in rollover crashes, which account for nearly one-third of the nation's annual deaths in cars and light trucks (including sports utility vehicles, minivans, and pickup trucks).

Responding to concern from the public, the federal government undertook the development of a rating system to determine a vehicle's risk of rollover. Last year, the National Highway Traffic Safety Administration (NHTSA) created and

implemented a five-star rating system as part of its New Car Assessment Program. The star ratings are based on a top-heaviness measurement known as the static stability factor, which is calculated mathematically using a vehicle's track width and center-of-gravity height. But automobile manufacturers and some consumer groups questioned NHTSA's decision to use top-heaviness as the sole measurement to rate rollover risk, without also taking into account other performance factors.

According to a new Research Council report, the static stability factor is a useful indicator of a vehicle's propensity to roll over, but the consumer information developed by the NHTSA is likely to be of limited practical use to the public. The report suggests a rating system with more categories, or a numerical score that would better communicate rollover risk. The committee suggested that the NHTSA develop a system that uses the static stability factor and information from road tests to provide a more complete picture of rollover behavior. NHTSA is currently developing dynamic tests for rollover in response to legislation.

[See [http://books.nap.edu/catalog/10308.html?infocus\\_2.1](http://books.nap.edu/catalog/10308.html?infocus_2.1)]

### ◆ Air Quality on Airplanes

The National Research Council recently examined the issue of air quality on airlines to see if concerns about dry eyes, dizziness, and other health complaints reported by both passengers and flight attendants are warranted. It found a shortage of data, making it difficult to establish a relationship between poor air quality on planes and health concerns, and urged the Federal Aviation Administration (FAA) to correct the deficit. But there is evidence that some people, particularly those with pre-existing medical conditions, face an increased risk of health problems when they fly.

Studies indicate that ozone levels on some flights may exceed FAA and Environmental Protection Agency (EPA) standards, according to the committee, which urged the FAA to ensure that its current regulation for ozone is met for all flights. High levels of ozone have been known to worsen respiratory problems such as asthma.

Low air pressure may pose risks as well. Although airplane cabins are pressurized, cabin pressure at cruising altitudes may still be too low to provide sufficient oxygen for infants and certain adults, the committee found, and urged the FAA to examine its current standard.

The committee also found that, while a large number of people sharing a relatively small space for an extended time can result in increased transmission of infectious diseases, airplane ventilation systems themselves don't appear to contribute to such transmission. The report calls on the FAA to conduct a rigorous scientific investigation to demonstrate that all of its air quality standards are adequate to protect public health, and to revise any standards that aren't. It also urged establishment of a surveillance program to monitor cabin conditions and health complaints in the future.

[See <http://www.nap.edu/books/0309082897/html/>]

## Stem Cells *(continued from page 2)*

cell is that in each, a different set of genes is turned on. All the other genes are 'locked.' "Basically," says Yang, "the cloning process is the unlocking of those locked genes." If some of the genes are not unlocked, then the embryo is likely to die. For example, Yang and his colleagues recently looked at the behavior of X chromosomes in clones. Female mammals each have two of these chromosomes, and the researchers found that in some of the clones, neither X chromosome worked properly. This problem, which caused the clones to fail, may, they believe, result from incomplete reprogramming.

"Perhaps," suggests Yang, speaking of his earlier work, "the long term culture of cells in the *in vitro* environment helps the reprogramming process along. Perhaps it makes that lock easier to open."

While much work remains to be done before the potential of stem cell and therapeutic cloning can be realized, astonishing advances have been already achieved.

"The important thing," says Yang, "is that the technologies of tissue engineering and cloning and stem cells bring us much closer [to clinical applications] than just a few years ago. And here, we're beginning the research. We can't see the end yet. But we have a beginning." — **Karen Miller**



At the University of Connecticut's Transgenic Animal Facility, Dr. Jerry Yang and his colleagues have shown that clones such as Daizy (shown above with her calf), cloned from aged cows, can have normal pregnancies and normal calves. (Photo: J. Yang)

[Karen Miller is a freelance science writer based in northeastern Connecticut. Her articles have appeared in *Northeast Magazine* and on the *Science@NASA* website. She is a regular contributor to the *Academy's Bulletin*.]

An expanded version of this article can be found at [www.ctcase.org/bulletin/17\\_2/cloning.pdf](http://www.ctcase.org/bulletin/17_2/cloning.pdf)

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179 Allyn Street  
Hartford, Connecticut 06103-1422