

Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

Volume 18,2 / Summer 2003



Activities of the Academy

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

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

"A Study of Fuel Cell Systems" (2002)

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

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

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

"Indoor Air Quality in Connecticut Schools" (2000)

"Efficacy of MTBE Use in Connecticut" (1999)

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

"Building Agricultural Biotechnology in Connecticut" (1997)

"Status of Connecticut Critical Technologies" (1997)

"Evaluation of Critical Technology Centers" (1996)

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

At the 'Next Frontier' of Biological Research: A New Center for Genomics and Proteomics at Yale

As part of Yale's \$1 billion initiative to expand its science and engineering facilities, the university announced, in the spring of 2002, the creation of a new Center for Genomics and Proteomics. The Center will focus on determining the meaning of the genes that make up various organisms, and of the proteins that are associated with them. It will study the way these genes and proteins function, and the way they interact with each other. It will look at what they do, and how to control them. The emerging fields of genomics and proteomics enable researchers to study organisms at one of their most basic levels. Ultimately, this work should lead to the ability to control what genes do, which should in turn generate new and powerful treatments for an extraordinarily wide range of human ills.

"This very new and very exciting area is the next frontier, the next direction for biological research," says Susan Hockfield, Yale provost and the William Edward Gilbert Professor of Neurobiology. "It represents a set of technologies and an approach that will become increasingly part of the standard repertoire in any of the molecular biologically inclined laboratories."

Yale expects to invest over \$200 million in the Center, to add new facilities and renovate existing ones. It will also invest an additional \$23 million to bring in new faculty, and to develop programs in these areas. The Center will allow researchers at Yale to take advantage of technologies that are just beginning to emerge.

(See Center, page 2)

News from the National Academies

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

◆ Carbon Monoxide Success Story

According to a new report from the National Academies' National Research Council, efforts to regulate carbon monoxide emissions throughout the United States have been enormously successful. Although a few areas with unique meteorological and topographical conditions still are susceptible to accumulating high levels of carbon monoxide and need to remain vigilant in controlling emissions and monitoring air quality, overall the number of monitors indicating violations nationwide has dropped dramatically. In 1971, more than 90% of locations with monitors were in violation; today, that number has dropped to just a few, on a few days, and primarily in areas prone, because of their unique features, to carbon monoxide buildup.

The report, which was sponsored by the US Environmental Protection Agency, found no need to tighten current federal carbon monoxide emissions standards on motor vehicles, and cited national emissions standards for new cars and pickup trucks, which are responsible for most carbon monoxide pollution, as the main reason for the drop in carbon monoxide levels.

Requested by Congress because of concern about the continuing vulnerability of a few locations to high carbon monoxide concentrations, the report suggests that government officials in those locales (such as cities located in basins, where atmospheric inversions combine with low winds to prevent air circulation, trapping colder air — along with carbon monoxide — near the ground) should plan for worst-case combinations of high

(See National Academies, page 7)

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

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 H. 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. Web site: www.ctcase.org. To subscribe to the Bulletin, contact us by phone, email or subscribe online at our web site.

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

Center (continued from page one)

The fields of genomics and proteomics have advanced rapidly over the past few years. "The traditional method," explains Michael Snyder, Chair of Molecular, Cellular, and Developmental Biology, and the Center's director, "was to study one gene, or a few genes, at a time."

Now, though, with complete DNA sequences — known as genomes — identified for whole organisms, and with the new techniques that are available to study them, researchers can work on thousands of genes at once.

"In order to do this, though, things have scaled up," says Snyder. And that is why Yale's Center has become necessary. This work requires expensive equipment: microarrays, mass spectrometers, and more, and the Center will make these easier for researchers to obtain. It also takes new technologies, some of which are still being developed. And, often, it takes more than one laboratory. Here, too, the Center will help, by bringing researchers together.

"These are collaborative efforts," says Snyder. "No one group has the expertise to pull off some of these projects. You'll need bioinformatics, as well as basic experimentalists in order to accomplish some of these goals."

Many Yale researchers have already begun to utilize these new techniques, says Snyder. But the Center will provide an infrastructure to make this easier for them. "We'll have a core of infrastructure and expertise that anybody can tap into," says Snyder. About 40 to 50 faculty members have already expressed interest, he says, and he expects that number to grow.

A 'Center without Walls'

The Center should have participation from faculty throughout the university. Yale is using "a bit of a different approach" than most other campuses, says Hockfield. A lot of universities have approached this, she says, by creating freestanding structures that are, in a sense, separated from the rest of the campus.

But at Yale, the Center has been configured as a "Center Without Walls." Rather than being housed in a particular building, the Center will, in essence, be located everywhere that researchers are using these technologies.

"By doing this, not only do we capture the enthusiasm and interest and potential of those who are currently working in this area, but we leave it open for other people, as their research evolves to a place where they want to make use of these technologies," Hockfield says.

The Center will be organized, explains Snyder, into four core areas: functional genomics, which focuses on analyzing what tasks each specific gene performs; chemical genomics, which looks at the way small molecules interact with genes and

(See Center, page 8)

IN BRIEF

Science and Engineering Notes from Around Connecticut



Business & Industry

CONFLICT OF INTEREST. Research financed by industry results in substantially greater pro-industry results, according to a study done at **Yale**. An examination of over 1,140 original biomedical research papers found that industry-sponsored research reached pro-industry conclusions 3.6 times more often than non-industry sponsored research. Industry support of biomedical research has increased dramatically in the past twenty years, according to **Justin Bekelman**, the study's lead author, and a fourth-year student at **Yale Medical School**. The study also found that one-quarter of biomedical researchers at universities receive funding from industry, and that about two-thirds of academic institutions have some ownership of start-up companies sponsoring research at the institutions.

MILK MONEY. Supermarkets overcharge for milk, according to studies conducted by **Ron Cotterill**, director of the **Food Marketing Policy Center** at the **University of Connecticut**. Cotterill recently evaluated the effect of the Northeast Dairy Compact, which guaranteed New England farmers a minimum price for their milk. He found that the Compact raised prices by 3 cents a gallon, but that the supermarkets raised prices an additional 14 cents a gallon to increase their own profits. Cotterill also found that when the Compact expired in 2001, farm prices fell to about \$1 per gallon, but supermarkets continued to charge consumers about \$3 a gallon.

HEALS ALL WOUNDS. The US military is an eager customer of Newington's **Z-Medica**, whose founder, **Frank Hursey**, has developed a unique way to prevent blood loss from traumatic injuries. Hursey, a former aerospace engineer who worked on NASA life support systems, based his invention on systems used to separate oxygen from other gases. **QuikClot** uses porous granules to separate the liquid and solid components of blood. Each granule contains holes just a few microns wide — small enough to absorb water quickly, but they don't pick up platelets, the components of blood that form clots. QuikClot granules come in packets that can be poured into wounds. The US military has ordered 50,000 of the packets over the past few months; the company recently added a second shift to handle the increased demand. Z-Medica donates its product to nations where land mines have injured people or where medical care is unavailable.

BIOSCIENCE IN NEW HAVEN. **Pfizer Inc.** has announced plans to build a \$35 million, 60,000-square-foot clinical research facility near **Yale-New Haven Hospital**. The facility will be used to test and monitor drugs that are under development; Pfizer researchers will work with scientists at the **Yale School of Medicine**, who will use imaging technology to track medicines as they work. Researchers will test treatments for diseases that include schizophrenia, Alzheimer's, diabetes, obesity, and osteoporosis, according to Pfizer. Construction on the new facility is expected to begin this fall; the building should open in 2005. The state sold Pfizer the 2.5 acres needed for the facility for a nominal \$1; it will turn over an additional 22 acres to the city of **New Haven**, for use by additional bioscience companies.



Communication

MISSING KIDS. In a move to help police locate missing children, over 1,000 **Southern New England Telephone Co. (SNET)** technicians have been made members of the state's **AMBER Alert System**, which allows police to send alerts about abducted

youngsters. If the system is activated, the technicians will receive a page telling them to check email messages on the laptops in their vehicles; they can then call the police if they spot a suspicious vehicle or a child that matches the description of the missing youngster. "We have 1,000 trucks on the road. They're on all the arteries in the state, including rural areas," said SNET president **Bill Blase**. According to state police spokesman **Sgt. J. Paul Vance**, child abductors often spend a few hours driving their victim to a different city, making highway observers critically important.

SPEAKING SENSE. Intelligent youngsters who speak a dialect other than Standard American English are often incorrectly diagnosed as learning disabled. That's because commonly used assessment tests can't easily distinguish between a child with a true learning disorder and one who simply speaks a dialect with its own unique grammatical structure. But it's possible to assess such youngsters accurately, according to **Valerie Johnson**, assistant professor of communications at the **University of Connecticut**. Johnson believes that tests must look at the child's ability to learn, rather than at what he or she has already learned. For example, youngsters can be asked to repeat a series of made-up nonsense words. "Research has shown that kids from minority communities who have true language disorders perform poorly on that test, while children from minority communities who are just exhibiting a language difference perform as well as their mainstream peers," notes Johnson.

HEALTH NETWORK. To reduce the burden of caring for the uninsured in New Haven, **Yale-New Haven Hospital**, the **Hospital of St. Raphael**, the **Hill Health Center**, and the **Fair Haven Community Health Center** have joined together to create the **Wellness Information Network (WIN)**. Financed by \$2 million in grants from the US Department of Health and Human Services, WIN allows the hospitals and clinics to share patient information via computer, and will eventually also link patients to primary health care services. Patients without insurance often end up in emergency rooms, and WIN can quickly provide the emergency room doctors with the health care history of such clients, so that, for example, if tests have already been performed, they don't need to be repeated. "Our physicians absolutely love the idea of knowing something about the patient," said **James E. Rawling**, executive director of community health at Yale-New Haven.

GOOD COMMUNICATION. With a five-year, \$1.4 million grant from the US Department of Education, **Southern Connecticut State University (SCSU)** will establish a program to train teachers and others in assistive technology. Assistive technology uses computers and other devices to help people with a variety of handicaps communicate. It includes both adaptive technology (designing microswitches, computer mice, software and other equipment to be used by people who, for example, may not be able to move their fingers easily) and augmentative communication, which gives non-speaking people a way to communicate (for example, supplying them with a keyboard). **Marianne Kennedy**, chairwoman of the SCSU **Department of Communication Disorders**, and **Barbara Shiller**, professor of special education and director of adaptive technology concentration, will be establishing the program.

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



Education & Cognition

BRAINPOWER. Most premature infants improve their verbal and IQ scores as they grow older, according to a study done at **Yale**. The research, which followed 296 low birth weight children from birth to age eight, found that the youngsters increased their Peabody Picture Vocabulary IQ score by eleven points, from 88 to 99. The average score for normal birth weight children is 100. Children in two-parent households, those with highly educated mothers, and those who received physical, occupational and speech therapy all showed improvement. "These are among the first results to show that the brain may recover from injury over time," said **Laura Ment**, the study's principal investigator.

KNOWING WHAT WE KNOW. Do you understand how tides work? Probably not nearly as well as you think you do, according to research by **Yale** psychology and linguistics professor **Frank Keil**. Keil has found that while people can accurately judge how well they know how to do things, such as whether they can make a particular recipe, they tend to badly overestimate their understanding of the world: of how things work, or why things are the way they are. People tend to assume that their brief insights about a subject means that they understand it fully, Keil explains. "... people extract what they need to know to get by, and confuse that success with having a much deeper knowledge ... adults and children mistake their skill at using information outside their heads with having it internally represented in their own minds." Keil recently received a \$1.3 million award from the National Institutes of Health to continue his work.

BETTER THAN THE SAT. A test that seems to predict success in college more accurately than SATs and high school grades has been developed by **Yale** psychology professor **Robert Sternberg**. The test, which has been administered to 1007 high school and first-year college students, measures creative and practical skills as well as analytical ability. "What we are trying to do is to link psychological theory to the prediction process," says Sternberg. Sternberg and his colleagues are now refining the test, making it shorter and more accurate; a later phase of development will examine its commercial viability.

CONTINENTS APART. Under the guidance of their earth science professor, **Thomas Fleming**, two **Southern Connecticut State University** undergraduates joined an expedition that traveled to Antarctica to study the way magma, oozing through long fissures in the earth's crust, influenced the disintegration of the supercontinent of Gondwanaland, about 180 million years ago. The students, along with the rest of the team, spent December and January in a tent base camp in the Antarctic mountains. They chose those months to take advantage of the Antarctic's summer, when temperatures rise to -5° F. The team's findings could help unravel the fundamental issues of how the earth works.

TEACHER TRAINING. The teacher training program at the **University of Connecticut's Neag School of Education** was lauded by the nonpartisan National Commission for Teaching and America's Future for its effectiveness in producing teachers that stay in the field. According to the Commission, rampant teacher shortages result in large part from a teacher retention problem: almost a third of all new teachers leave the classroom after three years. But among Neag graduates, about 90% stay on the job. The highly competitive school requires each of its students to have an academic major and provides extensive clinical experience including six semesters in school settings that range from urban to suburban to special education.



Energy

FAST AIR. **GE Wind Energy**, a business of Fairfield-based **General Electric**, has been tapped to provide the turbines for the nation's first offshore wind farm. The project, which is expected to supply Cape Cod, Nantucket, and Martha's Vineyard with nearly three-quarters of their electricity, will require 130 turbines, which will be located in Nantucket Sound. The turbines, which will require offshore towers rising 420 feet, will be ecologically advantageous because they produce no greenhouse gases, according to the project's supporters. The wind farm is expected to cost about \$700 million.

POWER OVERSEAS. **FuelCell Energy, Inc.**, of Danbury, will be supplying one of its Direct FuelCell generators to a Japanese manufacturing company. The 250-kilowatt generating unit will be installed at Nippon Metal Industry Co, which produces specialty steel. The unit, like all fuel cells, is able to produce electricity without combustion. When fed with hydrogen as a fuel, the overall system operates with extremely low levels of unwanted air emissions. When fed with natural gas (the most common current arrangement), the overall system does produce carbon dioxide, an inevitable result of the use of natural gas.

HYBRIDS. Hybrid cars, powered by a combination of gas and electricity, are increasingly popular in the state, according to local car dealers. "They've always been a demand vehicle," says **Steve Zion**, owner of **Toyota of Wallingford**. The hybrids, which get over 40 miles per gallon, produce little pollution compared to conventional vehicles. The cars get their best mileage in the stop-and-go traffic of cities, according to Zion. They switch back and forth between their electric and gasoline-powered engines in response to road conditions, using electricity whenever the car is idling or moving slowly.



Environment

SPRINGING UP. As a first step in protecting its vernal pools, the town of **Vernon** plans to find out where they are. These seasonal wetlands, which serve as breeding grounds for insects and amphibians, appear only in the spring, which can make them hard to find. The town has hired a soil scientist to locate the pools. First, aerial maps will be checked for visible pools. Geographically suitable areas will also be noted. Those areas can then be checked to see whether insects, salamanders, and turtles have laid eggs in the spot. Vernal pools can range in size from a few feet to a few acres.

NEW GROWTH. Accurately measuring the growth of trees in rainforests could help determine how well they can absorb carbon dioxide. **University of Connecticut** ecologist **Robin Chazdon** has been tracking the regrowth of tropical forests at four sites in Costa Rica that had previously been used as ranches. Using laser rangefinders to determine tree heights, she has found that many of the young trees grow at an extremely rapid rate. One of the youngest forests is growing an average of 1.5 meters a year, and some trees within the sites are growing 3 meters annually, she says. Chazdon also looks at basal area — the sum of the cross-sections of the trees — and their biomass, or volume. "There's a lot of interest globally in whether forests are taking up or releasing carbon," she says. "These forests are growing so quickly, they are very important for removing carbon from the atmosphere."

BEARY INTERESTING. The state's bear population has exploded from an estimated 100 animals last year to "more than a couple of hundred," according to **Paul Rego**, who oversees bear-monitor-

IN BRIEF

Science and Engineering Notes from Around Connecticut

ing work at the **Department of Environmental Protection (DEP)**. The DEP tags and monitors bears; females are radio-tagged, so that they can be located at any time. As Connecticut's forests age, bears are finding it easier to find suitable habitat. While most of the state's bears are currently found in **Litchfield** and **Hartford** counties, the animals are spreading east. Due to their every-other-year breeding pattern, Rego expects another jump in the young adult bear population in 2004.



Food & Agriculture

IRRADIATED BEEF. The **Stop & Shop Supermarket Co.**, with 75 stores across the state, has begun offering irradiated ground beef to its customers. Irradiation involves treating the food with beams of concentrated electrical energy; advocates believe that irradiation makes the food safer by killing harmful bacteria like *E. coli* and salmonella. Some consumer groups, however, argue that because the irradiation process produces new, unknown chemicals in the meat, its long-term effects need to be studied further. The irradiated meat, which will cost slightly more because of the extra processing, will be clearly labeled, according to company officials.

BONE DENSITY. Smoking is always bad for your bones, but alcohol and caffeine could, in some circumstances, help make them stronger. According to a study of 136 women conducted by **University of Connecticut** professor of allied health **Jasminka Ilich-Ernst**, the bone mineral density of former smokers always showed some deterioration, no matter how long ago the women had kicked the habit. Caffeine and alcohol, though, had both good and bad effects. Caffeine seems to diminish bone density, particularly in women with low calcium intake, but it also contains beneficial minerals, such as magnesium. And while large amounts of alcohol can poison bone cells, small amounts stimulate the metabolism of estrogen, which is beneficial for bone health, the heart, and memory function.

GARLIC POWER. Do you know which vegetable has most increased in popularity over the past decade? The answer is garlic. About 3.1 pounds of it is now consumed annually per person, according to the US Department of Agriculture, and, due to the increased demand, garlic production nationally has doubled. There's a demand for organic garlic, as well, like that grown in **Woodbury** by farmer **Joshua Rapport**. At his **Sacred Organics Farm**, Rapport grows 27 varieties of garlic, including hardneck, softneck, and elephant, and plans to add more. Last year, he harvested about 1,000 pounds of the bulbs.

ALL IN YOUR MIND? As most dieters know, the sight or smell of food can often entice people to eat, even if they're not hungry. A small molecule known as ghrelin may be responsible, according to **Yale** researcher **Tamas Horvath**. Horvath and his team found that ghrelin, which induces food intake, is expressed in the brain as well as produced in the stomach. It may be part of the pathway that allows information coming from outside the body to stimulate the appetite. "We believe that these neurons are conveying information regarding ... sensory cues as well." These brain ghrelin neurons, he says, may be what "enable these brain processes to dominate over the actual need for energy intake."

... BUT IT MAY NOT MATTER. Severely restricting calorie intake increases life span. But simply decreasing the activity of a single enzyme may accomplish the same thing without the need to eat less, according to researchers at the **University of Connecticut (UConn) Health Center** and the **Yale School of Medicine**. Building on earlier studies that identified a mutated

gene that extended life spans in fruit flies, **Stewart Frankel** of Yale and **Blanka Rogina** and **Stephen Helfand** of UConn, found that the enzyme Rpd3 histone deacetylase is key to the gene's effects. "Rpd3 is part of the pathway through which caloric restriction works ... once caloric restriction is induced, Rpd3 appears to act as a regulator of life span extension," explains Helfand. The researchers hope to find drugs that can inhibit Rpd3; some medications already exist that affect the enzyme.



Health

BREAST CANCER PREVENTATIVE. A study now underway at **Yale** and other centers is looking at how well Raloxifene (Evista), a drug commonly used to treat osteoporosis, protects women from breast cancer. In an unrelated study, researchers noticed that women taking Raloxifene (Evista) developed breast cancer less frequently than women taking a placebo. Now, the drug is being tested against Tamoxifen (Nolvadex), which has been used to prevent breast cancer for over two decades. The researchers hope to determine which drug is more effective in preventing the disease. They are comparing the ability of each to protect against invasive breast cancer in women who are at risk for the disease. The study hopes to follow 22,000 post-menopausal women around the country over a five-year period.

KILLING CELLS. A new approach to treating ovarian cancer is undergoing clinical trials at the **Yale School of Medicine**. The drug, Phenoxodiol, kills cancer cells by unblocking their death receptors. Associate professor **Gil Mor**, one of two researchers who will lead the trials at Yale, says Phenoxodiol seems to be able to induce cell death in ovarian cancer cells that do not respond to other treatments; the Phase Two trials will gather data on the drug's effectiveness. The trials will consist of intravenous injections of the drug two days a week for 12 weeks. Ovarian cancer is often fatal because, due to lack of symptoms, the disease is rarely detected until it is well advanced. It is the fourth leading cause of cancer deaths in women.

PREDICTING DEATH. Functional impairment is a key factor in predicting whether an elderly person will die within one year of a hospitalization, a **Yale** researcher has found. While most systems predicting survival rate look only at diagnoses, medicine and geriatrics professor **Sharon Inouye** has developed an alternative, the Burden of Illness Score for Elderly Persons, which also takes into account the ability of patients to care for themselves. "Functional impairment is an even more important determinant of outcome than diagnoses," says Inouye. Inouye's system looks at factors that include high risk diagnoses, dementia, and walking impairment. Her study forecast the outcomes for 525 patients from one university hospital, and performed more accurately than other predictive systems.

EXERCISE, AGAIN. A **Yale** study of 173 post-menopausal women found that 195 or more minutes of moderate exercise per week reduced an important measure of fat by 6.9% over the course of a year. The study found that while weight loss was minimal, intra-abdominal fat was substantially reduced. Regardless of total body fat, intra-abdominal fat is associated with insulin resistance, type 2 diabetes, hypertension, cardiovascular disease, and some cancers. According to **Melinda Irwin**, the study's lead author, and an assistant professor at the **Department of Epidemiology and Public Health** at the **Yale School of Medicine**, exercise may also counteract some of the aberrant metabolic processes associated with such fat.

BETTER THAN COFFEE? Interactions between the neurons responsible for keeping people alert have been discovered by

IN BRIEF

Science and Engineering Notes from Around Connecticut

researchers at **Yale**. These hypocretin neurons, which are located in the part of the brain that regulates food intake and biological rhythms, “have the ability to excite each other at a cellular level,” according to neurosurgery professor **Anthony van den Pol**, the study’s senior author. “It’s like turning on the ignition in a car, that in turn activates a number of different automobile circuits.” The neurotransmitter hypocretin stimulates these cells, while the neurotransmitter norepinephrine inhibits them. This research, says van den Pol, may lead to ways to help facilitate the performance and cognitive state of people who have to work long or unusual hours.

HELP FOR SMOKERS. A drug which is used to treat Parkinson’s disease could also help smokers kick the habit, according to a study done at **Yale**. The drug, selegiline hydrochloride, treats Parkinson’s by increasing dopamine levels in the brain. It may serve as a kind of substitute for smoking, which also increases dopamine levels. The Yale study focused on difficult-to-treat smokers who are unable to quit using conventional approaches like nicotine replacement. Dopamine is affected by a component of cigarette smoke other than nicotine. The research, which was conducted by **Yale School of Medicine** assistant professor **Tony George**, found that abstinence rates were significantly higher among those taking selegiline than among those in the control group.



High Technology

HELP FOR DIABETICS. A device that could allow diabetics to track their blood sugar levels without the need to draw blood has been developed by **Janusz Buchert**, founder and president of **Infratec Inc.**, in Wilton. The non-invasive device takes advantage of the discovery that the body’s natural mid-infrared heat emissions fluctuate, depending on glucose concentration in the tissue. The monitor measures infrared emissions in the ear, and a test done at the **University of Connecticut Health Center** found that this method produced measurements that were within a clinically acceptable range. Infratec hopes to develop a portable, cell phone-sized device that can be sold to the public; clinical trials are expected to begin within the next two years.

CRIME STOPPER. Using software developed by **University of Connecticut** economics professor **Stephen Sacks**, police departments around the state can quickly determine the most efficient way to deploy their officers. The software can calculate the minimum number of patrol cars needed to meet certain criteria, display where and when crimes have been committed, and help planners design and evaluate patrol districts. The work is similar to economics, says Sacks, because both involve finding the best way to allocate scarce resources. Sacks is currently working with departments around the state, including those in **New Britain, Bloomfield**, and the **Capital Region Council of Governments**.

EASY VOTER. To comply with recently instituted federal requirements, Connecticut will replace its traditional lever voting machines with ATM-style electronic touch screens. The switch will be made by 2006. The new machines, which will ask voters to verify their ballots before their votes are recorded, have the advantage of allowing voters to check their votes, and even change their minds. The machines should also make voting easier for the disabled. The state is considering several types of voting machines, and **Secretary of State Susan Bysiewicz** hopes to give the possibilities a field test, letting three Connecticut towns each try different machines.

MOVING ON. A study done in part at **Waterbury Hospital** has led to the FDA approving ceramic-on-ceramic replacement hip joints.

The very durable ceramic joints last up to 50 years; conventional hip implants, which are made of titanium and plastic, can wear out in as little as ten. The ceramic hips have other advantages as well, according to **Kristaps J. Keggi**, a Waterbury orthopedic surgeon who performed operations for the study. Ceramic does not cause the same risk of blood contamination as the titanium hips, he says. “Ceramic wears much less, and when it does wear, the particles it gives off are so small that they are carried away from the area by the blood.” The larger particles that flake from conventional implants can cause bone to dissolve.



Transportation

BAGGAGE CHECK. All checked bags at **Bradley International Airport** are screened for explosives via computer tomography x-ray scanners — the same CAT scan devices used for medical imaging. The luggage is checked as it travels on conveyor belts past the truck-sized machines. If the scanners find bombs, they generate a three-dimensional picture of the explosives on a color monitor, highlighting them in red. Such searches of checked baggage are now required by federal law, and the million-dollar scanners work far more quickly than alternative methods, such as trained dogs.

PLANE TRACKS. A radar system aimed at preventing collisions on the ground will be installed at **Bradley Airport** later this year. Currently air traffic controllers manage ground traffic through a system that depends on pilots and controllers visually and verbally communicating aircraft locations on runways, taxiways and ramp areas. This means that the pilots must be able to report their exact location, which can be problematic if, for example, the pilot is unfamiliar with the airport, or if poor weather obscures runway signs. With the new Airport Surface Detection Equipment (ASDE-X), controllers will be able to monitor traffic on the runways more reliably. The ASDE-X system includes radar signals sent from the top of the control tower, and ground-level sensors which identify planes using signals from a transponder. Transponders also send data about each plane’s speed and location. If two planes or vehicles are on a collision course, the system alerts controllers.

STREETWISE. In an effort to make **Hartford** a more livable and appealing city, Hartford officials have arranged for the help of a “traffic calmer.” **Dan Burden**, who has slowed traffic in other cities, including Seattle and Honolulu, will be showing officials how to redesign city streets to make them safer as well as more appealing. For example, traffic could be forced to move more judiciously if planners narrowed roads, extended curbs, or added bike lanes. Hartford was recently listed as the 29th most dangerous city for pedestrians in the country; city planners have come to realize that for modern cities to succeed, they need not only convention centers and hotels, but streets that seem hospitable to those who live there.

CHANGING DIRECTIONS. Contrary to popular belief, more commuters travel from homes in New York to jobs in Connecticut than the other way around. According to the latest statistics from the **Connecticut Department of Transportation**, in June of 2001, an average of 16,900 vehicles moved south on I-95 during the morning commute, while an average of 22,200 vehicles flowed north into Connecticut. This pattern holds true for train ridership as well, with the number of people traveling into Connecticut increasing by 192% since 1985. Analysts say that the trend reflects the fact that more jobs are located in the state than in neighboring areas. The reverse commuting trend also appears on I-95 to Rhode Island, and on I-91 to Massachusetts.

—Compiled and edited by Karen Miller

News from the National Academies (continued from page 1)

emissions and atmospheric inversions. Local measures such as vehicle inspection and maintenance programs that target high-emitting cars and pickups; the use of cold weather engine-block heaters that reduce the time before a vehicle's emissions-control catalyst is fully functional; and the use of low-sulfur gasoline that improves catalyst efficiency are recommended. The report also recommends that federal and state assistance be provided to help implement such measures.

[http://www.nap.edu/catalog/10689.html?onpi_topnews_042303]

◆ Not Too Late for the "Big Dig"

It is not too late to make management and organizational changes to the nation's most expensive public works undertaking — Boston's Central Artery/Tunnel project, known as the "Big Dig" — that will save money and shorten the time to completion, says a new report from the National Academy of Engineering and the National Research Council. The most important step, according to the report, is expediting the processing of about 3,500 disputed payments to contractors and approved changes to design and construction contracts, a steadily growing backlog that promises more delays and cost overruns if left unresolved. In addition, the report recommends developing a process to make the transition from construction to operation and maintenance; this process should include an aggressive plan to retain only those staff consultants who are essential for finalizing and closing out all contracts and claims.

The Central Artery/Tunnel project was conceived to improve traffic flow through downtown Boston, link several major roadways and transportation hubs, and replace a badly deteriorated elevated highway. So far, the 7.8-mile system of bridges and underground highways and ramps has exceeded the original cost estimate of \$2.6 billion by \$12 billion and is projected to be completed in 2005, seven years late. Project planning began in 1982, ground was broken in 1991, and the first major portion — the Ted Williams Tunnel beneath Boston Harbor — opened in 1995.

The National Academy of Engineering study was initiated in August 2002 at the request of Massachusetts Turnpike Authority, which was assigned oversight of the project in 1997 by the state legislature, to obtain an independent assessment of management and contract administration practices. The committee focused on the future — what could be done to complete the project. It only considered past performance, cost and schedule escalation, and financing plans as they might affect future performance.

[http://www.nap.edu/catalog/10629.html?onpi_topnews_022503]

◆ Dramatic Decline in Ocean's Largest Fish Species

The biggest fish species are disappearing from the world's oceans, according to a study published in the May 15 issue of *Nature*. Halibut, tuna, cod, swordfish and marlin populations have decreased by 90% over the last 50 years, after the beginning of industrial fishing, the report says. The report's authors suggest that longline fishing — in which lines are trailed up to 60 miles behind a boat — is one of the leading causes of this rapid decline. The lines can use thousands of hooks, indiscriminately catching a wide variety of species.

The authors offer several solutions, including improving fishing technology to reduce the amount of fish caught unintentionally and killed as waste. They also suggest declaring certain fishing areas off-limits long enough to allow the populations of affected

fish to rebound. Marine Protected Areas: Tools for Sustaining Ocean Ecosystems, a 2001 report from the National Academies' Ocean Studies Board, calls for a national system of protected marine areas to overcome the shortcomings of conventional marine-conservation practices, which usually focus on protecting individual species rather than entire marine ecosystems.

Another Ocean Studies Board report, "Effects of Trawling and Dredging on Seafloor Habitat" (2002), describes how gear type, number and location of bottom tows, and the physical and biological characteristics of seafloor habitats all affect the impact of commercial fishing on ocean ecosystems. Finally, the 1998 Ocean Studies Board report, "Sustaining Marine Fisheries," recommends that fishery managers develop policies aimed toward substantially reducing fishing to restore fish populations and protect ecosystems. Additionally, management plans should include not only commercial fishing but also recreational and subsistence fishing, and should protect more coastal and ocean areas.

[<http://www.nationalacademies.org/headlines/#sh0516>]

◆ Food Safety Standards and Public Health

Federal and state food safety criteria need to be clearly linked to specific public health goals, and should be established using the latest scientific tools and methodologies, according to a new report from the Institute of Medicine and the National Research Council of the National Academies. Current food safety criteria have been pieced together by different agencies over many decades, in response to problems and concerns as they arose. The report, which was sponsored by the US Department of Agriculture (USDA) and the Food and Drug Administration (FDA), concluded that with the technology now available, these criteria, which include performance standards for food producers, can be clearly correlated to specific public health objectives.

The committee praised recent efforts by the USDA, FDA, Centers for Disease Control and Prevention, and state health departments to develop and integrate disease monitoring and surveillance activities through the national FoodNet network and other means, and urged that periodic, systematic microbiological sampling be carried out on foods commonly associated with foodborne illness at various points along the entire farm-to-table continuum. The report recommends that Congress both allocate funds to build and maintain centralized databases to store this information, and require the development of a national plan to integrate the information gathered through food sampling with public health agencies' surveillance data. Congress also should ensure that the agencies have the administrative flexibility to efficiently update the criteria as better technologies and methods for testing and improving safety become available.

Specific recommendations include requiring labels warning consumers of the potential harm from not properly cooking the product (current labeling recommends safe handling procedures) as well as labels on cheeses made from unpasteurized, or "raw," milk. The committee also recommended all sales of raw milk — which is currently permitted to be sold only within states where it is produced — be banned. The report urges the FDA to take steps to increase the understanding and application of its comprehensive guide for seafood safety in international commerce of fish and shellfish to ensure that safety hazards are properly detected and addressed prior to shipment. All imported produce should be expected to follow the same or equivalent safety practices required for growing and harvesting domestic produce.

[<http://www.nap.edu/books/030908928X/html/>]



Michael Snyder is the director of Yale's Center for Genomics and Proteomics. [Photo: M. Snyder]

proteins; medical genomics, which focuses more on medical applications; and bioinformatics, which uses computer technology to make sense out of all information generated in the laboratory.

One goal, says Snyder, is not only to do cutting edge research in these areas, but to stimulate the development of new technologies that will allow the research to advance even farther.

Recently, the Center awarded its first round of pilot grants. Out of 37 proposals, seven were selected, and given a total of \$300,000 in funding. "We chose those that seemed most likely to grow into their own larger scale genomic program," said Sherman Weissman, Academy member and Sterling Professor of Medicine and Genetics at the Yale School of Medicine, and the Center's co-director. These projects, Weissman explains, "represent either extending genomics to different organisms, or totally different aspects of broad scale analysis."

An expanded version of this article is available online at www.ctcase.org/bulletin/genomics.html

Indeed, in addition to further developing techniques that will help in the genomic and proteomic analysis of such model organisms as arabidopsis plants and fruit flies, the pilot grants will fund a project that will profile phospholipids — the fats that help form cell membranes — in different functional states.

The Center's goals are far-ranging and ambitious, admits Snyder. But he believes that they can be achieved. "There's so much interest in this whole area," he says. Already, the Center has accomplished much: its activities range from the new grants, to holding monthly meetings that foster interactions among its participants, to sponsoring a DNA day at the Peabody Museum.

The Center's biggest contribution, says Snyder, will be in "promoting the development and access of these advanced technologies, at all levels." That's broad, he says. "But that's really what it's going to do." — **Karen Miller**

[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.]

Visit our web site at www.ctcase.org

PRESRT STD
US POSTAGE PAID
PERMIT 16
CENTERBROOK, CT

Bulletin of the
CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING
179 Allyn Street
Hartford, Connecticut 06103-1422