

# Bulletin *of the*

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

Volume 17,1 / Spring 2002



## Activities of the Academy

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

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

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

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

“Indoor Air Quality in Connecticut Schools” (2000)

“Efficacy of MTBE Use in Connecticut” (1999)

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

“Building Agricultural Biotechnology in Connecticut” (1997)

“Status of Connecticut Critical Technologies” (1997)

“Evaluation of Critical Technology Centers” (1996)

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

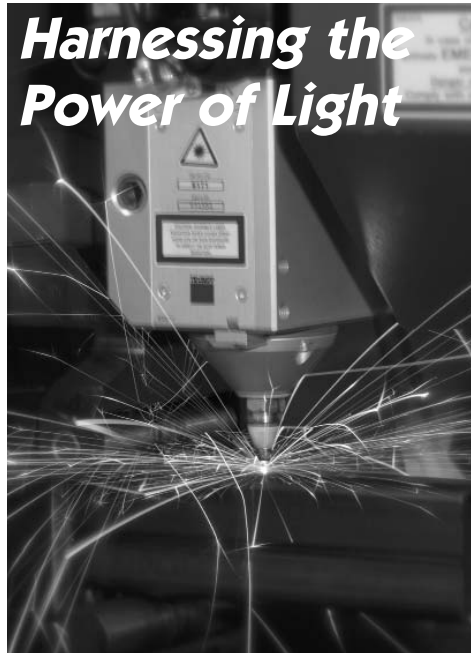
“A State Science and Technology Policy” (1992)

“Electromagnetic Field Health Effects” (1992)

“Economic Impact of AIDS Health Care in Connecticut” (1990)

## Photonics in Connecticut:

### Harnessing the Power of Light



TRUMPF'S TUBEMATIC tube and pipe laser cutter offers precision and accuracy. (Courtesy of TRUMPF Inc.)

Today, we are in the early phases of a technological revolution, one that uses photons—particles of light—to perform work. Two key inventions and developments are substantially responsible for this revolution: the laser and the very-low-loss optical fiber.

Connecticut is a world center of photonics manufacture, development and research, and is home to several major photonics companies, including: JDS Uniphase in Windsor, Coherent\*DEOS in Bloomfield, TRUMPF Inc. in Farmington, Advanced Fuel Research in East Hartford, CiDRA in Wallingford, and Zygo in Middlefield. Photonics research is also being done at the University of Connecticut and at Yale.

(See *Photonics*, page 2)

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

## News from the National Academies

The following is excerpted from press releases of the National Academies and from *InFocus Magazine*, a news resource of the National Academies which can be found at [www.infocusmagazine.org](http://www.infocusmagazine.org)

### ◆ ‘The Best Advice Possible’

National Academy of Engineering President William Wulf, writing in a recent issue of the National Academies' *InFocus Magazine*, stresses the critical need, in a society increasingly dependent on science, engineering and technology, for “public policy ... informed by the best advice possible.” The role of the National Academies as a “trusted, authoritative, unbiased adviser” has become even more important than ever, he argues, in the aftermath of the terrorist attacks of Sept. 11.

He attributes the Academies' reputation for authoritative, unbiased advice to the “scrupulous process we use to develop it” and outlines the major features of that process, which include:

- Advice “generated by a committee of unpaid experts chosen for just that purpose” whose “areas of expertise span those needed to address the issue” and who have been “carefully vetted to ensure no conflicts of interest and a balance of biases.”
- Committees that “seek broad input from all interested parties. Their information-gathering meetings are open to the public and announced well in advance.”
- Reports that “are based on fact, not opinion. Although the people on our committees are excellent, we're not  
(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*

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## 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."

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## Photonics (continued from page 1)

JDS Uniphase, Coherent\*DEOS, CiDRA and Advanced Fuel Research all began as spin-offs of United Technologies Corporation (UTC). Several of these have merged with and/or bought other related photonics enterprises. TRUMPF Inc. is the North American subsidiary of TRUMPF GmbH +Co. KG. (the TRUMPF Group), a privately owned German firm with world-wide plants; the one in Connecticut is its major US manufacturing and research facility. Zygo was founded over 30 years ago by a team that included Academy member Carl Zaroni.

Lasers and related optical and electro-optical components are essential elements in modern, optical-fiber based telecommunication systems.

**JDS Uniphase** (<http://www.jdsu.com>), a global company with annual sales of \$2.1 billion, has approximately 400 employees in Connecticut. The Connecticut division manufactures high-speed external modulators and laser wavelength lockers. At other sites, the company manufactures a wide range of optical components for telecommunications systems, including semiconductor lasers, transmitters, couplers, multiplexers, circulators, tunable filters, optical switches, and isolators. Module and subsystem level products include amplifiers, transponders, transceivers, optical performance monitors, and dispersion compensation modules. The company also manufactures industrial lasers, advanced interference pigments such as those used on some currency and credit cards, optical display and projection products, and gas cluster ion beam surface equipment, and supplies test equipment for network installation and for system production applications.

**CiDRA** (<http://www.cidra.com>) is also a significant manufacturer of telecommunications and optical networking equipment. According to their web site, "CiDRA Corporation designs, manufactures and markets component, module and subsystem products for dynamic routing, monitoring and conditioning of optical signals.."

Two Connecticut photonics companies, TRUMPF Inc. and Coherent\*DEOS, make lasers and related systems that are used in manufacturing processes.

**TRUMPF Inc.** (<http://www.us.trumpf.com>), with headquarters and manufacturing facilities in Farmington, has about 500 employees in Connecticut and specializes in high power CO<sub>2</sub> and Nd:YAG lasers for material processing. These lasers have power levels of up to 20,000 watts.

TRUMPF's technologically advanced products include CNC laser cutting centers, punching machines, and press brakes. They also produce state-of-the art marking lasers, CAD/CAM software, punch and press brake tooling, and portable power tools. The speed, versatility, accuracy, and controllability of these systems greatly enhance the ability to do "just-in-time" manufacturing, resulting in lower inventory costs and ease of custom manufacture. Seventy percent of TRUMPF's business is

(See Photonics, back page)

# IN BRIEF

## Science and Engineering Notes from Around Connecticut



### Communication

**CALL HOME.** Using **East Haven's** new "reverse 911" phone system, a single dispatcher will be able to contact all 28,000 of the town's residents with just a few keystrokes. The disaster warning alert system, which can make 1,000 phone calls per hour, replaces the previous warning system, in which emergency workers drove around town calling through loudspeakers. Installed to help protect townspeople from the area's frequent floods, the system can be adjusted to call residences both in and out of state. It can also target specific areas: in addition to notifying residents of natural disasters, it might also be used to alert neighborhoods about lost children or wandering Alzheimer's patients. Officials can also program the system to check on elderly people who live alone. The \$22,000 set-up was paid for by the federal government as part of a disaster prevention program.

**TAKE TWO ASPIRIN.** Patients and doctors can eliminate the phone tag game by communicating with each other through a secure Internet site, in a pilot program now underway through **ProHealth**, a Connecticut doctors' organization, and the health insurer **ConnectiCare**. Through the voluntary system, patients can renew prescriptions, obtain specialist referrals, and receive laboratory results. They can also ask their physicians about non-emergency problems using a webVisit consultation, in which the patient answers a questionnaire which is then converted into a report; the physician can respond to questions via email. "I think we're looking at a new way that medicine is going to be practiced," says **ConnectiCare** chief medical officer **Paul A. Bluestein**.

**SPEAK TO ME.** By combining voice recognition with a kind of artificial intelligence, entrepreneur **Kevin Dowd** hopes to develop software that will allow computers to interpret and act on human speech. Through **Brainhat Corp**, his East Hartford start-up, Dowd hopes to design computers that do more than just respond to simple commands; he hopes to enable humans and machines to have true conversations. The problem, he says, is determining how to represent and manipulate knowledge using words. Right now, his software achieves this by sharply limiting topics of discussion; a first-generation version, which can be found at [www.brainhat.com](http://www.brainhat.com), lets the computer talk about the weather, restaurant food, statues, and spiders. Eventually software like his could allow humans to use normal speech to control computers, houses, and cars.

**SOUND OFF.** With varying possibilities for acoustical configurations, **Belding Theater**, the new 950-seat recital hall at the **Bushnell** in Hartford, can be adjusted to provide the best sound for each type of program. The acoustics can be altered, says project manager **Russell Cooper**, of **Jaffe Holden Acoustics** in Norwalk, primarily by changing the tilt of the ten reflectors—wood veneer pieces that hang from the ceiling and vary in size from 9 to 10 feet long and 4 to 7 feet wide. Velour banners, curtains, and acoustic lofts at the sides of the theater will also help control the sound. Each type of concert demands a different list of acoustical configurations, making the sounds slightly different.



### Education & Cognition

**FRESHWATER INSTITUTE.** Created with a \$500,000 grant from the Northeast Utilities Foundation, **St. Joseph College's** new **Freshwater Institute** boasts one of the few indoor simulated streams—known as a riffle tanks—in the nation, along with refer-

bished science laboratories and a large, new rainforest-like enclosure for the school's resident green iguana. The new facilities will enable the college's faculty and students to conduct year-round experiments that will lead to a better understanding of the health of area rivers and streams. In addition, according to **St. Joseph** president **Winifred Coleman**, it will allow the college to build up its environmental-science programs as well as expand its science programs for area middle and high school students. The Institute plans to examine **Trout Brook** in West Hartford, the **Park River** drainage system, and water quality and insect populations along the **Connecticut River**.

**GYM TECHNOLOGIES.** Even gym can be high-tech these days. In gym class at East Hartford's **O'Connell Elementary School**, the kids use electronic digital pedometers programmed with their weight and stride distance; the youngsters use the devices to track the number of miles they travel per session. They may also use heart monitor sets, which include a wireless transmitter strapped around the chest, and a wristwatch with a readout display. The device helps students keep their heart rate within a target zone during class. Teacher **Michael Gerich**, who has been selected the state's elementary school teacher of the year due in part to his willingness to use technology, believes that the technology can help relate gym to other curriculum areas, such as math, by, for example, tracking pedometer statistics by class and grade.

**SICK OF SCHOOL.** Teachers die more frequently from autoimmune diseases than the rest of the population, according to a study done by **University of Connecticut Health Center** professor **Stephen Walsh**. Walsh found that teachers in general are 10-15% more likely to die from this class of disease, in which the body attacks itself: autoimmune diseases include rheumatoid arthritis, rheumatic fever, and multiple sclerosis. Walsh found that teachers in the 35 to 44-year-old age group are 50% more likely to succumb than those in older groups. This pattern, familiar to epidemiologists, suggests that the diseases are triggered by an infection. Typically, the pattern occurs because those who are susceptible to the disease die off early. As fewer susceptible individuals remain, cases decrease. Some evidence suggests the diseases may be triggered by the Epstein-Barr virus, which causes mononucleosis in teenagers, and is carried by 95% of adults. To find these patterns, Walsh examined data from more than 6 million death certificates.

**MASTERING DATA MINING.** A master's degree in data mining will be offered by **Central Connecticut State University (CCSU)**, in New Britain. This emerging field focuses on ferreting out the hidden patterns in the increasingly large masses of data generated by businesses, government and other organizations. Using data mining techniques to sift through car repair records has, for example, enabled companies to spot car manufacturing problems. The CCSU degree is the first offered in Connecticut, and it is believed to be one of only a handful found worldwide. Initially, it will be offered only through the Internet, with classroom courses planned for a future time. Data mining has been listed by MIT's *Technology Review* as one of ten new technologies that will change the world.

**LAB WORK.** In a typical lab class, the teachers hand out the directions and the students follow the steps. But under a new curriculum for introductory physics labs at the **University of Connecticut**, the

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

# IN BRIEF

## Science and Engineering Notes from Around Connecticut

students will have to start thinking for themselves. Instead of following preassigned formulas, the students will devise their own experiments. The new approach, based on a model developed at the University of Minnesota, brings school work closer to research. During the lab, they first draw pictures and organize information, then they describe what's happening physically, solve the equations, calculate the answer, and, finally, evaluate the answer to see if it's reasonable.



### Energy

**FUEL CELL DONATION.** A 200-kilowatt fuel cell donated by **Connecticut Natural Gas Corp.** will help provide power at the **University of Connecticut** Storrs campus, and will also serve as a learning tool for students who research and develop fuel cells. The 40,000 pound unit, with an installed market value of about \$1 million, was formerly used to generate energy for the corporate headquarters of Connecticut Natural Gas in Hartford; the facility was demolished to make way for Adriaen's Landing. Fuel cells, which are growing increasingly popular as an alternative energy source, operate without combustion, so they produce almost no pollution, and, because the fuel is converted directly into electricity, they are able to generate electricity more efficiently than internal combustion engines.

**GREEN POWER.** **Wesleyan University** plans to power its athletic center, which accounts for 10% of the college's energy use, with electricity generated from renewable sources. The new policy, which was sparked by the efforts of ten Wesleyan students, is expected to prevent up to 2.1 million pounds of carbon dioxide and 16,000 pounds of sulfur dioxide from being released into the atmosphere each year. Wind power will provide 5% of the energy, while 27% will come from landfill methane and 68% from small hydroelectric projects. Although the new policy will add about \$40,000 to the university's annual energy costs, college officials believe that it is important to support alternative types of energy, said **Harry Kinne**, director of the school's physical plant. Wesleyan students hope to persuade the university to use renewable energy to provide power to senior student housing, which accounts for another 6% of the college's energy use.

**CHEAP HEATS.** As an alternative to electric or oil, compressed sawdust may not sound like much. But pellets made of the stuff provide an efficient and economical way to heat a house, according to **Paul and Beth Litrico**. Their Manchester company, **CJ's Pellet Depot, LLC**, distributes the pellets, which are used in special stoves; the Litricos, who heat their house with the fuel, say they paid only \$500 in heating costs last year. The pellets are not only efficient, but also ecologically sound, according to the Litricos, because they're recycled wood products, made of the sawdust generated by the mills that make furniture and lumber for new house construction.

**COLD COMFORT.** A proposed liquefied natural gas (LNG) plant, slated to be built in **Waterbury** by **Yankee Gas Services Co.**, is needed to supplement existing supplies of natural gas, according to company spokeswoman **Sandy St. Pierre**, who says it will also help protect customers from wild price swings. Liquefied natural gas accounts for as much as 25% of New England's natural gas supply during the winter. Natural gas is used by consumers in the form of a vapor; the liquefied version, which has been cooled to minus 260° F., must be heated back into a gas before it can be used in the home. The proposed plant is expected to be ready for operation by late 2004 or early 2005.



### Environment

**MOSQUITOES AND WEST NILE VIRUS (WNV).** **Theodore Andreadis** reports that **The Connecticut Agricultural Experiment Station** will monitor the infection of mosquitoes at 72 sites this summer. Should money permit, additional sites will be monitored. During 2001, The Station trapped 190,000 mosquitoes. Fifty-three isolations were made in a record 14 mosquito species as far north as Cornwall and east to the Rhode Island line. (In addition, the Station found Eastern equine encephalitis virus in 11 species of mosquitoes.) Collaborators in the **Departments of Public Health and Environmental Protection** and at the **University of Connecticut** detected infected horses and birds to the Massachusetts and Rhode Island lines. Six human cases of WNV, including one fatality, occurred, all near the southwestern shore. Andreadis concluded that WNV seems firmly established and will almost certainly re-emerge in 2002.

**NOT EASY BEING GREEN.** South American monk parakeets are becoming increasingly common in Connecticut's coastal towns, according to **Southern Connecticut State University** graduate student **Steven Living**, who is studying these birds. These small, bright green parrots, which gather in colonies that can hold more than seventy nests, have lived in North America since the 1960s. They are believed to be descended from pets that were released either by accident, or by owners tired of caring for them. Living has found that the birds' range now extends from at least **Greenwich to Guilford**. So far, they seem to be restricted to the coastal corridor, but, he says, they may spread inland as their population grows.

**HEATING UP.** In the first published analysis of the Kyoto-Bonn protocol to slow global warming, **Yale** economics professor **William D. Nordhaus** concludes that, because the United States refused to participate, the protocol will have little effect. Nordhaus believes that the agreement, which was a revision of the original 1997 Kyoto protocol, was flawed because it looked only at emissions reduction without looking at costs. It was designed, he says, so that the United States would have had to pick up almost all of the costs of implementation. By refusing to sign the protocol, says Nordhaus, the United States incurs no costs at all. Nordhaus believes that in the long run, it makes more sense to levy a carbon tax than to try to enforce rigid controls on emissions.

**HIGH TOPS.** The largest tree in Connecticut is a shagbark hickory in Newtown, identified in 1997; a network of volunteers around the state is dedicated to locating such "notable" trees. But maintaining such huge trees can require special care. In trees that rise above their surroundings, for example, a lightning rod should be mounted in the top-most branches, and then grounded at the tree's base, according to **Jeff Ward**, station forester at **The Connecticut Agricultural Experiment Station**. Large trees can be helped in other ways. For example, according to **Pete Parzuchowski**, who operates a tree removal service in Danbury, embedding a steel rod horizontally in a tree can prevent a V-shaped crotch from splitting. Beech, red and white oak, white pine, and sugar maples are among the state's longest-lived trees, with a life span that can reach 400 years.



### Food & Agriculture

**CHILD CARE.** State legislation that took effect this fall makes it easier for nursing mothers to care for their infants by requiring that businesses provide a private place in which the mothers can

# IN BRIEF

## Science and Engineering Notes from Around Connecticut

express milk at work. Some Connecticut businesses already offer such help. **Aetna**, in Hartford, offers a lactation consultant to help women nurse, providing free breast pumps and a lactation room. Almost 40% of the mothers who participate in the program nurse their babies for more than six months; one survey indicates that, typically, only 31% of mothers are continuing to nurse infants at that age. Nationally, almost 51% of all mothers with children less than a year old work full- or part-time; breast-feeding provides many benefits to infants, from increased immunities to higher IQ.

**VEGETARIAN DELIGHT.** A diet high in cholesterol, animal protein, and vitamin B12 is linked to adenocarcinoma, a cancer of the stomach and esophagus, according to research done at **Yale** and two other universities. The study, which compared the diets of 1,095 cancer patients to that of 687 healthy people, also found that plant-based nutrients like dietary fiber, dietary beta-carotene, folic acid, and vitamin B6 were associated with a lower risk of the disease, while the regular use of vitamin C supplements were linked to a 40% reduction in cancer risk in the lower and middle stomach. Obesity is also strongly linked to the risk of these cancers, researchers found. Adenocarcinoma has increased by 300% since the mid-1970s, according to Yale professor **Susan Mayne**, the study's lead author and associate director of the **Yale Cancer Center**.

**LEARNER'S CHOICE.** Through a **Connecticut Agriculture in the Classroom** program aimed at **Hartford** fifth-graders, state officials hope to encourage more youngsters to consider careers on the farm. Through games and exhibits, the youngsters are taught about various job possibilities, from seed and soil scientists to equipment dealers to artists that draw labels. The children, who were amazed to learn that oysters are farmed in Connecticut, and that chickens lay an average of 244 eggs per year, were even more astonished to find that a single earthworm can process 36 tons of soil a year, and that worm farms are also a feature of the state's agricultural industry.

**TAGGING ALONG.** By tracking the migration patterns of local lobsters, researchers hope to gain clues to the massive lobster die-offs in the western part of Long Island Sound. The project involves weighing, measuring, and tagging up to 5,000 lobsters; the white or orange markers will be inserted into the lobsters' backs at the point where their jointed tail begins. The scientists hope to learn whether the lobsters spend their lives in a single part of the Sound, or whether they migrate from east to west and back again. If they migrate, then the western part of the Sound could recover from the die-off more quickly. While the total lobster population in the Sound has rebounded to slightly under the size of the average annual catch, most lobsters in the western part of the Sound remain too small to be legally caught.



### Health

**WEST NILE VACCINE.** Researchers at **Yale** have created a vaccine that immunizes mice against West Nile virus; this is the first step toward developing a similar vaccine for humans. The disease, which is not usually serious, but which can cause a fatal infection of the central nervous system in vulnerable patients, is considered an "emerging disease," according to Yale professor **Erol Fikrig**, who headed the study. The virus, which is spread by mosquitoes, first appeared in the United States near New York City in 1999, and since has been found in other parts of the Northeast, the South and the Midwest. Researchers were able to isolate the virus that causes the disease, and to reproduce a protein from that virus. Injecting that protein into uninfected mice stimulated the animals to produce

the antibodies that help protect them from the virus itself. The protein could also be used to develop a diagnostic test for the virus.

**TUMOR KILLER.** A molecule that induces the body to destroy blood vessels in tumors has been engineered by researchers at **Yale**; the procedure does not harm blood vessels in normal tissue. Led by Yale professor **Alan Garen**, the team synthesized an artificial molecule, called icon, that binds to a natural molecule found only in tumor blood vessels. Icon consists of two parts: a section of a molecule which attaches to the blood vessel molecule, and the section of an antibody that activates the immune system. In other words, icon attaches itself to a blood vessel in a tumor, and then signals the immune system to destroy that blood vessel. This, in turn, destroys the cancer. Icon, says Garen, should protect against all tumors that contain blood vessels. A similar procedure, he believes, could also protect against other diseases that rely on growing blood vessels, such as macular degeneration.

**INVADERS.** Many bacteria are able to cause disease because they can inject the host cell with proteins that actually subvert the host's behavior, forcing it to perform actions that benefit the invading pathogen. Using a synchrotron particle accelerator to produce ultra-high resolution images of key components of the hollow, needle-like organelle that injects the proteins, **Yale** microbiology professor **Jorge Galan** has discovered that before these proteins can be utilized, they must first bind to a "chaperone protein." This ensures that the pathogen will continue to recognize them. The discovery may offer a new way to halt many infectious diseases, by, for example, preventing the secreted protein from binding to a chaperone protein. Pathogens that rely on this behavior include the bacteria that cause food poisoning, typhoid, plague, and dysentery.

**DIFFERENT STROKES.** Hormone replacement therapy (HRT) will not help prevent a second stroke in women with cerebrovascular disease, according to a study done recently at **Yale**. The research, which followed 664 post-menopausal female stroke victims for a period of three years, found a marginally higher number of fatal strokes in those who took a standard dose of estradiol. Those in the HRT group who survived a second stroke suffered slightly worse neurologic and functional deficits. "Conventional estrogen therapy really should not be used solely for stroke prevention," said Yale neurology professor **Lawrence M. Brass**, one of the study's authors. Over half of all strokes occur in women, according to Brass, and of those who survive a stroke, 90% are left with a permanent disability, with 40% requiring significant help in the daily activities.

**WHATEVER WORKS.** Patients who waver between conventional and alternative medical treatments can find both at the **Integrative Medicine Center** at **Griffin Hospital** in Derby—the only program in the Northeast that offers a combination of holistic, conventional, and naturopathic solutions to each patient. The center is co-directed by **David L. Katz**, a conventional physician, and **Christine Girard-Couture**, a naturopathic physician, who work together to evaluate each patient and arrive at an appropriate treatment. Such treatment could include conventional medicine, lifestyle changes, herbals, acupuncture, and meditation.



### High Technology

**FIGHTING TERRORISM.** An "adversarial intent program," which uses computer models of causality to predict enemy actions, could be instrumental in developing a new, more effective way to fight terrorism; this research, due to be turned over to the military within the year, is the brainchild of **University of Connecticut** researcher

# IN BRIEF

## Science and Engineering Notes from Around Connecticut

**Eugene Santos**, an engineer who is also trained in cognitive science. "Since the terrorist attacks on September 11, the linear, large-scale military operations like the Persian Gulf War, are a thing of the past," says Santos. The military, he explains, is reconfiguring itself to better respond to tactics used by terrorists. This approach means to counter an enemy's strength by focusing on its weaknesses. Santos' model should help the army shift from its current military doctrine of operations, which is based on achieving specific objectives, to one that focuses on influencing future enemy actions.

**STOPPING SEIZURES.** Surgery performed at the **University of Connecticut Health Center (UCHC)** can substantially reduce the number of seizures in the 20% of epileptics who don't respond to medication. The procedure, known as vagus nerve stimulation, involves implanting a stop-watch sized device in the chest. Wires from the device are attached to the left vagus nerve in the neck, which affects the area of the brain responsible for seizures. The wires deliver preprogrammed electrical stimulation to the vagus nerve 24 hours a day, reducing seizures by about half in 30% to 40% of those treated. In addition to the preprogrammed electrical pulses, a patient can trigger additional stimulation by passing a magnet over the device, which can minimize or end a seizure.

**THEORETICALLY SPEAKING.** Einstein didn't get it quite right, according to **University of Connecticut** physics professor **Philip Mannheim**. Mannheim's theory of gravity predicts that gravity repels as well as attracts. Like Einstein, Mannheim believes that gravity can be described as a curvature in space-time. His theory, however, describes that curvature differently. It predicts that gravity will behave like Newtonian gravity on the small scale with which we are familiar; that it will behave as described by Einstein's Theory of General Relativity up to the scale of solar systems, but that at the scale of galaxies, gravity is a force that can also repel. Mannheim believes that his theories can account for two mysteries in modern cosmology: the fact that galaxies spin quickly, and the fact that the universe seems to be expanding at an accelerating rate.

**HEART STOPPING.** A portable, cost-effective program to test young athletes for sudden death risk factors has been developed by **Yale** surgeon **James Rosser**. Operation Beating Heart uses a miniature, five-pound ultrasound device to scan the heart for defects, a computerized pulmonary function exam, and an electrocardiogram (EKG). These tests have traditionally taken place only at clinics or hospitals. With Rosser's method, they can be performed anywhere, by certified athletic trainers working under the guidance of experts at remote locations. Young athletes can be felled by hypertrophic cardiomyopathy, a rare heart condition that usually goes undetected in the screenings currently used.

**DRUG DEAL.** **Genaissance Pharmaceuticals**, of New Haven, has signed an agreement to provide information from its database of gene variations to **Pfizer Inc.** The information could be used to speed the development of drugs that can be customized to individual patients. Genaissance scientists have discovered 80,000 versions of nearly 5,000 genes; these variations, known as haplotypes, can indicate which individuals will respond to a particular type of medication. The company is conducting a study of haplotypes that could determine which of several cholesterol-lowering drugs will work best for a particular patient, based on that patient's DNA.



## Industry & Business

**KNOWLEDGE IS POWER.** Using a data system that is being jointly developed by **Yale University** and the **University of Connecticut**,

towns and individuals will be able to use census data to create online maps. This project is part of an ongoing, statewide effort to collect and utilize demographic and economic data; the government, along with universities and the private sector, is working to make such data easily accessible to the public via the Internet. An Internet portal, for example, scheduled to be launched within the next few months, will allow citizens to examine information held at state agencies.

**NEARING MARKET.** Connecticut biotechnology startup **Alexion Pharmaceuticals** became the first in the state to have a drug enter clinical trials; these trials, which are the final tests before the Food and Drug Administration allows a company to put a drug on the market, take place only after the drug has already passed safety and effectiveness tests. The trials will include 3,000 patients, and could take up to a year and a half. Alexion's drug candidate, pexelizumab, lowers the risk of heart attack and death after coronary bypass surgery. An anti-inflammatory medication that interferes with certain links in the body's immune system, the drug appeared to reduce death rate by 79% compared to results obtained by a placebo. The drug also seemed to significantly reduce cognitive impairment caused by the surgery, which releases tiny emboli which lodge in the brain and cause cell death.

**HIGH TECH SOUND.** In just a year and a half, Connecticut technology networking group **Silicon Sound** has grown from 500 to 1,500 members. According to the group's president, **Angelo Rossetti**, Connecticut's technology companies are more spread out than those in urban settings, so that even those working in the field often don't realize how many similar businesses surround them. He believes that this ignorance is a major impediment to technology growth in the state. The group, which has no membership fees, sponsors quarterly networking events.



## Transportation

**SEPARATE EXIT.** Threatening airline passengers can quickly be shunted into a secure area with the Rapid Access Portal, a sophisticated high-tech safety system developed by New-Britain-based **RAPOR, Inc.** The system, which is currently being tested by American and United Airlines, is capable of checking people at a rate of about one per person a second: the speed is possible because those who are shown to be carrying metal are moved into a side area, where they can be more thoroughly checked without delaying the other passengers. But the system can do more than just scan travelers for contraband metals. Its software also can be instructed to permit access in response to key cards, facial scans and hand geometry, and it can be programmed to allow specific people access to particular areas only at certain times.

**FAST LANES.** Connecticut speeders may decide to slow down. At least that's the goal of Operation Centipede, a new state police law enforcement technique that relies on laser guns, a new helicopter, and a plentitude of police cars. The intensive operation involves stationing police cars about every mile on selected highways, relying on the helicopter to help track targeted vehicles. In its first trial, on the **Wilber Cross Highway**, police officers were able to issue 339 tickets for speeding and other moving violations, fining drivers a total of \$60,000 in a single eight-hour shift. "This is just a demonstration of the number of people out there not obeying speeding laws," said **Sgt. David Aflalo**.

—Compiled and edited by **Karen Miller**

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

seeking their own opinions—just the facts with evidence-based judgments.”

- Reports that are “peer-reviewed by a group comparable in expertise to that of the committee and representing a broad spectrum of views—including extreme views. We require every comment by a reviewer to be addressed by the committee and ... monitor whether the responses are adequate.”

[See <http://www.infocusmagazine.org/1.2/president.html>]

### ◆ Autism: Early Intervention Key

A new report from the National Research Council recommends routine early screenings, similar to those currently done for vision and hearing problems, for autism and related developmental disorders. Citing the “long recognized” benefits of intensive schooling for young children with such conditions within the first decade of life, and noting that experienced professionals can reliably diagnose autism as early as age 2, the report urges prompt educational intervention.

Instruction in academic and social skills—which is required under federal special-education laws—should be provided for a minimum of 25 hours every week year-round, the committee recommends. Parental involvement also should be encouraged and supported, and more should be done to educate teachers and classroom aides in the field. Relevant state and federal agencies should set aside extra funds over the next five years to train those who work with or are accountable to children with autistic spectrum disorders and their families, the report continues, noting that educators often face immense and unique challenges in socializing and instructing such children.

[Read the report at <http://www.nap.edu/books/0309072697/html/>]

### ◆ Palliative Care for Cancer Patients

According to a new report from the National Research Council and the Institute of Medicine’s National Cancer Policy Board, improvements in palliative care (the management of symptoms and side effects) for cancer patients have not kept pace with the medical advances that have extended the lives of these patients. Where the willingness and means exist to provide adequate pain control or compassionate care, insurance regulations, lack of coverage, or both, often make it difficult or impossible for health care providers to do so.

The report cites a “single-minded focus on cure, compounded by society’s ambivalence toward death and dying,” as the reason that little attention is being paid to palliative cancer care. The National Cancer Institute must step up its commitment to research and training on palliative care and serve as a model for others, the report states, while public and private insurers must re-examine their coverage of palliative care services. In particular, the federal Centers for Medicare and Medicaid Services should fund projects to devise better ways to deliver and reimburse this care when and where cancer patients need it and information on palliative care and related options must be made readily available to patients and families.

[Read the report at: <http://bob.nap.edu/books/0309075637/html/>]

### ◆ The Promise and Peril of Stem Cell Research

Medical researchers seeking cures for debilitating diseases see almost unlimited potential in stem cells, both embryonic and adult, which hold the promise of generating new red blood cells for patients with leukemia, neurons for victims of stroke or Alzheimer’s or Parkinson’s, pancreatic cells for diabetics, and more. According to a new report from the National Research Council and the Institute of Medicine, publicly sponsored research on embryonic and adult stem cells would provide the most efficient and responsible means to fulfill this promise. Such funding would help ensure that “more scientists with a broader spectrum of perspectives” could pursue a variety of research questions, and that their results would be made widely accessible through scientific publication. Public funding also offers greater opportunities for regulatory oversight and scrutiny.

Much basic research must be done before patients can benefit from medical advances. However, such research raises profound ethical and public-policy questions, especially in the case of embryonic stem cells, which are primarily drawn from frozen human embryos left over from *in vitro* fertilization procedures.

The committee called for development of new embryonic stem cell lines “to replace existing lines that become compromised by age, and to address concerns about culture with animal cells and serum that could result in health risks for humans,” and urged rigorous pursuit of research on immune rejection, including further study of somatic cell nuclear transfer (sometimes referred to as therapeutic cloning), an ethically controversial technique. The committee also recommended that a national advisory board be established at the National Institutes of Health comprising outstanding scientists, ethicists, and others to ensure that proposals for federally funded work were scientifically sound and met mandated codes of conduct.

[Read the report at <http://www.nap.edu/books/0309076307/html/>]

### ◆ More Effective Emissions Inspections

A new report by a Research Council committee concludes that state vehicle emissions inspection programs are actually targeting the wrong cars. Most states are using too many resources on inspecting newer cars, which have the latest pollution-control technologies and are generally cleaner than older models, the report says. In contrast, these malfunctioning vehicles, which make up only about 10% of the nation’s fleet, typically emit about 50% of the most harmful air pollutants produced by motor vehicles. The report urges states to make these high-emitting older vehicles the primary target of state emissions inspection and maintenance programs.

The report also urges support of policies that provide financial relief or other incentives so owners will obtain long-lasting repairs or replace faulty vehicles, and notes growing evidence that less testing of vehicles with a low probability of failure—including exemptions for testing recent-year models—could be very cost-effective. It recommends that evaluation of the emissions benefits from inspection and maintenance programs be based on information collected from vehicles as they are being driven instead of assumptions in projection models.

[Read the report at <http://www.nap.edu/books/0309074460/html/>]

related to laser technology, and today the TRUMPF Group is the world's largest manufacturer and integrator of CO<sub>2</sub> and Nd:YAG laser resonators with total annual sales of \$1.1 billion.

**Coherent\*DEOS, LLC** (<http://www.cohr.com>), based in Connecticut and a subsidiary of Coherent Incorporated, manufactures lasers for many different applications. Coherent Incorporated had annual sales of \$480 million in 2001, and Coherent\*DEOS contributed significantly to that total. Coherent\*DEOS manufactures CO<sub>2</sub>-based lasers with power levels up to 300W, and plans to expand this product line to levels over 500W in a year or so. It should be noted that the world market for these low power CO<sub>2</sub> lasers is about \$250 million annually; if one includes high power lasers, the total figure exceeds one billion dollars per year, providing ample opportunity for Coherent\*DEOS to grow and expand.

**Zygo** (<http://www.zygo.com>) is a significant photonics player in the semiconductor, telecommunications, and industrial fields. Zygo is a leading supplier of metrology systems, macro-optics, and micro-optics. Zygo's TeraOptix division's products include precision micro-optics subcomponents and packaging. ZTO integrates precision optical subcomponents with customer-supplied elements onto a silicon optical bench using photolithographic and wafer fabrication techniques. Zygo's MicroLUPI™ interferometer is an advanced micro-optic metrology system which provides precise, automated high-speed optical testing of discrete or

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

array-based micro-optical components, which provides non-contact 3-D surface measurement and analysis of highly curved, flat, or spherical components ranging from 20 microns to 3 millimeters in diameter. Their NewView 5000™ interferometer provides non-destructive, fast, accurate, repeatable surface texture measurement and analyses with no sample preparation required, which makes it useful in field conditions.

**Advanced Fuel Research** (<http://www.afrinc.com>) is also a significant manufacturer of equipment used in optical instrumentation and measurement. Much of the company's photonics activity has been organized into a division called TurboSense.

Although still very young, the photonics industry is growing rapidly. Connecticut has a number of the world's leading manufacturers of photonic equipment and components, and, thanks to the presence of these companies as well as the state's university research centers, a reservoir of skilled workers and engineers.

It has been a mere 40 years since the first laser was built; 40 years from now, the use of photonics may well eclipse many electronic applications. Connecticut is ideally positioned to take advantage of this scenario. For the state's photonics industry, this means tremendous potential for growth—and a very bright future indeed. ♦ **Jane Sibley, science writer, and George Foyt, executive editor for engineering, CASE Bulletin**

## Bulletin *of the*

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