

Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



1976

Volume 20,1 / Spring 2005

"... the potential to make man bionic"

Biomedical Engineering in Connecticut

We can rebuild him. We can make him better, stronger, faster..." For people over 30, these words may evoke memories of television's Six Million Dollar Man. However, for people working in today's biomedical engineering (BME) disciplines, it might be considered a mantra.

What is BME?

One of the youngest and fastest-growing engineering fields, (particularly among women), BME combines engineering design expertise with medical or biological science. Enter the words "biomedical engineering" in an Internet search engine and more than a million entries appear.

The Tufts University website (<http://ase.tufts.edu/biomedical/about/discipline.asp>) lists a number of specialties within BME including:

- > **biotechnology:** creating or modifying material for beneficial ends, including tissue engineering
- > **physiologic modeling, simulation and control:** using mathematical and physical modeling and computer simulation to understand physiologic relationships
- > **biologic effects of electromagnetic fields:** studying the effects of electromagnetic fields on biologic tissue
- > **biomechanics:** studying static and fluid mechanics associated with physiologic systems
- > **biosystems:** integrating biology, bioinformatics, complex systems analysis, in silico biology (use of computers to simulate or analyze a biological experiment)
- > **biomedical instrumentation:** developing biosensors to detect, monitor and measure physiologic events
- > **medical imaging:** providing graphic displays of anatomic details and physiologic function
- > **prosthetic devices and artificial organs:** designing and developing devices for therapeutic replacement or augmentation of bodily function
- > **rehabilitation engineering:** designing and developing therapeutic rehabilitation devices and procedures
- > **ergonomics:** applying scientific knowledge to the design of devices, objects

(See Biomedical, 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 online at www.infocusmagazine.org.

◆ Hold Complementary and Alternative Therapies to Same Standards as Conventional Ones

A new report from the Institute of Medicine recommends that complementary and alternative medical treatments be held to the same standards as conventional treatments for demonstrating clinical effectiveness. The same general research principles should be followed in evaluating both types of treatments, although innovative methods to test some therapies may have to be devised, according to the report.

The committee noted in particular the growing popularity of dietary supplements as well as the lack of consistency and quality in these products, which are an important component of several

(See National Academies, page 7)

In Memoriam: D. Allan Bromley (1926-2005)

One of the world's leading nuclear physicists, D. Allan Bromley, died February 10 at age 78.

The first person to hold the Cabinet-level rank of Assistant to the President for Science and Technology, Bromley served from 1989 to 1993 under George H.W. Bush. He oversaw a five-fold increase in both the staff and budget of the White House Office of Science and Technology Policy, which he directed during this period; chaired and revitalized the Federal Coordinating Council for Science, Engineering and Technology; and achieved an unprecedented level of cooperation and communication among the more than twenty federal agencies that support US science and technology.

He was founder and director of the A.W. Wright Nuclear Structure Laboratory at Yale from 1963 to 1989, where he carried out pioneering studies on both the structure and dynamics of atomic nuclei. He was considered the father of modern heavy ion science, a major field of nuclear science. His laboratory at Yale graduated more doctoral students in experimental nuclear physics

from 1965 to 1989 than any other institution in the world. He received numerous honors and awards, including, in 1988, the National Medal of Science, the highest scientific honor awarded by the United States.

A leader in the science and science policy communities locally, nationally and internationally, Bromley was a founding member of the Connecticut Academy of Science and Engineering. He always gave of his time when asked to guide and assist the Academy's work, contributing to several important in-depth studies conducted for state agencies; helping the Academy and the state create the Connecticut Medals of Science and Technology, chairing both the first and the most recent Awards Selection Committee for those awards; and helping guide the Academy's Initiative for Science and Technology, which is focused on engaging more youths in science and technology related activities. His work will have a lasting impact on Connecticut's science and technology programs. He will be deeply missed by his friends and colleagues at the Academy.

Biomedical (continued from page one)

and environment for human use

- **medical informatics:** analyzing patient data, interpreting results and assisting in clinical decision making, including expert systems and neural networks
- **clinical engineering:** designing and developing clinically related facilities, devices, systems and procedures

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** ◆

The Connecticut Light and Power Company
Pfizer

◆ **Contributing Patrons** ◆

Pitney Bowes
Schlumberger-Doll Research
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

Michael J. Werle, President
UTC Office of Science and Technology (ret.)

Alan C. Eckbreth, Vice President
Consultant & United Technologies Research Center (ret.)

Gale Hoffnagle, Secretary
Senior Vice President and Technical Director, TRC Companies Inc.

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.)

Edward Monahan, Executive Editor - Science
Director, Connecticut Sea Grant College Program
Professor of Marine Sciences, Professor of Resource Economics
University of Connecticut

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@ctcase.org. 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

- **bioengineering:** applying biology, engineering and clinical sciences skills to the fields of life science and health care delivery.

Why is BME important?

According to Neil Yeston, vice president of academic affairs at Hartford Hospital, BME offers tremendous potential for improving quality of life. Yeston identified three areas he calls "the greatest examples of the promise BME holds for the future": robotics, imaging technology and genomics.

Yeston predicts that the most promising application of robotics technology will be its role in precise, minimally invasive and more efficient surgery. Robotic systems like Hartford Hospital's daVinci Surgical System® allow all instrumentation within the patient to be placed remotely, provide surgeons with magnified views that are more precise than those available using current surgical binocular loops, and eliminate even the slightest tremor in a surgeon's hand.

New imaging technology is replacing invasive diagnostic procedures with safer, more rapid techniques. "When CAT scans emerged in the 1970s, a typical abdominal diagnostic test took 45 minutes," Yeston said. "Today, a similar procedure takes only seconds and provides better imaging and new capabilities."

And Yeston looks to another exciting future application: genomics. "While the media has focused on genomics as a tool to clone an ideal individual or modify genes, for me, its most promising application is in providing ideal preventive therapy," Yeston said.

Hartford Hospital is partnering with Hartford-based Genomas to develop technologies that offer the potential to individualize the prescription of medicine. "Consider what these technologies could do for patients who need high cholesterol medicine as just one example," Yeston said. "One patient might require four times as much as another patient because each person's genetic make up is different. Emerging technologies will allow doctors to immediately prescribe the exact amount of medicine each patient requires."

BME also holds tremendous potential for the US economy. The United States leads the world in this sector, with annual American exports of medical device and biotechnology products currently exceeding \$6 billion.

What's going on in Connecticut?

According to the Connecticut Business and Industry Association (CBIA), the number of biosciences companies in the state has grown from four to 40 in the last 10 years. The industry is being fostered by Connecticut nonprofits, healthcare organizations, academia and industry.

Academy member Joseph D. Bronzino heads the Hartford-based Biomedical Engineering Alliance and Consortium (BEACON), a nonprofit trade association comprising academic, clinical and corporate partners. The organization is dedicated to developing and commercializing new medical technology, including BME.

"We want to foster an environment in Connecticut that encourages collaborative research, stimulates industrial partnering and facilitates the creation of new medical technology, companies and jobs," he said. "To accomplish these goals, we provide BEACON members with access to expertise and resources within our network."

Tom Ellen, chief executive officer of Vivax Medical in Torrington, is a member of BEACON. Vivax, a startup company, develops non-invasive medical devices that offer care advantages to patients and caregivers with a simultaneous potential for dramatic decreases in healthcare costs. For example, the company has developed a

(See Biomedical, page 8)

IN BRIEF

Science and Engineering Notes from Around Connecticut



Business & Industry

NATURAL HEDGE. In North America, the growing demand for natural gas is outpacing supply, leaving most experts to believe that the import and storage of liquid natural gas (LNG) is the only way to head off huge shortages in the future. And that's why the \$50 million LNG storage unit currently being built by **Yankee Gas Services** in **Waterbury** is getting a lot of attention. It is the first of its kind to be built in the state in three decades. This facility, explained Yankee's director of gas management, **Marc Andrukiewicz**, will allow the company to buy imported natural gas when prices are low and store it, once it has cooled to liquid form. Then, during cold spells, when demand and therefore prices are high, they can warm it back to its gaseous form and inject it into the system.

VISITING PROFESSORS. To promote increased scientific interaction and understanding, **Pfizer** and **Yale** have launched a novel "visiting professor" pilot program, developed and sponsored by Pfizer's **Discovery Laboratories** in Groton, the **Women Leaders Network** at Pfizer and the **Office for Women in Medicine** at Yale. The program kicked off with the award of the first professorship to Yale researcher **Nita Maihle**, who will join the Pfizer research team for 12 weeks. Maihle is a professor in the **Department of Obstetrics & Gynecology and Reproductive Sciences**, as well as in the **Departments of Pathology and Pharmacology**. Affiliated with the **Yale Cancer Center**, she has spent much of her career trying to identify and understand the causes of cancer. Said Pfizer researcher **Karen Houseknecht**, "Dr. Maihle not only brings her scientific expertise to the lab, she serves as a role model for women in science, which is something we value at Pfizer." Yale faculty will also gain a better understanding of the drug discovery process.

BRADLEY SOARS. **Bradley International Airport** has reported the first year-to-year profit (7.53%) since 2000, reversing the downward trend in air travel precipitated by September 11 and its aftermath. The airport's marketing director gave several reasons for the reversal, listing the return of consumer confidence as the most important one by far. Others include the rebound of national air travel, competition between airlines, new flights added by Delta and its Song affiliate as well as the introduction last year of Independence Air, a new, low-fare airline.

INDUSTRIAL FIZZ. Danbury-based **Praxair** may have a small presence in Connecticut (only 500 of its 25,000 employees worldwide live here), but the company is holding its own in a very competitive industrial gas marketplace. Key indicators of profitability, like net income (up 70% since 2000), net margins, return on capital and return on equity have posted "healthy gains," according to CEO **Dennis Reilley**. Although Reilley attributes much of his company's fortune to strict fiscal discipline and long-term contracts, he also predicts that three new markets could add "fizz to Praxair's bottom line." They are oil refining (hydrogen), home health care (oxygen) and China (multiple gases).



Communication

GAMING CELLS. "It's wild what's happening," said **Phil Taksen**, president and CEO of **Venan Entertainment** in Middletown, as he tries to explain the phenomenon of mobile gaming or game-playing on cell phones, one of the fastest growing uses for the small portable handsets. He said the appeal is broad, from "college students to soccer moms to traveling businesspeople." They simply

download a mobile game directly to their phone for a cost of \$2 to \$7. Energized by a whole new generation of cell phones with bright flashy screens, powerful computer chips and longer-lasting batteries, the market's potential for growth is enormous.

ONLINE RITUAL. For many who live in **Westport** or a surrounding Connecticut town, reading WestportNow.com has become a new daily ritual. It's a website, updated daily, that offers local features and columns, traffic and weather reports, board meetings, sports events and lots of photographs. Said **First Selectwoman Diane Goss Farrell**, "Everyone takes it very seriously. It's become an institution so quickly..." **Gordon Joselof**, a former television news and wire-service reporter, started the website in 2003 and keeps it going with a small staff; he also serves as moderator of Westport's Town Meeting, which makes him privy to all kinds of town happenings. Joselof considers the venture not only a "community service and digital record of town history" but also "an early stake in a potential boom market" — online community journalism.

FAST AND WIRELESS. "Anywhere that a cell phone works within its high-speed coverage area," said Verizon Wireless about its new wireless broadband service, "the Internet service should work as well." The service in question, called "BroadbandAccess," provides customers with unlimited wireless access to high speed Internet service (as fast as the wired versions). Locally, it's now available in **Greater Hartford, Greater New Haven, Fairfield County, Bradley International Airport**, both shoreline casinos, as well as Greater Boston and Providence. Verizon Wireless spokesman David Thomson said the company had been "investing heavily" in upgrading its network of cell towers to enable incredibly fast data transfers. Although, other wireless carriers, such as Sprint and Cingular, are also upgrading their networks, they have yet to catch up to the connection speeds (300 to 500 kilobits per second) claimed by Verizon Wireless.



Education & Cognition

CONNECTICUT COLLEGE OF TECHNOLOGY. **Karen Wosczyzna-Birch**, state director of the **College of Technology**, will provide leadership and direction for a \$3 million, four-year project funded by a grant from the National Science Foundation to establish a **Regional Center for Next Generation Manufacturing under the Connecticut College of Technology**. The goals include development of recruitment and retention strategies for attracting a diverse population into science, engineering and technology career paths and facilitating development and implementation of new courses and programs in laser manufacturing and alternative energy sources. Special topics will cover lean manufacturing and digital manufacturing. Collaborators will include industry, government agencies and the twelve community colleges with the six four-year state colleges as well as the technical high school system. The College of Technology has expanded to include two Associate of Science degrees that encompass over eleven engineering technology options, including biotechnology, plastics, lineman technician, industrial diagnostics, integrator technician, waste water and photonics.

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@ctcase.org

IN BRIEF

Science and Engineering Notes from Around Connecticut

NORTH END ARTS. The **Green Street Art Center** in **Middletown** officially opened this year with the launching of its new after-school arts program for kids in grades 3-12. The program includes homework help from **Wesleyan** students and a daily arts-related class of poetry, painting, dance or drumming. As was the goal, most of the 50 children enrolled in the program so far live in the city's north end, within blocks of the center. Most receive financial assistance or complete scholarships to cover the \$1500 per semester tuition. **The North End Action Team** was instrumental in helping the center reach out to neighborhood kids. In the future, the center hopes to entice a small number of families beyond the North End to join as well. The Art Center will soon be offering a series of daytime classes for seniors and young children.

BREAKTHROUGH WOMEN. The exhibit, *Great Women, Great Science*, which will be open through April 10 at the **Bruce Museum of Arts and Science** in Greenwich, does more than showcase the considerable scientific accomplishments of four early pioneer women of science. It also documents what each of these early 20th century women had to go through to get recognition for themselves as scientists and for their breakthrough discoveries. The original idea behind the exhibit, said **Carolyn Rebbert**, curator of science, was to convince young people, both male and female, to pursue careers in science.

CET DEGREE. "The new four-year CET [computer engineering technology] program will prepare students to acquire a wide range of skills needed to adapt themselves to the rapidly growing components of high-tech industry," said **Connecticut Commissioner of Higher Education Valerie F. Lewis**. Students who enter the bachelor of science degree program at **Central Connecticut State University's School of Technology** will be trained for positions such as system designer, network administrator, quality control engineer and software developer. Students graduating from community college with an associates' degree in the field should be able to transfer credits easily into the four-year degree program.

THE RIGHT STUFF. The **Capital Preparatory Magnet School**, scheduled to open next fall at **Capital Community College** in downtown Hartford, is looking for motivated, self-driven students who want a tough, college-preparatory high school experience. The school, which is one of eight new magnet schools in Hartford, hopes to draw half of its 220 students from Hartford and the other half from surrounding areas. "It is by design rigorous," said **Steve Perry**, one of the school's planners. "We make no bones about it. If you don't want to do a lot of homework, if you don't want to go to school in the summer, if you don't want to wear a uniform – then this is not the place for you."

CHEMISTRY FOR A SUSTAINABLE FUTURE. At **St. Joseph College**, **Peter Markow** is initiating a new program for secondary school teachers exploring ways of introducing chemistry for a sustainable future into secondary schools and introductory college chemistry courses. This effort is part of the college's planning for the establishment of the **Center for Chemistry for a Sustainable Future**. The group will meet twice this year, once during National Chemistry Week in the fall, and again around Earth Day in the spring of 2005, for workshops highlighting sustainable chemistry principles and their adaptation to individual laboratory experiences. The chemistry faculty has expertise in designing, writing and publishing inquiry-based experiments at the secondary and college levels. Teachers will be invited to participate in week-long summer workshops designed to foster their ability to nurture future scientists who understand and value the connections between sound, sustainable chemical practices and a healthy planet.



Energy

FRENCH FRY FUEL. Two students and a professor at the **University of Connecticut (UConn)** have developed bio-diesel fuel from recycled cooking oil, which will contribute "green" power to the UConn shuttle bus. The three, engineering professor and Academy member **Joseph Helble**, and students **Gregory Magoon** of Manchester and **Joanna Domka** of Branford, are part of a committee of students, faculty, administrators and staff whose mission it is to make the campus more environmentally friendly. They took on the project after learning about the success of a similar one at the University of Colorado. With 4,000 gallons of used cooking oil per year from students' french fries, chicken nuggets and fish sticks, they had plenty of raw material to work with. The school administration also contributed start-up funds of \$15,000 for the project.

LET THE SUNSHINE IN. Beginning in the 1970s, schools were built without any windows, just constantly bright, shadowless, fluorescent lighting intended to control energy costs and keep kids from daydreaming. Since then, the thinking has changed dramatically, with natural light making a comeback not only for aesthetics but also for general health and wellbeing. According to the Bridgeport-based architectural firm, **Fletcher Thompson**, a 1999 California study tracked 21,000 students in three states. Those in classrooms with natural light showed consistently higher test grades over those who studied in artificial light. A good example of the firm's commitment to natural light was their recent renovation of the **Polaris Center** in East Hartford, a treatment facility for kids with behavioral and emotional problems. They took a dark, crumbling factory building, stripped it down to the foundation and rebuilt it to let in as much natural light as possible. The result is an open, airy place with lots of windows and high ceilings that not only reflects light but contributes to the optimism of a school bent on helping kids society often forgets.

FUEL FOR THOUGHT. Forty years after **Pratt & Whitney** first answered NASA's call for a source of reliable fuel cells, fuel cells have become an important Connecticut industry. What's more, the **University of Connecticut (UConn)** has positioned itself right at the center of it. The **Connecticut Global Fuel Center (CGFCC)**, founded in 2001 by UConn's **School of Engineering**, has quickly become the nation's most respected research center in the field, with over 40 professors representing the multiple disciplines of chemistry; chemical, mechanical and electrical engineering; biology; and computer science. Yet scientists have yet to resolve some of the key dilemmas surrounding fuel cell technology. Key among them is what type of fuel to use in the cells that will be non-polluting, renewable and cost-effective to extract. One of the primary roles of CGFCC is to support private companies as they get their fuel cell systems to the next stage of commercial realization. "Fuel cells will definitely change the way we live our lives, said **Ken Reifsnider**, director of the Center, "but ...we're still very early in the process."



Environment

SUDDEN OAK DEATH (RAMORUM BLIGHT) REACHES CONNECTICUT. During the 1990s, hikers in California noticed the rapid decline of many native oak trees that they first called Sudden Oak Death (SOD). In 2001, pathologists identified the cause as the microorganism *Phytophthora ramorum*. So far, natural infections of *P. ramorum* are confined to 14 coastal counties of

IN BRIEF

Science and Engineering Notes from Around Connecticut

California and one county in Oregon. *P. ramorum* has, however, also appeared in West Coast nurseries. Because the pathogen has attacked more than 30 species besides oak, the disease is beginning to be called Ramorum Blight to avoid any hint that it only affects oak. Pathologists **Sharon Douglas** and **Robert Marra** at **The Connecticut Agricultural Experiment Station** in New Haven were on the lookout for it in Connecticut. With collaboration from the USDA and The Station's nursery inspectors, Douglas and Marra tested plant samples using culture and DNA analysis. They confirmed that *P. ramorum* reached Connecticut during 2004 on rhododendrons, viburnums and lilacs. Since the symptoms of *P. ramorum* infections vary from bleeding and lethal stem cankers to leaf blotches, and because they mimic other disorders, diagnosis is difficult and requires careful analyses. The pathogen can spread long distances on interstate shipments of infected stock, or locally via planting stock, soil, water, shoes and tires. *P. ramorum* is a serious pathogen with still-unknown potential for disrupting Connecticut ecosystems, which are rich in oak. Because early detection is important for containment and management, it is important to be concerned and aware of this pathogen. The Station has posted a fact sheet at <http://www.caes.state.ct.us/FactSheetFiles/PlantPathology/fspp084s.htm>

FISH STORY. "The changes [to the **Connecticut River**] are nothing short of dramatic," said **William Hyatt**, director of Inland Fisheries for the state's **Department of Environmental Protection (DEP)**. Over the past three decades, he explained, the river's fish life has been transformed even as the river has become a "playground" for boaters and anglers. For example, striped bass, once declining, now number in the hundreds of thousands. Blueback herring used to be numerous but now may be a victim of the ubiquitous bass. A small Asian clam, once unknown here, somehow got into the river and multiplied. These and other changes, like the increase in water temperature, are documented in a recently published study, entitled *The Connecticut River Ecological Study (1965-1973) Revisited: Ecology of the Lower Connecticut River 1973-2003*. Many of the participants in the original study also took part in the update, which was undertaken, in part, to determine the impact of the now-closed **Connecticut Yankee** nuclear power plant on river ecology. So far, the study is inconclusive on that score.

IT'S HOW YOU FRAME IT. "The way you frame a problem can often frame the outcome," says Academy member **Gary Yohe**, an economics professor at **Wesleyan** who has been embroiled in the endless debate about global warming. He suggests that global warming be framed as a situation with an uncertain future that may or may not cost a crushing amount of money to fix. Given that scenario, he suggests the prudent move would be to buy insurance for the problem, just in case it is one. Insurance could be a tax on the carbon content in fossil fuel of \$10 per ton, roughly equating to 5 cents per gallon of gas. "It's a modest price to pay," says Yohe, "compared to the cost of doing nothing."

911 OYSTER. The **Oyster River Coalition** in **Old Saybrook** hopes to get help saving the heavily developed Oyster River from none other than its namesake, the oyster. One of the oyster's little known attributes is the ability to filter many gallons of water per day. Coalition member **Jim Keaney** explained how the oyster "takes in putrid water through its bivalves, consuming the bad nutrients and letting the improved water flow back out." The only problem is getting the oysters to thrive in their new home. Previous efforts to place baby oysters from the **Noank Aquaculture** into the river were not successful. This year, steps are being taken to make the river bottom more hospitable to oysters by raking it and then adding big piles of mature oyster shells. The idea, explained Keaney, is to give the little ones something to cling to.



Food & Agriculture

COLOR MATTERS. It used to be that lavender or purple was only for Easter. But this Christmas, according to **Rob Keane**, spokesman for Stop & Shop in Newington, 2,400 purple poinsettias, called "Plum Pudding," stocked in a few stores as a test run, "pretty much sold out the day we put them out on the shelves. They were very popular," he added. But for **Bob Dinucci**, co-owner of **Lane and Lenge Florist** in West Hartford, the big seller was the DaVinci poinsettia that had red, white and green variegated leaves all on the same plant. **Carol Quish**, public service specialist at the **University of Connecticut's Home and Garden Center**, explained that the colors are manipulated through selective breeding. That means "if breeders see a branch with a leaf that is a different color than the rest," she said, "they take cuttings from that branch to reproduce it."

DOWNTOWN BREWS. Ten years ago, microbreweries were the rage everywhere, including Connecticut. Liquor stores devoted whole coolers to the sometimes fruity European-style lagers; well-established restaurants added stainless steel fermenting tanks. Even though microbreweries have decreased in Connecticut (peaking at 24 in 2000 and now down to 14), an almost cult-like following predict the trend will reverse itself. As proof, they cite two new ones being opened soon: the **Cambridge House** in Granby and a third location for the **Southport Brewing Company** in Branford. **David Wollner**, co-owner of the **Willimantic Brewing Company**, a popular microbrewery, housed in a turn-of-the-century limestone and granite former post office, feels his beer establishment and others have done more than satisfy customers. They have also helped revitalize cities by bringing people downtown. The same can be said for **Hartford's City Steam Brewery Café**, housed in a lofty H.H. Richardson-designed former department store on Main Street, with its beer vats harnessed to the old steam heat plant that still occupies the building.



Health

OF MICE AND LYME. A new study provides direct evidence that vaccinating mice can prevent the incidence of Lyme disease in humans, but not as much as expected. Researchers in the **Department of Epidemiology and Public Health** at the **Yale School of Medicine** conducted a four-year study in which they trapped and vaccinated 1000 white-footed mice in isolated woodland sites near New Haven. The results, which were published in the *Proceedings of the National Academy of Science*, showed that by vaccinating mice, researchers did reduce the infection of ticks that carry the disease to humans, but only by 27%. Said investigator **Durland Fish**, professor of epidemiology at Yale, "this changes our view on how Lyme disease is circulated between wildlife and ticks." Other animals will have to be vaccinated as well to further reduce human risk. "But," he said, "this confirms the value of ecological studies. With many of these diseases, just treating the human patient isn't going to cut it."

BOLD ON STEM CELLS. To ensure that Connecticut is "not shut out of an important biotechnology field," House and Senate leaders in the state are promising to "fast-track" stem cell legislation. Currently, state support for the legislation is across party lines. **Governor M. Jodi Rell** stands behind it, as do both leaders of the Legislature. Rell has earmarked \$20 million of the state's estimated \$335.6 million FY2005 surplus in her 2005-2007 budget for stem cell research. Others are pressing for more

IN BRIEF

Science and Engineering Notes from Around Connecticut

— at least \$100 million over the next ten years. Unlike the Bush Administration, which allows federal funding only for existing stem cell lines, the proposed Connecticut legislation would “encourage research at **Yale** and the **University of Connecticut** on stem cell lines... extracted from 5-day old embryos” that would otherwise be discarded by fertility clinics.

HEALING CHAMBER. When two Boston residents in separate incidents had carbon-monoxide poisoning from warming up in their cars with the motor running on a cold snowy day (unaware that their tailpipes were clogged with snow), they were not rushed to nearby Boston hospitals. Instead, they were taken to **Hartford Hospital**, one of the few New England hospitals with a hyperbaric chamber big enough to treat several patients at a time. The multiplex chamber, according to **George Perdrizet**, director of **Hartford Hospital’s Center for Wound Healing and Hyperbaric Medicine**, uses 100% oxygen, pressurized to 2.5 atmospheres, to help “flush toxic gas from the bloodstream of poisoning victims.” The hospital also uses the chamber to treat certain kinds of wounds, especially those resulting from diabetic ulcers. Perdrizet says that although scientists still don’t know how hyperbaric “therapy helps heal wounds,” it has been able to “reduce the amputation rate for diabetic foot ulcers by 40%.”



High Technology

WINNING THE RACE AGAINST TIME. “These two assays will take the guesswork out of cancer treatment,” said lead investigator **Gil Mor**, associate professor in the **Department of Obstetrics & Gynecology and Reproductive Sciences** at the **Yale School of Medicine**. Mor explained that the new technology, called the Yale apoptosis assay, will determine upfront “whether a drug kills the tumor” while another technology, the ChemoFX assay, will determine “whether a drug stops tumor growth.” In the past, it would take about six months once a particular cancer drug was selected to determine if it works or if a tumor had become resistant to it. Such a long wait, especially when it means starting all over again with a new drug, can be an eternity to a patient whose search for a cure is a race against time.

TECH CONNECT. A new program called Innovation@Work connects small- to medium-sized Connecticut technology companies with some of the state’s leading technology customers, like **Mohegan Sun**. Innovation@Work was designed by the **Connecticut Technology Council** as a way to “boost tech commerce and create an innovative culture for the state.” The small tech companies often don’t have the marketing budget or staff to mount the kind of sustained sales effort it would take to get a foot in the door at a large corporation. And the large companies don’t have the time to listen to hundreds of sales pitches. Innovation@Work solves the problem by requesting a brief summary of products and services from each competing tech company and then helping the large companies narrow down the list of vendors. For example, after looking at summaries from a list of 70 potential vendors, Mohegan Sun agreed to hear sales pitches from 22 local tech firms. Mohegan Sun uses computers to track the millions of dollars that flow through their gaming tables and slot machines as well as to run their sophisticated surveillance system.

LEARNING FUN. “Teachers want content; the kids want excitement,” said **John Crandall** of **Norwalk**, who creates educational game software that teaches mathematics, geography and typing to kids. Crandall, who started out as a computer teacher, got into the educational software business in 2002 because he

wasn’t satisfied with existing resources. Today his company, called **Edventure Software**, sells 20,000 games per year to customers in every state in the United States and Canada. His secret is humor. For example, “if students do poorly in a game... a funny scene pops up so they won’t feel discouraged.” His characters are racially diverse and his female characters, in particular, are strong and active. Crandall does all his work from home with design help from local freelance animators and programmers.

CRIMINAL DATA FAST. This year, **Connecticut** state troopers and police in all 100 municipal police departments will have “single query access to troves of information – from detailed criminal histories to conditions of bail.” This advancement will come in the form of computer upgrades, a new \$26 million Offender Based Tracking System and an \$8.5 million revision to the COLLECT system of warrant and arrest files. Although domestic calls, car-stops and drug raids will remain volatile situations, at least with quicker access to data, police officers will be better prepared to deal with potentially dangerous situations. Said **Cmdr. John Murphy** of the **East Hartford Police Department**, “these upgrades will be significant tools in the tool box.”



Transportation

A TOWN AND ITS RIVER. “This is an opportunity to not only bring a white-water park to New England, but also to open up a river,” said **Dan Mullins** of **Willimantic Whitewater Partnership**. His group recently presented a vision, developed by 21 landscape architecture students at the **University of Connecticut**, for creating a paddling course in the **Willimantic River** that would reconnect the town to its river. Besides the white-water park, the plan proposes developing various ways to access the river from Main Street and creating parks and trails along its banks along with displays that showcase the town’s natural history, scenic overlooks and put-in and take-out areas for canoeists and kayakers. By restoring the river and its environment, the students and Whitewater Partnership hope to stimulate the eco-tourism potential of Willimantic, once a booming mill town.

I-95 SHORELINE. Transportation planners at the state **Department of Transportation (CONNDOT)** released a study recently that proposes changes for the shoreline portion of I-95. The study targets those areas heavily traveled by tourists and residents on their way to and from recreational areas such as **Hammonasset** and **Rocky Neck State Parks, Mystic Seaport**, the casinos, Rhode Island beaches and Cape Cod. It suggests improvements like “widening lanes, providing a third lane, extending shoulders and reconfiguring ramps.”

MAJOR POWER. Although it was a European consortium — the European Aeronautic Defence & Space Company (EADS) and UK-based BAE SYSTEMS) — that recently rolled out the giant passenger jet Airbus A380, **Pratt & Whitney** of East Hartford still hopes to be a major power in the plane’s future. So far, the odds are good. Airbus has already awarded Engine Alliance (the Pratt & Whitney/General Electric joint venture formed in 1996) engine contracts for 73 A380s or 49% of the 149 planes on order. Competitor Rolls Royce, on the other hand, has contracts for only 49 planes or 33% of those on order. The other four owners of the 27 ordered planes have yet to choose an engine vendor. Buyers of the new plane — currently Air France, Lufthansa, Qantas, Emirates Airlines of Dubai, FedEx and UPS — can choose the engine manufacturer they prefer.

— Compiled and Edited by **Barbara Standke**

From the National Academies (from page 1)

complementary and alternative approaches. The report calls on Congress to amend the regulation of supplements to improve quality control and consumer protections and to create incentives for research on the efficacy of these products.

The report also assesses Americans' reliance on complementary and alternative medicine (CAM) therapies. Use of CAM is widespread, with more than one-third of US adults reporting that they have pursued some form of these treatments, which include products such as herbal remedies, techniques such as acupuncture, and schools of practice such as naturopathy. Fewer than 40% of CAM users have disclosed their use of such therapies to their physicians. More than half of physicians report that they would encourage patients to talk to them about using CAM and would refer them for treatments that fall into that category.

A common set of methods and standards for generating and interpreting evidence is necessary if health care providers are to make informed decisions about the use of both conventional treatments and CAM. Randomized controlled trials (RCTs) provide the best evidence of efficacy, the committee said, but other study designs can generate useful information on treatments that do not lend themselves to RCTs.

[<http://www.nap.edu/catalog/11182.html>]

◆ Data Show No Health Risk From Cape Radar Site

Available scientific data provides no evidence of adverse health effects to Cape Cod residents from long-term exposure to radio-frequency energy from a nearby US Air Force radar installation, according to a new report from the National Research Council. The report investigated whether the PAVE PAWS radar might be responsible in part for the reported higher rates of certain cancers in the area. The committee concluded that there is no increase in the total number of cancers or in specific cancers of the prostate, breast, lung, or colon due to radiation exposure from PAVE PAWS. However, the committee found in the scientific literature a few biological responses to radio frequency exposures that were statistically significant. Although the report notes that such responses do not necessarily result in adverse health effects, it recommends additional studies to better discern the significance, if any, of those findings.

Operated on Cape Cod since 1979 by the US Air Force Space Command, PAVE PAWS is a phased-array warning system designed to detect and track sea-launched and intercontinental ballistic missiles. PAVE PAWS was the subject of two 1979 Research Council reports that examined the safety and possible health effects of the radar. The new report follows up on the findings and recommendations of the 1979 studies.

The committee found no evidence of a mechanism or pathway by which levels of radio-frequency energy similar to those emitted by PAVE PAWS could change biological processes. The report recommends additional biological studies to investigate possible health effects of PAVE PAWS exposure in cell and animal systems, and requests studies of plant growth in the vicinity of PAVE PAWS, such as tree-ring growth before and after the radar went into operation. Though not directly applicable to human health, these studies do provide long-term data on biological effects under conditions similar to human exposure.

[http://www.nap.edu/catalog/11205.html?onpi_newsdoc01132005]

◆ Health Implications of Perchlorate Exposure

A new report by the National Research Council on the health effects of perchlorate, a chemical that in high doses can decrease thyroid function in humans and that is present in many public drinking-water supplies, says daily ingestion of up to 0.0007 mil-

ligrams per kilogram of body weight can occur without adversely affecting the health of even the most sensitive populations. That amount is more than 20 times the "reference dose" proposed by the US Environmental Protection Agency (EPA) in a recent draft risk assessment.

Environmental releases of perchlorate — a component of rocket fuel and fireworks — have been discovered in 35 states, and more than 11 million people have perchlorate in their drinking water at concentrations of 4 parts per billion or higher. As it considers a first-ever national standard for acceptable levels of perchlorate in drinking water, EPA has issued a series of draft risk assessments, each containing a reference dose upon which a standard could be based. Controversies over the scientific conclusions reached in the risk assessment led the federal government to request that the National Research Council review the issue.

The most recent EPA risk assessment, published in 2002, proposes a daily reference dose of 0.00003 milligrams per kilogram (mg/kg) of body weight, which the agency said would correspond to a drinking-water concentration of 1 part per billion based on certain assumptions about body weight and daily water consumption. Perchlorate inhibits the thyroid's uptake of iodide, which is essential for the production of thyroid hormones. One potential consequence of that effect is low thyroid hormone production, or hypothyroidism. EPA has predicted that an ultimate consequence of that effect is the development of thyroid tumors — a conclusion the agency based on the occurrence of a few thyroid tumors in rats exposed to perchlorate. The committee disagrees with EPA's conclusion and thinks that perchlorate exposure is unlikely to lead to thyroid tumors in humans. Humans are much less susceptible to disruption of thyroid function or formation of thyroid tumors than rats, and therefore the way rats responded to perchlorate exposure is not a good indicator of how humans would react.

[<http://www.nap.edu/catalog/11202.html>]

◆ Methane Hydrate: A New Source for Natural Gas?

Methane hydrate, abundant in Arctic regions and beneath the ocean floor, is a highly concentrated source of natural gas. But accurately identifying hydrate deposits remains a challenge, and it is unclear how much of the world's vast reserves can actually be recovered. Also, methane is a greenhouse gas that has been widely cited as a factor in previous episodes of global warming; releasing methane from hydrate could affect global climate change.

Because the potential of this natural resource is so great, the United States, Canada, Japan, Korea, and India have established research programs to study it. Congress authorized the US Department of Energy (DOE) to conduct or oversee America's investigations in this area, and called for the National Research Council to assess DOE's methane hydrate R&D program.

A new Research Council report finds that, while the program boosts the ability of US commercial interests and scientists to develop energy from gas hydrate and to understand potential geological constraints on drilling through hydrate, improvements are needed. About 60% of the program's annual budget has gone to three industry-managed research projects. Because of their size and price tags, special checks and balances should be implemented to aid such efforts, the report says. Reviews of project progress ought to be based on solid science, and results should be available in public databases. The program should fund postdoctoral fellowships to enhance training in the field, and should closely examine links between methane hydrate and climate change, the report adds. Greater scientific oversight of DOE's program is needed to ensure that its key goals are met, the report concludes.

[http://books.nap.edu/catalog/11094.html?infocus_4.3]

Biomedical (continued from page 2)

mobility system that can automatically transfer a patient from bed to wheelchair and vice versa.

For startup companies, like Vivax, the biggest issue is capital. "There is a fairly well-developed venture capital system in the United States," Ellen said. "But, many good companies with great ideas can't get funding because they don't provide a big enough return for venture capital companies. If Connecticut is serious about fostering development of business and hiring, the state needs to join the other states that currently provide a source of money to support worthy early-stage startup companies."

In 2001, the University of Connecticut (UConn) was the first public university in New England to offer an undergraduate program in Biomedical Engineering. In just three years, the program has grown to almost 200 students. Projections indicate it will grow to 400 students within the next three years.

According to Academy member John D. Enderle, program director for BME at UConn, the undergraduate program is very hands-on and offers students experience with the latest tools as well as the advantage of the school's 40-year history of graduate-level education in BME. The undergraduate program offers six different tracks and numerous elective BME courses. In a unique twist, UConn offers select freshmen the opportunity to apply for acceptance into the UConn School of Medicine.

Students in the school's undergraduate program also participate in the National Science Foundation (NSF) Engineering Senior Design Projects to Aid Persons with Disabilities. Students construct custom-designed devices and software for people with disabilities.

Members of the state's clinical, industrial and academic communities agree that BME holds tremendous potential for future job growth.

*This article has been condensed for print publication.
The full text is available at <http://www.ctcase.org/bulletin/bme.html>*

A recent BEACON report completed with support from Northeast Utilities (www.hartfordspringfield.com) indicates that Connecticut's infrastructure is poised to support growth in the medical device sector of the economy. "Of particular importance is the presence of a number of precision manufacturing companies that are diversifying to accommodate the medical device industry," Bronzino said, adding that he hopes this trend will be encouraged and supported.

According to Pete Gioia, economist at CBIA, "Industry projections suggest that there will be more than 80 biosciences companies in Connecticut within the next 10 years." That figure is double the number of bioscience companies active statewide today.

Enderle notes that pharmaceutical and biotechnology companies have a strong presence in Connecticut. "We also have small medical device companies which I believe will be the foundation for BME growth in Connecticut," he said.

Noting that the US population is aging, Yeston says that the potential job market is enormous for people with the right combination of knowledge and creativity. "Today's older people want to be active," Yeston said. "With BME, we may one day be able to provide brain implants or neurosurgery advances to counteract diseases like Parkinson's..." he said, adding "It might sound ridiculous, but BME can provide us with a real opportunity to make safe and long-lasting replacement parts. BME has the potential to make man bionic." — **Karen Cohen, science writer & owner, The Write Stuff, LLC.**

Visit our web site at www.ctcase.org

DEEP RIVER, CT 06417
PERMIT 155
US POSTAGE PAID
PRESRT STD

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