

Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



Volume 17,3 / Fall 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 web site; executive summaries of the most recent reports are available on the Academy web site at www.ctcase.org.

"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)

"A State Science and Technology Policy" (1992)

"Electromagnetic Field Health Effects" (1992)

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

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

◆ An Unhealthy State of Affairs: The Consequences of Uninsurance

In a recent article for the National Academies Op-Ed Archives, Arthur Kellermann, M.D., M.P.H., co-chair of the Institute of Medicine's Committee on the Consequences of Uninsurance, set forth a number of his committee's most notable, and most troubling, findings.

Convened to answer the question, "What difference does it make that more people do not have health insurance?", the IOM committee was asked to examine many aspects of the consequences of uninsurance, from the impact on individuals to the effect on "families, communities, and the nation as a whole." Citing yet another increase, during 2001, in the number of Americans who do not have health insurance (as indicated by statistics from the US Census Bureau), Kellermann notes that a rising level of unemployment "directly leads" to a rising number of uninsured adults, teenagers, and children." This is because most Americans under the age of 65 obtain health insurance through an employer, either their own or that of a spouse or family member, and thus the employment rate is directly linked to the rate of health insurance — or uninsurance.

Kellermann notes that a number of the committee's findings dispelled "surprising misperceptions about the uninsured" and support a strong correlation between adequate coverage and good health.

The uninsured, the committee found, often forgo early treatment of symptoms, with the result that when treatment is finally sought, the illnesses are likely to be more advanced. This effect is most notable with conditions such as hypertension and cancer, where early detection and treatment is critical. The committee found that for chronic health conditions such as diabetes, heart disease, kidney failure, HIV infection, and mental illness, the uninsured suffering from these conditions have "consistently worse medical outcomes" than the insured.

With health care costs and insurance premiums soaring, and the nation's economy remaining weak, "the problem of uninsurance is likely to get worse — perhaps much worse — in the near term" according to Kellermann, who warns that increasing numbers of workers, especially those in lower pay grades, will be unable to afford to pay their share of the higher premiums, co-pays, and deductibles. And while states have provided a safety net of coverage for many children through public insurance programs such as the State Children's Health Insurance Program, many states, facing increased costs and reduced tax revenues, are preparing to pare these programs.

In summary, Kellermann warns that:

"Few Americans can assume that they and their children will always have coverage. This is particularly true in a fragile economy. Rapid growth in health care costs, coupled with a rising rate of uninsurance throughout the United States, is placing our health care system under tremendous stress. Left unchecked, these forces will have profound consequences for the health of all Americans, insured and uninsured alike."

[See [http://www4.nationalacademies.org/onpi/oped.nsf/\(Op-EdByDocID\)/F822733C82CE884B85256C5D00538248?OpenDocument](http://www4.nationalacademies.org/onpi/oped.nsf/(Op-EdByDocID)/F822733C82CE884B85256C5D00538248?OpenDocument)]

(See National Academies, page 2)

Our Thanks to Academy Sponsors

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.

Special recognition and thanks for continuing support of the Academy's programs to the Connecticut Department of Economic and Community Development

◆ **Leading Patrons** ◆

Northeast Utilities
Pfizer
United Technologies

◆ **Sustaining Patrons** ◆

Boehringer Ingelheim

◆ **Contributing Patrons** ◆

Aquarion Water Company
Pitney Bowes
Schlumberger-Doll Research
Southern New England Telephone
The Stanley Works

The Connecticut Academy of Science and Engineering

The purpose of the Academy is to *"provide guidance to the people and the government of the State of Connecticut ... in the application of science and engineering to the economic and social welfare."*

OFFICERS OF THE ACADEMY

John P. Cagnetta, President
Senior VP, Northeast Utilities (ret.)

Michael J. Werle, Vice President/President Elect
Director for International and External Programs
UTC Office of Science and Technology (ret.)

Joseph D. Bronzino, Secretary
Vernon Roosa Professor of Applied Science, Trinity College

Peter G. Cable, Treasurer
Principal Scientist, GTE/BBN Systems & Technologies

EXECUTIVE DIRECTOR

Richard Strauss

EDITORS

George Foyt, Executive Editor - Engineering
Manager of Electronics Research, UTRC (ret.)

Jan Stolwijk, Executive Editor - Science
Professor of Epidemiology and Public Health (Emeritus)
Yale University School of Medicine

MANAGING EDITOR

Martha Sherman

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 web site at www.ctcase.org.

The Connecticut Academy of Science and Engineering is a private, nonprofit public-service organization established by Special Act No. 76-53 of the Connecticut General Assembly.

COPYING PERMITTED, WITH ATTRIBUTION

From the National Academies

(continued from page 1)

◆ Science and Security in an Age of Terrorism

On October 18, 2002, the presidents of the National Academies issued a joint statement on "Science and Security in an Age of Terrorism." The statement begins by noting that after the attacks on September 11, 2001, the scientific, engineering, and health research community responded rapidly, from initiating new research to analyzing needs for improved security," adding "This community recognizes that it has a clear responsibility to protect the United States, as it has in the past, by harnessing the best science and technology to help counter terrorism and other national security threats."

Urging what it describes as an "appropriate balance between scientific openness and restrictions on public information," the statement notes that while restrictions are "clearly needed to safeguard strategic secrets," openness also is needed to accelerate the progress of technical knowledge and enhance the nation's understanding of potential threats. This balance requires clear distinctions between classified and unclassified research, the authors note, adding, "We believe it to be essential that these distinctions not include poorly defined categories of 'sensitive but unclassified' information that do not provide precise guidance on what information should be restricted from public access."

The statement urges a renewed dialogue among scientists, engineers, health researchers and policy-makers, and offers two "action points": one focused on scientists, engineers, and health researchers and the other focused on policy-makers.

The first calls for the scientific, engineering, and health research community to work closely with the federal government to determine which research may be related to possible new security threats and to develop principles for researchers.

The second urges the federal government to affirm and maintain the general principle of National Security Decision Directive 189, issued in 1985:

"No restrictions may be placed upon the conduct or reporting of federally funded fundamental research that has not received national security classification, except as provided in applicable U.S. statutes."

The three presidents conclude their statement with the following appeal:

"Achieving the purpose of scientific and technological activity — to promote the welfare of society and to strengthen national security — will require ingenuity from our science, engineering, and health community, as well as from the many agencies of the federal, state, and local governments involved in counterterrorism. The nation's safety and the continued improvement of our standard of living depend on careful, informed action on the part of both governments and the scientific, engineering, and health community. A continuing, meaningful dialogue needs to begin — one that produces a true collaboration for the many decisions that need to be made."

[See <http://www4.nationalacademies.org/news/nsf/0a254cd9b53e0bc585256777004e74d3/64fa661785eed14785256c56005d0ad6?OpenDocument>]

(See From the National Academies, page 7)

IN BRIEF

Science and Engineering Notes from Around Connecticut



Communication

EASY LISTENING. Listening comprises 60% of a student's school day, says teacher **Linda Reger**, of **Elizabeth S. Shelton School** in **Shelton**, and, studies have shown that classroom acoustics have a great effect on a child's education. Students who can hear properly have improved speech perception, phonemic awareness skills, reading skills, and overall academic ability. To improve classroom acoustics, Reger, who teaches the hearing impaired, has obtained a state grant to install FM sound-field amplification systems in Shelton classrooms. The systems will include four speakers in each classroom, and two microphones, one headset, which can be worn by the teacher, and one handheld portable, which can be passed from child to child. The FM sound-field systems work like miniature public address systems, and can amplify a teacher's voice by approximately eight to ten decibels.

GETTING CONNECTED. With a new modem technology offered by **Madison**-based internet provider **Cybershore**, dial-up users can send and receive information nearly 30% faster than is possible with standard technology. The new V.92 industry standard is a follow-up to V.90, the most common modem technology now in use. The V.92 Pulse Code Modulation feature increases transmission speeds from approximately 31 kilobytes per second (Kbps) to 48 Kbps. So far, more than 3,000 users across the state subscribe to the service.

ANALOG SYSTEM. While most Connecticut communities have switched to digital police radio systems, costing more than \$1 million, **Hamden** has chosen instead to replace its outdated radio system with a high-frequency analog system, expected to cost between \$400,000 and \$600,000. The town's current system, which dates from the fifties, generates signals too weak to pass through buildings, or to reach low areas of town. The new system, which can penetrate buildings, would guarantee coverage over 95% of the community. It will offer private channels, so that officers can exchange confidential information, and it will help strengthen signals for the town's fire department, which already uses an analog radio system.

HAPPY TALK. Women often prefer to communicate through the Internet because the anonymity eliminates many of the social constraints that often silence them, says **Rosemarie Conforti**, associate professor of media studies at **Southern Connecticut State University**. Conforti, who studies the role of computer-mediated communication in relationships, found that women feel less intimidated when they talk online, in part because of the absence of critical non-verbal signals. Online, they can express themselves more freely. The downside, though, is that women tend to feel that online relationships are more honest — this, she warns, may be simply a projection of their own feelings. Conforti, who speculates that men may use the web in completely different ways, and for different reasons, than their female counterparts, hopes to look at the way men communicate online.

GRIBBIT! GRIBBIT! CROAK! Communicating takes more energy than jumping. At least that's true for frogs. According to **University of Connecticut** ecology and evolutionary biology professor **Kentwood Wells**, who studies frog communication, the metabolism of some frog species increases by 25 times when the animal produces the noises that attract mates and scare off rivals. When a frog jumps, however, its metabolism increases by only about three times. The difference, says Wells, results from the needs of the specialized muscle tissue in the male frog's trunk.

This unusual tissue provides the force necessary for the frog to produce its distinctive mating calls. It contains more blood vessels than is typical in muscle, and each individual cell carries a higher than usual concentration of mitochondria, which provides the extra energy that the animal needs.



Education & Cognition

READ ON. Using functional magnetic resonance imaging, **Yale** researchers have found brain abnormalities in dyslexic children as young as age seven. The researchers, headed by **Yale** pediatrics and neurology professor **Bennett Shaywitz**, looked at an area on the left side of the brain that is typically highly active in skilled readers. They found that this spot is disrupted in dyslexic readers. "Dyslexic children can't use the highly specialized area that is activated in good readers and therefore don't read automatically or fluently," said Shaywitz. "Because they develop compensatory systems on the front and right side of the brain, they read more accurately over time, but remain slow readers." Dyslexia is a common disorder, affecting one out of five American children, says Shaywitz.

SELF-HELP. Alzheimer's patients may be trying to repair their own damaged brains, according to **University of Connecticut** researcher **Ben Bahr**. Bahr has found that the brain possesses a cellular repair system to help it deal with neurodegenerative diseases like Alzheimer's. The disease is caused in part by excess protein deposits inside neurons, which prevent the neurons from communicating with each other. Bahr has found that in Alzheimer's patients, there is an increase in the digestive enzymes that the body uses to destroy those proteins. Bahr's research, which involves finding ways to help the body enhance the response of these helpful enzymes, could lead to a new treatment for the disease.

TEACHING THE TEACHERS. **Central Connecticut State University (CCSU)** has been awarded a \$1 million, three-year federal grant to train elementary, middle, and high school teachers to use technology effectively in the classroom. Helping teachers become more comfortable with the modern technologies is key to enabling students to benefit from these new forms of learning. "When our students go out to the field they must be prepared not only to use technology, but also to bridge the gap between students who have great technological know-how, and those who do not," said **Ellen Whitford**, dean of the **School of Education and Professional Studies**. The grant will be used to train both prospective and current teachers.

SCHOOL DAYS. At **Yale-New Haven Children's Hospital**, a child-sized robot with a semi-spherical swivel head will be helping to bring sick kids back into the school. The teleconferencing robot, known as **PEBBLES**, allows a child in a hospital bed to observe and participate in school activities. The robot takes the youngster's place in the classroom, and, from the hospital, the youngster can use game controllers to manipulate the mechanical device. The child is able to turn the robot's head, and to zoom its digital camera in and out. The robot also has an orange translucent hand that can be raised and waved. Children can do

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

homework using a scanner-printer that allows teachers to feed assignments into a slot at one end, with the homework sent back through the other.

COUNT ON IT. An ability to distinguish between groups of different sizes seems to be hard wired into the human brain, according to **Yale** researchers. In a study headed by Yale psychologist **Karen Wynn**, scientists found that infants as young as five months were able to distinguish between groups containing different numbers of dots. This is evidence for a built-in sensitivity to numbers, which Wynn terms “a sense of enumeration.” The ability to count is built on this sense, and, combined with language skills, it is what gives humans the ability to do higher math. In adults, the number sense seems to reside in the particular portion of the brain known as parietal lobe, says Wynn. Researchers still need to determine whether infants also use the parietal lobe for enumeration.



Energy

HYDROGEN IN ABUNDANCE. Fuel cells can power everything from cars to homes. But before they can fulfill their promise, something is needed: affordable, abundant hydrogen to use as fuel. A hydrogen generator developed by **Proton Energy Systems Inc.**, of **Rocky Hill**, is one device that can provide it. The generator, explains company president **Walter Schroeder**, makes low-cost hydrogen from excess off-peak electricity and water. About the size of a dishwasher, the machine is able to produce \$10 worth of hydrogen using only \$2 of electricity. The company is already selling prototypes, and expects to have a commercial product ready in about two years. A single hydrogen producing machine sells for about \$40,000, and lasts for about 25 years, says Schroeder.

HYDROGEN AS CAR FUEL. And in **South Windsor**, **HydrogenSource LLC**, a venture backed by **UTC Fuel Cells** and Royal Dutch/Shell Group, is figuring out how to convert gasoline, natural gas, and oil into a hydrogen-rich substance on which fuel cells can run. The company also hopes to take advantage of Shell’s wide network of gas stations to become a leader in providing the technology that gas stations will need to serve fuel cell-powered cars. Such capabilities must be in place before the cars, which are not expected to be commercially produced before the end of the decade, can be widely used.

YANKEE KNOW-HOW. **Yankee Gas Services Company** is installing an additional twelve miles of gas mains in the towns of **Oxford**, **East Lyme**, **South Windsor**, and **Ellington**. The \$4.5 million dollar project is part of a \$23 million four-year expansion program that began in 2001; last year, the company added 34 miles of new gas mains in communities across the state. The expansion could aid a pair of industrial parks in Oxford. “All businesses, particularly the small ones that tend to locate in Oxford, benefit when there is an alternative source of energy available,” said Oxford official **Joe Andreana**. The company hopes for a rate increase to help recoup the costs of the first two years of the expansion program, according to a gas company spokesperson.



Environment

BEAR WITH IT. To better monitor Connecticut’s rapidly increasing black bear population, the state **Department of**

Environmental Protection (DEP) has begun trapping, marking and releasing the animals. DEP biologists have set up bear bait traps in areas where bears have been reported. The bears will be marked with numbered ear tags, so that later sightings can provide information about the bears’ population and movements. Some of the female bears will be provided with radio collars, allowing biologists to observe their habitat preferences, home range size, habits, and overall activity. The bears are most frequently sighted in northwest Connecticut.

TICK CONTROL. Connecticut homeowners may be able to control Lyme disease by marking the edges of their yards with a device that coats mice with a tick-controlling chemical. The Maxforce system, produced by **Bayer Environmental Science**, consists of black boxes containing rodent bait. To reach the food, mice must pass through a corridor containing a wick that coats them with Fipronil, a chemical used to control ticks on cats and dogs. Fipronil kills ticks that feed on the treated mice. In tests conducted by the federal Centers for Disease Control and Prevention on **Mason Island** in Groton, homes using the system had a 96% drop in ticks three years after starting the program, and the infection rate among the remaining ticks dropped from 25% to 7%. On the mainland in **Fairfield**, **Litchfield**, and **New London** counties, **The Connecticut Agricultural Experiment Station** is testing the system.

BUTTERFLY ATLAS. Volunteers from the **Connecticut Butterfly Association**, the **Agricultural Experiment Station** in New Haven and the **University of Connecticut** have compiled an atlas of the butterflies on 118 quadrants of the state. The atlas features photographs of all life stages — egg, caterpillar, chrysalis, and the colorful adults. The *Connecticut Butterfly Atlas* with its unique series of photographs will be published in the spring by the state **Department of Environmental Protection**. It should serve as a reference for butterfly watchers and for trends in butterfly populations. Because the atlas identifies butterfly habitats, it can guide habitat conservation. The work was coordinated by **Jane O’Donnell** at the University of Connecticut.

FIFTEEN-FOOT INVADERS. The giant hogweed, a poisonous plant discovered within Connecticut borders in July, bears flowers like giant versions of Queen Anne’s Lace. But the invader can grow up to fifteen feet high and has leaves up to five feet in diameter. Its sap can cause a blistering, pus-filled or itchy dark rash. Although declared a noxious weed, hogweed (*Heracleum mantegazzianum*) has been confused with the ornamental *Angelica atropurpurea* and planted inadvertently in gardens. Members of the statewide **Connecticut Invasive Plants Working Group** based at the **University of Connecticut** discovered hogweed in the state, and like workers in nearby Pennsylvania, are searching for it and hoping to eradicate the weed, already in **Cornwall**, **Trumbull**, and **Canterbury**. It can be seen at www.ecy.wa.gov/programs/wq/plants/weeds/aqua012.html.

RAIN, RAIN, GO AWAY. Pollution can decrease rainfall by affecting the tiny ice particles within cumulonimbus, or thunder, clouds, according to **Yale University** researcher **Steven Sherwood**. Sherwood looked at the effects of small airborne pollution particles, including smoke, mineral dust, and sulfates. These particles, known as aerosols, decrease the size of ice particles in the clouds. Over areas such as South America, where biomass burning occurs, aerosols have been shown to reduce ice crystal diameter by as much as 2%. The study, which relied on satellite data, was funded by NASA.

IN BRIEF

Science and Engineering Notes from Around Connecticut



Food & Agriculture

AT THE ROOT OF THE MATTER. Fungi attached to tree roots may help mitigate the effects of acid rain on some trees in the northeastern United States, according to a study whose authors include **Yale** professors **Thomas Siccama** and **Gene Likens**. The researchers, working at New Hampshire's Hubbard Brook Experimental Forest, found that tiny tunnels had been burrowed through grains of sand in the soil. The tunnels were produced by ectomycorrhizal fungi, which are able to penetrate the grains and take up calcium. The fungi, which obtain sugar from tree roots, seem able to deliver the mineral directly to the trees, which prevents it from being leached away by acidic soils. The fungi also deliver phosphorus. Trees that host these calcium-consuming fungi include conifers, beeches, oaks, and birches.

MORE PROTEIN? MORE WATER! A high-protein diet increases the need to drink water, according to research led by **University of Connecticut (UConn)** nutritional scientist **Nancy Rodriguez**. The study, which looked at five UConn student athletes, showed that as the students consumed more protein, their kidneys produced more concentrated urine, with blood urea nitrogen levels reaching abnormal ranges. The recommended daily protein intake for a person weighing 150 pounds is 70 grams; most Americans get twice the recommended amount. "Based on our findings, we believe that it is important for athletes and non-athletes alike to increase fluid intake when consuming a high protein diet, whether they feel thirsty or not," says Rodriguez. For most people, just a 2% decrease in body fluid can decrease endurance performance and cardiovascular function.

BUT COFFEE'S OK.. Although coffee's often blamed for causing dehydration in athletes, **University of Connecticut** exercise physiology professor **Larry Armstrong** believes the accusation to be unjust. While several studies have shown that caffeine is a mild diuretic, he says, there is no evidence that exercise and caffeine together will result in chronic dehydration. Armstrong found that when coffee is consumed, the body does retain some of the fluid, and that a person who regularly drinks coffee has a higher tolerance to its diuretic effect. His work looked at the effects of moderate caffeine consumption, one to four cups a day. His findings, he points out, are "contrary to the advice of most exercise physiologists." His research was funded by the National Coffee Association.

SOY AND BONE. Soy is already known to improve cholesterol levels and decrease risk of heart disease. It may also help with osteoporosis. **Karen Prestwood**, of the **Center on Aging** at the **University of Connecticut Health Center**, is conducting a study to examine the effects of soy proteins on bone density. Soy contains isoflavones, molecules that work on the same receptors as estrogen, says Prestwood, who has previously shown that low doses of estrogen have a positive effect on bone, especially in older women; she believes that soy may act the same way.



Health

NOGO BLOCKER. A team of Yale researchers led by neurobiologist **Stephen Strittmatter** has developed a synthetic peptide that allows nerve fibers to grow in damaged spinal cords in rats. Rats given this treatment have improved their ability to walk. Strittmatter had previously described a protein, Nogo, which inhibits nerve growth. The new peptide blocks Nogo from func-

tioning by binding to the Nogo receptor, and it may not only prevent, but reverse, the damage caused by Nogo. The peptide might promote growth in older injuries, explains Strittmatter, because in some cases, the damaged nerve fibers remain in place and if Nogo is blocked, they may be able to grow again. If this is true, the peptide could eventually be used to heal problems caused by brain and spinal cord injuries, by trauma or stroke, and by degenerative diseases like multiple sclerosis.

THE RIGHT ATTITUDE. Even more than your cholesterol level, blood pressure, weight, and the amount you exercise, your longevity may depend on your attitude toward old age. In a recent study, researchers at **Yale** and Miami University found that "individuals who reported more positive self-perceptions of aging demonstrated significantly longer survival than those who reported more negative self-perceptions of aging," said Yale assistant professor and lead author **Becca Levy**. The researchers looked at how 660 middle-aged Ohio men and women felt about aging in 1975, and then correlated their responses with their survival rates 23 years later. The men and women were asked about statements like "As you get older, you are less useful." The study found that those with a positive view of aging lived 7.6 years longer than their more pessimistic compatriots. For comparison, low cholesterol levels extend life span by about four years.

BIG BONED. The genes of a Danbury family with exceptionally dense bones may hold the key to successfully reversing the bone loss caused by osteoporosis. Researchers at **Yale** and the **University of Connecticut**, led by **Richard P. Lifton**, of the **Yale School of Medicine**, found that some family members have a variation of a gene known as LRP5, which builds bone in the first twenty years of life. Normally, this gene is turned off by a regulatory protein called Dkk-1. But the Danbury family has a version of LRP5 that cannot be turned off by the regulatory protein, so their bones continue to grow in density as they age. Although much work lies ahead, the researchers are starting to explore ways to develop their discovery into a treatment.

BRAIN IMAGING. With a \$7.1 million grant from the National Institute of Biomedical Imaging and Bioengineering, **Yale** researchers will develop tools that can help diagnose and treat epilepsy by observing the ongoing neurological activity in the brain. Epilepsy, which affects about 100 million people around the world, is caused by clumps of irregular tissue in the brain that spark seizures by disrupting the brain's normal signals. Usually, the disorder is treated with medication that merely attempts to control it. But if the brain's physical anomaly can be located, physicians can sometimes completely eradicate the condition using surgery. With the grant, researchers will develop advanced imaging technologies and mathematical modeling strategies that will permit doctors to "see" the brain and to locate any abnormal tissue, without opening the cranium.

TREATMENT GUIDE. Yale cardiothoracic surgeon **John A. Eleftheriades**, along with Yale colleagues, has compiled data that can help surgeons determine when to operate on a growing aortic aneurysm, and when to let it alone. Aortic aneurysms — bulges in the aorta between the stomach and the heart — often go unnoticed until they grow large enough to burst, with fatal results. But surgery involves replacing a section of the aorta with a flexible Dacron tube, and complications can range from 3 to 8%, so physicians are often reluctant to take action. The risk of rupture is apparently proportional to the size of the bulge, and Eleftheriades has found that if the aneurysm grows to the diameter of a soda can, it has a 42% chance of bursting within three years.

IN BRIEF

Science and Engineering Notes from Around Connecticut



High Technology

THE EYES HAVE IT. Using military eye-tracking technology originally developed to aid fighter pilots, **Yale** researchers found that while both autistic and normal adults swing their gaze back and forth when observing tense social situations, the autistic adults focus on mouths, while healthy adults focus on eyes. The device uses an infrared camera to track changes in eye position, allowing the researchers to see exactly what the subject is looking at. The results, says Yale psychologist **Ami Klin**, are especially intriguing because, although autistic symptoms often don't show up until age 3 or 4, normal infants learn as early as three months to look at eyes when searching for information about feelings and intentions. Klin said that his results support a theory that autism results in part from the stunting of brain development that comes from limited social input resulting from a focus on objects rather than people. Eye-tracking tests could lead to an earlier diagnosis of the disorder.

A PLANET IS BORN. A very young star discovered at **Wesleyan University** may be in the process of forming its own planets, according to Wesleyan astronomer **Bill Herbst**. The sun-like star, which has been observed for the past 6 years by Herbst, a team of Wesleyan graduates and undergraduates, and others, is about 3 million years old. (Our sun, by comparison, is 4.6 billion years old.) Regularly, the baby sun dims for about 18-day periods. During these times, astronomers believe, it is blocked from view by a large thick cloud of orbiting rocks and dust. Researchers believe that this cloud may be evolving into planets, a process expected to happen over months and years. The Wesleyan team discovered the star, KH 15D, through a 0.6m Perkin telescope on the university campus.

QUANTUM BIT. A researcher now at **Yale** and his colleagues at CEA-Saclay Laboratories in France have designed an electrical circuit that keeps a grain of superconducting aluminum containing about one billion atoms in a quantum state for about .5 microseconds — more than 100 times longer than in previous systems. The superconductivity of the aluminum circuit designed by **Michel Devoret** and his team causes all the electrons in the grain to act coherently and in concert, so that the circuit can remain in two distinct quantum states. This means that electrical current flows through the circuit in opposite directions at the same time. Such a circuit could be used as a 'bit' in a quantum computer. Typically, bits can only hold one state (on or off) at a time.

SLEEP TIGHT. Using bird songs enhanced with music and sounds imperceptible to the human ear, **Wesleyan** psychologist **Namni Goel** has found that noise, as well as light, can influence the body's circadian rhythms. In the two-year study, subjects listen to two hours of sound stimulus either before or after going to bed. Goel analyzes the effects of the stimulus by examining body temperature readings, and salivary tests for the hormone melatonin. Electrodes placed on the subjects' heads collect data on brain waves, eye movement, and muscle movement. The effects of sound on circadian patterns are similar to those of light: a two-hour bout of sound before bedtime makes subjects wake up later; on waking, it makes them rise earlier. Learning how to alter sleep patterns through sensory stimuli could mean finding another way to treat sleep disorders.

SHOCKING. Using weapons that zap suspects with 50,000 volts of electricity, police in **Guilford** and other Connecticut

towns can now subdue miscreants without hurting them. The M26 Advanced Tasar, which works at a distance of up to 21 feet, shoots out two stainless steel probes, which remain connected to the device by high voltage insulated wire. The probes, which penetrate about 1/4 of an inch into the subject's skin, deliver an electrical signal that overrides nerve impulses from the brain. This causes an uncontrollable contraction of body muscles that knocks the suspect off his feet. The device remains activated for five seconds, giving the police a chance to move in.

SEA LEVEL. At **Robert Ballard's Immersion Institute** at **Mystic Aquarium**, folks in Connecticut can check out the wildlife way over in the Pacific Ocean. A remote-controlled robot in the National Marine Sanctuary, at Monterey Bay, California, sends a live video feed to the Aquarium via the Internet. The real-time display is shown on a large screen; visitors can also use individual computer stations to watch sea creatures in their natural habitat. Ballard hopes that Monterey will be just the first of several locations that will be able to be viewed at Mystic, and, perhaps, beyond. "We are building a production facility so we can distribute what we have to other learning communities," said Ballard.



Industry & Business

STOCK BEHAVIOR. The stock market may be unpredictable — but it can be studied using mathematical theories. According to **University of Connecticut** mathematics professor **Richard Bass**, the market in some cases can be viewed as a kind of Brownian motion, a random movement which occurs when small particles are jostled continually by their neighbors. Bass has discovered that these randomly moving particles behave predictably when they collide with a boundary. No matter how that boundary is shaped, the particles tend to move perpendicular to it immediately after the collision. The stock market also has boundaries, says Bass, such as the psychological barrier of 10,000 points for the Dow-Jones average, and his theories may give insight into the market's fluctuations near such boundaries. "Many theorems in probability have applications to finance," he says.

GOOD FOR YOU. High unemployment increases mortality rates, according to a study led by **Yale** researcher **M. Harvey Brenner**. Employment, he explains, is an essential element of social status, and without it, people become susceptible to depression, cardiovascular diseases, AIDS, and many other illnesses. The study, which was commissioned by the European Union, studied historical processes concerning mortality and unemployment since World War II, and its results will be used to determine national policies relating to inflation, health services, and education. This will be the first time that fiscal economic policies will be influenced by public health implications. Brenner also looked at the effects of types of employment, finding that jobs that encourage personal interaction, have greater stability, and involved extensive use of knowledge produce better health among workers, while certain low-end jobs increase mortality.

MERCURY PHASEOUT. Legislation passed by the **Connecticut General Assembly** requires that businesses limit the amount of mercury in their products; the new laws are part of a three-year state initiative to reduce mercury contamination. The legislation requires the gradual phasing out of all mercury added products. It requires manufacturers of mercury-containing products to notify the **Department of Environmental Protection** regarding the

(See In Briefs, back page)

◆ Discouraging Terrorism: Some Implications of 9/11

This new report, issued by the National Research Council, summarizes the findings of the Panel on Understanding Terrorists in Order to Deter Terrorism, convened in early 2002 by the Center for Social and Economic Studies at the request of the Defense Advanced Research Projects Agency (DARPA) of the US Department of Defense to study “what terrorists value.”

The panel attempted to identify “the ingredients of terrorists’ mentality and situation that are positively meaningful to them and that might be deterred by threat or inducement,” and examines the question of deterrence, both its limitations and how it can be adapted to adequately deal with terrorism. The panel attempts to identify what “audiences” are critical to terrorists, and analyzes the “network mode” of organization common to terrorist groups. In addition, the panel looks at those long-term conditions (demographic, economic, political, and cultural) that are conducive to terrorist activity, and examines the ways in which these conditions can be made less favorable for terrorism.

The report offers several specific recommendations about deterrence and prevention, including increased efforts to utilize third parties; adoption of policies “directed toward distancing and alienating relevant audiences”; efforts to direct intelligence efforts at the points of most vulnerability (i.e., dependency on audience, ideological inflexibility, organizational weakness, etc.); and better preventive strategies to improve those conditions (demographic, economic, political, educational) that render societies vulnerable to the effects of terrorist organizations. In summary, the report urges a general approach that is “adaptive, opportunistic, and multisided.”

[See <http://books.nap.edu/books/0309085306/html/>]

◆ Predicting Abrupt Climate Change

A recent National Research Council report concludes that while scientists don’t have enough information to predict when abrupt climate changes will occur, they do know, from an analysis of the Earth’s history, that periods of gradual climate change are likely to include episodes of abrupt change, including severe floods and droughts and sudden changes in average temperatures.

The report recommends that the likelihood of sudden climate shifts be studied more closely, especially given the current global warming trend.

The committee that wrote the report was chaired by Pennsylvania State University’s Richard B. Alley, who has made several trips to Greenland and Antarctica, where he and his colleagues have drilled almost two miles deep into the ice to discover what the climate was like thousands of years ago.

When the climate is being forced to change — as is the case now with greenhouse gases that are warming the planet — it increases the number of mechanisms that can spark an abrupt change, the report says. To better understand these mechanisms, especially those that occur during warming trends, researchers need to improve computer models that simulate abrupt climate change. The ultimate goal should be to accurately forecast such events.

[See http://books.nap.edu/catalog/10136.html?infocus_2.1]

◆ Revamping Evaluation of Undergraduate Science, Technology, Engineering, and Mathematics Teaching

A new report from the National Research Council urges the nation’s colleges and universities to use evidence of student learning to measure teaching effectiveness in undergraduate science, technology, engineering and mathematics education. Schools should also provide faculty with ongoing teaching instruction and establish endowments to reward excellent teaching, according to the report.

Noting that both the public and private sectors have invested heavily in university research in the areas of science, technology, engineering, and mathematics, establishing “rigorous peer-review systems” to evaluate faculty research in these areas, the report observes that “In contrast, the evaluation of teaching in these fields has been haphazard and less exacting,” with those who excel in the classroom often receiving little recognition. Faculty members and administrators often believe it is impossible to “objectively gauge the effectiveness of teaching skills or the impact of departmental curricula.”

However, “fair strategies” for such evaluations do exist, and should receive greater appreciation and wider use, according to the report. “First-rate scholarship focused on improving teaching and learning also should be recognized and supported as a bona fide academic endeavor on par with top-notch research.”

Teaching and program effectiveness should be judged by the extent of student learning, a factor which is often overlooked, according to the study, and university officials must make undergraduate education in science, technology, engineering and mathematics a top priority. They should expect “teaching methods that are based on scientific evidence about how students learn best,” and should establish centers to provide faculty with professional development opportunities. Department heads should provide separate ratings on teaching, research, and service — each with supporting evidence — as components of their faculty evaluations, and external agencies and boards that certify colleges and universities for accountability should revise their policies to stress student learning as a primary criterion for program accreditation, the report concludes.

[See http://www.nap.edu/catalog/10024.html?onpi_topnews_111302]

In Briefs (continued from page 6)

amount of mercury that the products contain; it prohibits the sale of mercury added-novelty items, and most mercury fever thermometers; and it requires labeling of products to which mercury has been added.

WHAT GOES UP. Approximately 1.35 million elevators around the world are maintained by Farmington-based **Otis Elevator Co.** And when problems occur, they're handled by Otisline, a 24-hour, computer-based repair system. Otisline tracks its elevators around the clock through its REM (Remote Elevator Monitoring) feature, which continuously feeds elevator data to the Otisline centers. The computers also contain extensive operating information on each elevator that Otis services, including malfunctions, repairs, and routine maintenance.

BETTER TREATMENT THROUGH GENES. In an attempt to both foster research and encourage the development of industry, **Yale University** will invest \$200 million in a center dedicated to the study of genes and proteins. At the **Center for Genomics and Proteomics**, researchers will focus on understanding how diseases work on a molecular level. They'll look at how genes function, and at the particular proteins that the genes produce. The goal will be to better understand how diseases develop from cellular processes, and to develop molecular-based treatments. The research is expected to generate new companies; similar research at Yale has already spawned several pharmaceutical start-ups, including **Genaissance**, **Alexion**, and **Cellular Genomics**.



Transportation

HYBRID. The increasingly popular hybrid cars, which can run on both gas and electricity, offer benefits to consumers — but

can pose some problems for emergency personnel. "The difference between a hybrid and a regular car is that our hybrid has a cable that [is at] 300 volts," said **Allan Wohlstrom**, service manager at **Toyota of Wallingford**. The high voltage cable runs from a battery in the rear of the vehicle to the engine in the front. In a recent presentation at the Wallingford dealership, Toyota and Honda service technicians showed over 100 area firefighters how to safely handle such cars in an emergency, explaining which battery cables could be cut, and how to cut them, which components should be removed to disable the electrical system, and where on the car body firefighters can cut in order to reach someone who's trapped.

BACK TO THE FUTURE. Once an integral part of **New Haven's** transportation system, trolleys are again making a comeback. But, this time, they're really electric buses. Decked out in classic red and green paint, with wooden benches and brass rails and poles, the four 22-foot long vehicles were financed by a \$1.25 million federal grant, with matching funds from the city of New Haven. Officials hope that the trolleys will alleviate traffic and parking congestion downtown; the zero-emissions vehicles should also help reduce air pollution.

DRIVE TIME. Over the past ten years, the time it takes Connecticut commuters to get to work has risen by 16%, from 21 minutes, to 24.4 minutes, according to the US Census. But drivers apparently prefer spending those extra minutes on their own; during the past decade, the number of those using car or van pools has dropped by 17%, and the number of those using public transportation, like trains or buses, has remained constant.

— *Compiled and edited by Karen Miller*

Bulletin *of the* CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

179 Allyn Street
Hartford, Connecticut 06103-1422

Visit our web site at www.ctcase.org!