

Bulletin of the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



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Connecticut Science Center Releases Educational Videos and Classroom Activities

Although it opens in 2008, the Connecticut Science Center is using the construction of its dramatic new building to help teach science and math skills even before it's finished. That's the idea behind The Science of Building, a new series of digital videos that can be viewed on the Center's website at www.CTScienceCenter.org, which are available to teachers just in time for the new school year. The videos use the construction of the new facility to demonstrate how science and math is used in everyday life activities, like construction, and its lessons are directly tied to the state's new Connecticut Science Framework. Each video is accompanied by a classroom activity, which can easily be incorporated into a teacher's lesson plan along with the video.

The first of the series of videos focuses on simple machines, and is illustrated by the actual construction machinery involved in building the Center. The second video explains how glaciers and erosion caused the path of the Connecticut River to meander, effecting lifestyles along the river and dictating how the Science Center's foundation should be built. In this video the Center is joined by CASE member and geologist Ralph Lewis and members of Archeological and Historical Services, Inc. The third video explains the process of making concrete and the chemical reaction it undergoes. It was created with the help of Tilcon Connecticut, demonstrating the science of concrete from the quarry, where it all begins to the final product used for building the new Science Center. These are just the first in a series of videos that will be offered by the Connecticut Science Center to help teachers bring real-world science into the classroom. The Center's Program Outreach staff is available to provide teachers with more information at (860) 727-0457.

Distributed Generation One Solution to CT's Burgeoning Energy Needs

In an effort to meet increasing energy needs and rising electricity costs for Connecticut businesses and residents while using efficient, environmentally sound resources, the Connecticut General Assembly passed Public Act 05-01, An Act Concerning Energy Independence (EIA), in a June 2005 special session. One of the most important of the conservation measures called for under the act is the provision of monetary incentives designed to encourage corporations, large-scale industries, and commercial enterprises to install on-site generators, thus creating a distributed electrical power system. According to Beryl Lyons, media spokesperson for the Connecticut Department of Public Utility Control (DPUC), this is nothing less than a win-win situation, since any attempt to remove power from the grid reduces energy costs to Connecticut consumers and allows large-scale users to meet their power needs using state of the art technology that is environmentally sound and efficient.

The need for more power

Quite simply, Connecticut does not have access to sufficient electrical power to meet all of its needs because of growing demands on power throughout the state, particularly in the southwest corridor. Complicating this issue is the fact that Connecticut Light and Power Company (CL&P) and United Illuminating Company (UI) currently are not permitted to generate power, but only to distribute it, often at a premium because of the combined impact of deregulation, rising prices for crude oil and natural gas, and Federally Mandated Congestion Costs (FMCCs). [Required by federal law since February 1, 2004, FMCCs are line item charges—added to all user utility bills—for congestion costs (energy related), and for reliability-related costs. Congestion costs occur when a more costly generator is dispatched before a less costly one because there isn't adequate transmission

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News from the National Academies

The following is excerpted from press releases of the National Academies and from Infocus Magazine (www.infocusmagazine.org), a news resource of the National Academies.

◆ Strengthening the Foundation of US Aviation Research

[CASE president Alan C. Eckbreth served on the Steering Committee for this report, and chaired Panel B: Propulsion and Power. CASE member David (Ed) Crow also served on Panel B.]

If the United States is to maintain global leadership in the field of aviation, NASA (the National Aeronautics and Space Administration) should expand its partnerships with public and private institutions and prioritize its aeronautics research according to a "decadal survey" that ranks projects based on their ability to improve the nation's air transportation system, according to a new report from the National Research Council.

"The air transportation system will need to double its capacity over the next 10 to 35 years, develop new technologies to reduce noise and emissions, and decrease the number of accidents even though the number of flights will increase substantially," said Paul Kaminski, committee chair and former under secretary of defense for acquisition and technology in the Defense Department. "To achieve these goals efficiently, NASA should create a more balanced split between in-house and external funding of its aeronautics projects and fund the ones with the highest expected payoff."

The report provides a list of research challenges and strategic objectives for NASA to pursue over the next 10 years, including developing aircraft that are quieter, more efficient, and less polluting; developing technologies to reduce delays during peak travel conditions, and designing "smart" systems that can quickly detect and respond to anomalies outside or inside a plane. The report recommends that NASA have clear criteria for starting, continuing to support,

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capacity to get the generation from the less costly plant to the load center that needs it, and reliability charges are related to the generating plants themselves. (www.wattsnewct.com)

David Dobratz, Senior Program Administrator and Evaluator for the Conservation and Load Management Department of CL&P, explains the impact of deregulation this way: "Deregulation has created a situation where the responsibility for overseeing the reliability and economic viability of energy resources for Connecticut residents and business owners has been removed from the local distribution companies (CL&P and UI)."

According to Michael Schoeplein of the Institute for Sustainable Energy at Eastern Connecticut State University, Connecticut customers have experienced approximately a 50% rate increase in their electric bills during the past three years and could see

another 10–15% increase if improved means of generating clean, efficient energy are not developed.

When energy demands are particularly high, usually during the summer, Connecticut has traditionally relied on what are known as "peaking plants"—generally older, non-utility owned power plants which are coal/oil fired (with associated reliability and emissions issues) and which generate power at about 34% efficiency because they don't utilize the waste heat that is generated. Schoeplein explains that FMCCs exist as penalty charges for using these outdated power plants. A typical CL&P residential ratepayer, using 700 kilowatt-hours a month, pays almost \$9 a month in congestion charges (*Hartford Courant*, 2006). One of the benefits of the EIA is that funds supporting the development of on-site generators should be recoverable from FMCCs.

Lyons of the DPUC points out that Connecticut accounts for 28% of all New England's electricity demand, and the southwest corner experiences some of the worst congestion problems in the country. The proposed incentives will include lower back-up power charges, lower natural gas fuel charges, and direct grants and payments to cover installation charges. These monetary grants will be in proportion to the amount of electrical load that the on-site generators will remove from the grid. Participants could receive up to \$500 for each kilowatt of power generation capacity. Additionally, customers will be able to sell renewable energy credits back into the market to offset the cost of the project.

Current Projects

As of May 2006, there were seven organizations petitioning for these funds. Among these are Fairfield University, Anthem Blue Cross, Cellu Tissue, and Frito-Lay. Fairfield University expects approval for a DPUC grant to fund a co-generator project that it anticipates will be up and running by February 2007. This turbine generator will run on natural gas and supply the university with 90% of its electric needs and 67% of its heating needs. In the summer months, the heat waste energy can be converted to chilled water that will cover much of the university's air-conditioning needs. William Auger, manager for energy services at Fairfield, states that they do not want to become fully independent from UI, particularly in the short term, until costs and efficiency are assessed. "The project is a green technology where we will actually reduce our emissions. If we are successful in obtaining the state grant, our annual savings are projected to be \$1.2 million, bringing our utility costs back to 2005 levels," adds Associate Vice President for Campus Planning and Operations Richard Taylor. "These savings will be applied to our true mission—educating our students."

Anthem Blue Cross and Blue Shield of Connecticut has been a long time partner with UI in working to implement energy conservation measures. In 2006, UI approached Anthem and suggested applying for grant money to build an emergency generator that, because of Anthem's conservation measures, needs only to produce 2.25 megawatts to service the electrical demands of the company's 600,000 square foot campus, housing four office buildings. Based upon the recommendation of engineering firms that assessed their needs, Anthem's director of facility services, William Pakulis, chose to install an emergency generator relying on diesel fuel rather than a gas-operated turbine. This \$2.5 million project will serve as a back-up, upon UI's request, when utility demand is high. It will be capable of powering up within a half hour and serving the campus for as long as a week. Anthem is being awarded \$500,000 for the project, with the understanding that any surplus energy will be bought back by UI.

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IN BRIEF

Science and Engineering Notes from Around Connecticut



Business & Industry

A RIVERFRONT CAMPUS IN EAST HARTFORD. Mark Scheinberg remembers the beginning of **Goodwin College**. Scheinberg is president of the college—now a nonprofit school—which began operation as a small, private company in rented space above a Hartford pizzeria. Initially known as Data Institute, it offered a rudimentary computer class to four students. In 1983, it was accredited as a technical institution, and Scheinberg moved it to larger quarters in East Hartford. In 1999, it was named Goodwin College and licensed as a two-year college offering associate degrees. Now, the college is on the verge of an \$80 million expansion with construction of a new campus along the Connecticut River. The expansion will allow the college to help the state meet the growing need to train its workforce, said **Dan Matos**, developer of **United Technologies Corp's Rentschler Field**.

CONNECTICUT BIOSCIENCE R&D SPENDING UP. Total expenditures of bioscience operations held steady at about \$7.6 billion in 2005, compared to the previous year, according to data released by **CURE (Connecticut United for Research Excellence, Inc.)**, the educational organization and business support network for bioscience in Connecticut. Over the past five years, expenditures have grown 76%. Collected by CURE for its 11th Annual Economic Report, the data show the bioscience industry in Connecticut directly employed 17,402 people in 2005. That represents a 5% increase over the past five years. "These figures demonstrate how dynamically the biotechnology segment of our industry is evolving, and they confirm the wisdom of cultivating a diversified industry that balances biotechnology, university, and pharmaceutical operations," said **Paul R. Pescatello**, president and CEO of CURE.

MAKING AN IMPRESSION. If the message that manufacturing is hip, cool and happening failed to reach any of the thousands of students visiting the **Connecticut Convention Center** during a recent "Manufacture Your Future" career expo, it was not for lack of volume. A pounding beat, high-decibel music and the rapid-fire patter of professional disc jockeys greeted about 3,500 middle school, high school and community college students from throughout the state at the two-day event, where there was plenty of talk about the \$25- to \$30-an-hour paychecks available to top wage earners at some of the state's more than 5,000 manufacturers. "I do want to make a good living," said **Ciara Rivera**, a high-school freshman who likes computer-controlled manufacturing.

SMART DOORS. Some automatic doors made by **Stanley Access Technologies** have brains, like the one that knows enough to open wider when a forklift is approaching. Other doors have eyes, such as the "jamb cam" video used to deter theft, monitor foot traffic and document fraudulent injury claims. Its cameras record crisp, full-color images of everyone who walks through the doors, even noting their height against a measuring stick. Stanley Access Technologies has used such advanced products to emerge as a leader in the burgeoning market for automatic doors. **Stanley Security Solutions**, which includes the automatic doors unit, recorded sales of \$818 million in 2005, up nearly 24% from the previous year. "This business has basically doubled in the last five years," said **Frank Luke**, the unit's chief operating officer.

PFIZER SELLS UNIT TO JOHNSON & JOHNSON. Pfizer Inc. has reached a definitive agreement to sell its **Pfizer Consumer Healthcare (PCH)** business to **Johnson & Johnson** for \$16.6 billion in cash, resulting in about \$13.5 billion in after-tax proceeds. The agreement, approved by the Pfizer board of directors, completes a review of strategic options for the consumer business that Pfizer initiated in February. "By obtaining excellent value for our consumer business, we have taken another important step to create value for our shareholders while transforming our company," said Pfizer chairman and CEO **Hank McKinnell**.



Communication

CAN YOU HEAR ME NOW? **Hartland**, in Litchfield County, is notorious for its spotty cellular coverage. This is not only an annoyance for residents, it's also a safety concern. There are no public telephones in Hartland other than the emergency call boxes at the fire stations. The town is installing two communications towers on its property—the first ever in town—so residents will have cellular coverage. "'No cell service' is the most common complaint I hear from residents," First Selectman **Wade Cole** said. Wireless carriers will be allowed to use the communications towers with approval from the **Connecticut Siting Council**. This could generate income for the town because carriers would pay the town to use the tower. Emergency services such as the town fire departments, highway department, ambulance association and the state police can add their antennas and use the towers for free.



Education & Cognition

BREAKING DOWN BARRIERS. As part of a demanding high school program that requires girls to undertake a year-long engineering research project, the **Women in Science and Engineering Program (WISE) at Westover Girls School** aims to break down stereotypes that often cause girls to shun science and math, according to program director **Ellen Twomey**. In addition to the year-long senior project, students in WISE have built electrical circuits, made model bridges, experimented with fuel cells and even built a catapult. WISE, developed in conjunction with Rensselaer Polytechnic Institute more than a decade ago, features challenging courses such as electrical engineering, computer architecture and computer science. It was cited this year as a model of curriculum innovation by the Leading Edge awards program, sponsored by the National Association of Independent Schools.

SCIENCE SCORES A CAUSE FOR CONCERN. America's fourth-graders made gains in science performance while eighth-graders held steady and high school seniors posted declines, according to the 2005 National Assessment of Educational Progress. Connecticut, like many states, reported no significant changes since fourth- and eighth-graders were last tested in 2000. Experts viewed the latest scores—particularly a decline in performance over the past decade by high school seniors—as a worrisome sign, especially as the nation seeks more scientists and engineers. "It's fairly well recognized that students are not where we want them to be," said **Terri Clark**, vice president of the **Connecticut Academy for Education in Mathematics, Science and Technology**, which promotes science and math in the state's schools.

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 CASE Bulletin, 179 Allyn St., Suite 512, Hartford, CT 06103-1422, or email us at acad@ctcase.org

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TESTING POLICY UNDER SCRUTINY. When her eighth-grade son, who has epilepsy, attempted to take the Connecticut Mastery Test this year, he couldn't read it, **Darlene Wojtusik** said—and the stress overwhelmed him. “How,” she asked, “can you give him an eighth-grade test?” That is exactly the kind of question top-level state education officials are asking about the impact of the pressure-packed annual test on at least a handful of disabled children with serious academic problems. Under the federal No Child Left Behind act, these children are required to take the six to seven hours of mastery tests at their actual grade level—tests that parents and educators believe are beyond their ability to comprehend. Officials in Connecticut, which is suing the federal government over the cost of No Child Left Behind, say the state has received neither the money nor the guidelines from the federal government to develop modified tests. In the meantime, those students must take regular tests at their grade levels.

YALE SCHOOL OF NURSING LAUNCHES PHD PROGRAM. This fall **Yale School of Nursing** (YSN) will begin accepting its first class of PhD students, who will be offered comprehensive tuition funding and stipends. The full-time program approved recently by the **Yale University Faculty of Arts and Sciences** will provide students with mentored teaching and research opportunities enhanced through collaborative work with other Yale graduate and professional schools. “This is a major accomplishment for YSN and for Yale,” said Academy member **Margaret Grey**, dean of the School of Nursing. The US Department of Education recently awarded YSN a three-year grant to support the recruitment and training of outstanding applicants for the PhD program.

TEACHING TEACHERS ABOUT SCIENCE. Connecticut is set to add science to its annual mastery test in spring of 2008, and about 180 teachers are taking part in workshops run by the **Connecticut Science Center** in preparation for the additional teaching required by the testing. Science is not her strength, but teacher **Ellen Hill**, who teaches second- and third-graders at the **Regional Multicultural Magnet School** in New London, says her students love science. “I always felt like it was out of my realm. I don't have a science background,” said Hill, a veteran of eight years of teaching. “I have an undergraduate [degree] in child development and education and a master's in special education.” Hill's background is not unusual, but she and many other elementary teachers in Connecticut and across the nation soon will face new demands to teach science as states gear up to test the subject under the federal No Child Left Behind act.

PHYSICS IN THE SUMMER. More than a dozen high school students from across the state spent a portion of their summer vacation at **Manchester Community College** studying the principles of engineering. The college opened up its classrooms and made teaching staff available for its first **Project Lead the Way**, an engineering academy for high school students to help guide them toward engineering fields in college and in the workforce. The college has developed the first major Project Lead the Way program in the state, in which students from various high schools can take three weeks of classes on campus during the summer. Fifteen students from **Avon**, **Berlin**, **Howell Cheney Technical**, **Farmington**, **RHAM** and **Simsbury** high schools participated in the Manchester program, which is funded by the **College of Technology Next Generation Regional Manufacturing Center**.



Energy

DIY ELECTRICITY. The **Fostini** family of four is not unlike so many others in Connecticut. They live in a house in the suburbs

with three bedrooms and two baths. But unlike most families, the Fostinis have a windmill—more precisely known as a wind generator—that turns a steady breeze into electricity, a rare sight in Connecticut. Phil Fostini is one of those prescient people who embraced alternative energy sources long before oil and gasoline prices shot up. Follow the long driveway to his Cheshire house, you come upon what amounts to Power Plant No. 1, a bank of solar photovoltaic cells facing south. In the distance is Power Plant No. 2, the windmill. On many days, those two energy systems can generate more electricity than his home even needs, and they provide significant savings on his monthly utility bill.

ENERGY EFFICIENCY. When managers at the **Ford Motor Co.** distribution center in Windsor Locks realized that they could save tens of thousands of dollars a year on electricity costs by changing their light bulbs, they did, last summer. Today, with lower-wattage but equally luminous fluorescent bulbs in place, the 230,000-square-foot **Hartford High Velocity Center** burns about half the kilowatt hours it did with metal halide lamps, said **Paul Tetrault**, the center's controller. Sensors turn off the lights in remote parts of the warehouse when no one's around. Electricity rates have since gone up dramatically, but overall, the center's electricity expenses have dropped, allowing it to more than recoup the \$42,000 it paid toward the \$180,000 retrofit. In all, the company expects to save more than \$100,000—or almost 50%—in the first year. Last year's bill was \$209,902.

GOING UNDERGROUND. Oil prices were still comparatively low when **George and Heidi Fellner** planned their new home in **East Haddam** more than five years ago. Fellner brought something unique to the design—an environmental sensitivity. They chose a geothermal heating system, a system that is more attractive by the day in a time of soaring energy prices. Fellner chose one that involved sinking two wells 300 feet deep and installing a polyethylene pipe filled with an antifreeze solution. In winter, that liquid is heated by the earth's warmth and circulated to a heat-exchanger in the home's basement that converts that heat energy to hot air, which is blown through the house, just as in a conventional forced-air system. In summer, the process is essentially reversed, with hot air taken from the home and essentially dumped underground. Fellner calculated that the average monthly cost to heat and cool his 3,240-square-foot home, including the electricity necessary to run his system, was \$70 a month, while a conventional oil-fired system would cost an average of \$142 a month.

POWER PLANTS A MAJOR INFLUENCE IN REGIONAL MERCURY EMISSIONS. The amount of mercury emitted into the atmosphere in the Northeast fluctuates annually depending on activity in the electric power industry, according to researchers at the **Yale School of Forestry & Environmental Studies**. The Yale study found that between 2000 and 2002, the emission rate of mercury decreased by 50%, but between 2002 and 2004, the rate increased between 50 and 75%. During that five-year period, overall emissions declined by 20%. The dramatic annual changes in mercury emissions, the study's authors say, cannot be explained climatologically by air flow patterns that would bring either clean or polluted air into the region.

UI BEGINS TRANSMISSION UPGRADE. The **United Illuminating Company** (UI) will begin construction on a 345-kV (345,000 volts) transmission line from **Middletown** to **Norwalk** later this summer. UI will construct, own, and operate transmission and substation facilities comprising approximately 20% of the total Middletown to Norwalk (M/N) Project which was approved by the **Connecticut Siting Council** in 2005. UI has awarded the first major construction contract to Siemens Power

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Transmission & Distribution, Inc. for the turnkey construction of the **Singer Substation** in Bridgeport. Singer Substation, when completed, will be the largest 345-kV Gas Insulated Substation in North America. The M/N transmission project will extend the existing 345-kV transmission grid into the 54-town Southwest Connecticut region and include 45 miles of overhead lines and 24 miles under local streets, including the portion of the line to be owned and constructed by UI. This is a project undertaken in conjunction with the **Connecticut Light and Power Company**.



Environment

SOUND'S RECOVERY: REAL, BUT AT RISK. Twenty years of efforts to clean up Long Island Sound have yielded progress, but the pressure from sprawling coastal development is relentless, and new threats to this 110-mile-long estuary have arisen. The water is cleaner, and toxic discharges have been curbed. Species such as seals, striped bass and the osprey have bounced back. Programs are underway to protect wetlands and better filter wastewater discharges from scores of sewage treatment plants. "For the first time in 400 years, the discharge of nitrogen has been decreased rather than increased," said **Mark Tedesco**, head of the federal Environmental Protection Agency's Long Island Sound Office in Stamford. The **Connecticut Council on Environmental Quality**, in its recently released annual report, notes that the state met its 2004 goal for reducing nitrogen three years ahead of schedule. But the report questions whether funding will be adequate to allow the same rate of progress to continue in the future.

CLEANUP AT ROOSEVELT MILLS. The renovation of the abandoned **Roosevelt Mills** building in Vernon into an apartment complex, bistro, and recreational center depends on the success of a relatively new environmental cleanup technique developed at the **University of Connecticut**. The technique uses solutions of potassium permanganate and sodium persulfate to eliminate carcinogenic solvents, including tetrachloroethene, also known as perchloroethylene (PCE), which were used in processing fabrics at the former sweater factory. These solvents built up in the soil beneath the factory during its nearly century of operation. The new technique will make the building safe for reuse—an important step in rejuvenating the town's declining industrial area, said town administrator **Laurence R. Shaffer**.

THE GREEN GIANT IS BACK. One of the biggest and most beautiful moths in the United States—one whose numbers had plummeted in southern New England—seems to be making a comeback. In the past 10 years, populations of the luna moth *Actias luna*, a pale-green creature with a wingspan of more than 4 inches, have increased in Connecticut. "They do seem to be doing OK," said author and naturalist **John Himmelman**, who attracts and monitors moths in Killingworth, using ultraviolet light. Luna moths can be seen from late May through August and elicit awe when spied at night on a screen door. Entomologist **Gale Ridge** at **The Connecticut Agricultural Experiment Station** in New Haven added, "Luna's long tails protect it against birds. If a bird pecks at the moth's long tail, the moth can still fly away. Also, the eye spots on the wing startle a predator, giving the moth extra moments to escape."



Food & Agriculture

GROWING A STEADY SUPPLY OF SWEET SWEET-CORN. Corn Belt farmers harvest and store a single planting of field corn in

the autumn. In Connecticut, however, farmers manage the complicated production of a steady supply of corn at just the right, sweet stage of maturity for people to eat throughout the summer. Immature kernels are small, and over mature kernels are starchy. Because a single planting of sweet-corn would mean only one brief feast on sweet sweet-corn, farmers plant repeatedly. A fixed schedule of planting at intervals of a few days, however, will not keep the coolers at farm markets steadily filled because corn grows and matures faster in warm than cool weather. So, sweet-corn growers count degree-days rather than calendar days. **Nelson Cecarelli**, who grows sweet-corn in North Branford, recently stretched the usual interval of a few days between plantings to a full 17 days of cool weather. A picking of corn at the right stage to maintain a steady supply of sweet-corn rewarded his trust in degree-days.

CORNY BUT NOT CRAZY. It sounds crazy, heating your house with kernels of corn. But the **Petersons** of Washington, Connecticut, who bought a corn-burning furnace nine years ago, get the last laugh. "People thought we were weird—up until it started getting cold this past year," said **Todd Peterson**. The system is analogous to a coal-fired system, only cleaner. The Petersons buy 6 tons of corn kernels from a farm in Salisbury in the fall and dump it into a basement storage bin 8 feet by 10 feet. About once a week, a hopper connected to the furnace is filled with corn kernels, which are automatically fed into the firebox. Even in the coldest weeks of winter, the hopper needs to be filled only once every seven days. "We love it. It's great," John Peterson said. "We started it last October, and it ran all winter. We burned just short of six tons of corn. Cost: \$620. We still have some left."

POULTRY INDUSTRY ON ALERT. Dealing with avian influenza is nothing new to Connecticut poultry farmers, who have faced various strains of the disease since it was identified in the 1920s. But as the state's family farms have been consolidated into industrial operations with millions of birds, the need to guard against a virus that can wipe out entire flocks has grown. The industry is also bracing for the possibility that a deadly form of the bird flu that has infected humans in southeast Asia may ultimately reach North America. As a result, "biosecurity"—which includes antibacterial boot baths, access restrictions and pre- and post-shift showers for employees—has become the industry watchword. "We're back on a high-alert status," said Michael Darre, a **University of Connecticut** animal science professor and a poultry specialist with the university's **Cooperative Extension Service**.



Health

NEW TOOL AGAINST CANCER. Radiation oncologist **Richard C. Shumway** likes his job, except when he has to tell a cancer patient that the disease has spread, and there is nothing more he can do. But these days, Shumway has another tool in his arsenal—the CyberKnife. The \$4.6 million machine, which arrived at **St. Francis Hospital and Medical Center** this spring, can deliver tremendous doses of tumor-zapping radiation without damaging surrounding tissue. It will not replace surgery or conventional radiation, at least for now. But the miniature nuclear accelerator's highly focused beams of radiation are strong enough to kill or control tumor cells in one to five treatments, each lasting about an hour. Shumway says he is excited that the CyberKnife some-day could allow him to attack cancers of soft tissue in the pancreas, lung and prostate—cancers often considered inoperable because of the location of the tumor or the frailty of the patient.

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A MOTHER'S PROTECTION. This gift won't turn up on anyone's baby shower list, but one thing an expectant mom can do for her baby is to get sick. That's not to suggest that a pregnant woman should deliberately get sick, but if she does become ill, she can pass antibodies on to her baby, who will be born with at least temporary immunological protection against the infectious agents. There does appear to be at least one curious exception to this rule, scientists from **University of Connecticut (UConn)** and Case Western Reserve University in Cleveland have found. A pregnant mother infected by the parasite that causes lymphatic filariasis early in her term is more likely, not less likely, to deliver a baby who will get sick later in life. Apparently, her child's immune system does not recognize the mosquito-borne parasite as a threat and will tolerate its presence, says **T.V. Rajan**, a professor of immunology and pathology at the **UConn Health Center**.

EARLY MARKER FOR AUTISM. The diagnosis of autism—characterized by a profound loss of social skills—often is not made until age 2 or 3, even though most doctors believe the disease's onset occurs much earlier. However, researchers at the **Yale School of Medicine** may have found a marker for autism in the mother's placenta. If the observation is confirmed, it may be possible to begin treatment for autism at birth and alleviate many symptoms of the disorder. **Harvey Kliman**, a professor in the department of obstetrics, gynecology and reproductive services, observed a biological abnormality in the placentas of mothers who gave birth to children with Asperger's Syndrome, an autism spectrum disorder. A Yale team then compared placentas from the births of 13 children with Asperger's and 61 unaffected children. They found placentas from Asperger's births were three times more likely to have biological abnormalities called trophoblast inclusions than unaffected children.

STEM CELL FUNDS DRAW INTEREST OF 77 SCIENTISTS. More than 70 Connecticut scientists plan to ask for \$60 million to study stem cells, a committee charged with divvying up grant money was told recently. The state stem cell research advisory committee received 77 letters from scientists or institutions expressing interest in applying for grants from Connecticut, one of only three states to approve funding for stem cell research. However, if all the interested applicants submit formal applications for money, most will be disappointed. The state has allocated only \$20 million for funding this year. Yet the level of interest and quality of proposals pleased committee members who expect to dole out the money this fall. "This is the first clear indication we have had that we are on the right track," said **M. William Lensch**, a researcher at Children's Hospital Boston and member of the advisory committee. "I'm incredibly pleased to see what has come in."

STOPPING DIARRHEA CAUSED BY BACTERIA. Turning on a surface receptor in cells lining the intestinal wall can halt the often deadly diarrhea brought on by the bacteria *V. cholera* and *E. coli*, according to a **Yale School of Medicine** study. Secretory diarrhea, which occurs when the small and large intestine secrete salt and water at rates higher than the intestine can reabsorb, is a major killer of children under five years of age worldwide. Unless stopped, the diarrhea can rapidly produce massive losses of fluid and salt and result in heart failure. Study authors **Steven Hebert**, professor and chair of the department of cellular and molecular physiology, and **John Geibel**, professor of surgery, found that activating a calcium/nutrient sensing receptor in the intestinal lining stopped the fluid secretions caused by cholera. Activation of the receptor halts fluid secretion by increasing the destruction of cell signaling molecules that are activated by the bacterial toxins.

BEING FIRED NEAR RETIREMENT DOUBLES RISK. Involuntary job loss near retirement more than doubles the risk of heart attack and stroke, report researchers at **Yale School of Medicine**. The results are based on 10-year observations of 4,301 individuals between age 51 and 61, out of which 582 had lost their jobs during that period. The study is the extension of an earlier study, in which the same sample was tracked for six years. The earlier research indicated heightened risk of stroke, but not a definitive link between job loss and heart attacks. "With longer follow-up and heart attack and stroke events, we were able to better assess the association between employment separation and the medical outcomes," said **William T. Gallo**, associate research scientist in the school's **Department of Epidemiology and Public Health**.



High Technology

ANIMALS PROVIDE EARLY WARNING OF BIOTERRORISM AGENTS. Pets, wildlife or livestock could act as sentinels to provide early warning for humans and could help identify many ongoing exposure risks for certain bioterrorism agents, researchers at **Yale School of Medicine** have found in a study published in *Emerging Infectious Diseases*. The study found that animals could provide an early warning to humans if clinical signs could be detected before human illness emerged or soon enough to allow preventive measures to be initiated. If a released biological agent persists in the environment (soil, water or air), active surveillance for sporadic illness in animals could help detect ongoing exposure risks. The geographic pattern of sick or dead animals could also be an indicator for the persistence of a biological threat.

UTC UNIT TO MAKE FUEL CELL FOR SUB. **UTC Power** plans to produce an ethanol-powered fuel cell for a near-shore submarine now in development for the Spanish navy, the company announced recently. It would be the first time the South Windsor-based company, a division of **United Technologies Corp.**, produces a fuel cell for a submersible warship, said **Henry DeRonck**, the company's general manager for space and defense. Siemens AG, the German industrial giant, makes hydrogen-powered fuel cells for submarines. But UTC Power's use of ethanol would be new, DeRonck said, and would allow diesel-electric submarines to stay underwater longer. UTC Power will take about five years to design and produce the first of the ethanol-powered fuel cell systems. The project could ultimately employ about 80, company officials said, and about 30 are already devoted to it. Some employees would be reassigned to the project, and others will be hired.



Transportation

YALE SHUTTLE BUS POWERED BY COOKING OIL. Yale unveiled one of its new shuttle buses at Commencement this year, one of a fleet that runs entirely on biodiesel fuel made with cooking oil recycled from its dining halls. "The experiment with 100% biodiesel complements Yale's use of alternative fuels in the rest of its shuttle fleet," said Associate Vice President for Administration **Janet Lindner**. "The University has converted all of its shuttle buses to biodiesel as part of its commitment to a greener campus and cleaner air. We have been making use of alternative fuel vehicles, such as hybrids, within our fleet and we have begun using alternative fuel in all Yale shuttle buses. These efforts will help promote a healthier environment for the New Haven community."

—Compiled and edited by Robert Vieth

The Connecticut Clean Energy Fund

The Connecticut Clean Energy Fund (CCEF) was created by the Connecticut General Assembly and is administered by Connecticut Innovations, a quasi-public organization. CCEF promotes the development and commercialization of clean energy technologies; the creation of clean energy supply; and the demand for electricity from clean, renewable sources in Connecticut in order to strengthen Connecticut's economy, protect community health, improve the environment, and promote a secure energy supply for the state. CCEF's funding comes from a surcharge on electric ratepayers' utility bills. Paul Michaud, in-house counsel for CCEF, states that the DPUC is charged with implementing the provisions under the EIA and that CCEF had intervened in the DPUC's EIA dockets to promote the inclusion of renewable energy distributed generation projects. Michaud argues that "unlike fossil fuels, renewables provide double benefits—helping the environment and possible reduction of FMCCs. The legislature recognized this double benefit in the EIA when it mandated CCEF to give preference to renewable generation projects that maximize the reductions of FMCCs." Unfortunately, the DPUC has consistently ruled that any renewable energy projects receiving funding through the CCEF are either not eligible for additional funding under the EIA or that any CCEF funding would be considered a cost in determining EIA funding. Michaud's concern is that CCEF projects, which derive funding from a small surcharge on ratepayers' bills, appear as a greater cost, making them "less economically competitive" in the petitioning process. On behalf of the CCEF, he has argued vigorously to have the proposed CCEF projects placed on a "level playing field" with fossil fuel projects. The DPUC's consideration of economically competitive projects will become even more critical as the EIA completes Phase II, where funding for long term contracts will be considered.

In June 2006, the CCEF funded the Bridgeport Fuel Cell Park, which will receive a \$500,000 pre-development loan based on milestone achievements. The park will be the largest in the nation, potentially providing over 9,300 households with clean energy and reducing congestion costs paid by residents in the southwest corner of Connecticut. The CCEF has also approved a \$1.7 million project for the development of the single largest photovoltaic system in the state, to be built on the grounds of a Staples distribution center in Killingly through its On-Site Renewable DG Program. The On-site Program is a \$21 million flexible, integrated-technology financial support program designed to stimulate the demand for installations that will use renewable energy.

Although there is no debate about the need to remedy Connecticut's energy crisis, the installation of multiple on-site, non-renewable generation facilities raises some environmental concerns. The push is to create cleaner, more efficient energy production; however, more generators undoubtedly mean more pollutants released into the environment. For example, even state-of-the-art smaller systems will almost certainly have higher emissions per kilowatt-hour than state-of-the-art larger systems. On the other hand, both will clearly have much lower emissions than current, older, coal/oil fueled systems. According to Paul Farrell of the state Department of Environmental Protection (DEP), "the best immediate solution is to encourage companies to purchase stationary generators that exceed environmental standards and use natural gas to generate power." The DEP is working with the DPUC to create marketing materials informing business owners of various options. Operators of these on-site generators would be asked to run them on the heaviest use days, when pollutants in the state are at their highest, keeping in mind that if these generators can service electricity needs without having to depend on the older plants, then the environmental benefits are significant. According to Joel Rinebold, director of the energy program at the Connecticut Center for Advanced Technology, "It is very important that Distributive Generators (DGs) are built in the right location

and with the right application to maximize value to the customer. "If they are the wrong size, the wrong application, or in the wrong place, then they may not have the desired public benefit and should not be subsidized." He emphasizes several criteria that must be carefully considered including:

- Costs
- Environmental concerns
- Economic development
- Grid reliability
- Producing premium power
- Fuel type and energy output
- Location and timing

An Act Concerning Energy Independence is a major step towards addressing a growing energy crisis in Connecticut. The cost of energy is unlikely to decline and environmental concerns will only grow stronger in the years ahead. It is clear that business leaders, legislators and ordinary citizens alike need to work together to minimize the impact of this energy crisis. Distributed generation, along with the development of renewable resources, represents a clear effort to put into place one viable solution to the crisis.

— **Wendy Millstein is a freelance writer based in Simsbury, CT.**

National Academies (continued from page 1)

and discontinuing a research project. It also notes the importance of synergies between research objectives of the country's civil aeronautics industry and those of national security.

[<http://www.nap.edu/catalog/11664.html>]

◆ Alternatives to Indian Point Nuclear Plant

The September 11 terrorist attacks prompted calls from concerned residents of New York State to shut down the Indian Point nuclear power plant near New York City. Responding to these concerns, Congress asked the National Research Council if it would be possible to replace the energy lost by closing Indian Point, which provides 25% of the electricity in New York City and the lower Hudson Valley. An expert committee concluded that Indian Point's energy supplies could be replaced with non-nuclear power plants, additional transmission lines, and new efforts by consumers to save energy, but the state would need to overcome many political, regulatory, and financial hurdles.

Not all of Indian Point's 2,000 megawatts would need to be replaced, if consumers use electricity more efficiently by switching to energy-efficient appliances and shifting some of their energy usage to off-peak hours, especially during hot summer days, the report notes.

The most readily available way to replace the rest of the energy is with plants fueled by natural gas—the current fuel of choice for future electric power plants in New York State. But the committee is concerned over possible shortages and high gas prices. New supply sources would have to be found, which will probably include imported natural gas. Building a new coal plant along with a new transmission line would be the cheapest alternative to Indian Point, the report says, but this option is unlikely to be ready by 2015, when Indian Point's operating licenses expire, unless planning starts very soon. Also, burning more coal would complicate the state's efforts to reduce greenhouse gas emissions. Coal plants release about twice as much carbon dioxide per kilowatt-hour as natural gas plants, and nuclear plants release none. Renewable sources of energy—from wind, the sun, or biomass -- also look promising to the committee, but they could be deployed only on a small scale by 2015.

(See National Academies, page 8)

◆ Lower Acceptable Natural Fluoride Levels Urged

A new report from the National Research Council finds that children who are exposed to too much naturally occurring fluoride in drinking water—4 milligrams or more of fluoride per liter of water (the maximum allowed by the US Environmental Protection Agency)—risk developing severe tooth enamel fluorosis, a condition characterized by ugly discoloration, enamel loss, and pitting of the teeth. In the past, this condition was considered aesthetically displeasing, but not an adverse health effect. But because enamel protects teeth and underlying tissue from decay and infection, a majority of the committee said that the damage caused by severe enamel fluorosis should be deemed a toxic effect. Although two of the 12 committee members maintained that the condition should still be considered a cosmetic problem, the entire committee agreed that EPA should lower its “maximum contaminant level goal” for fluoride in order to prevent it.

About 10% of children in communities with water fluoride concentrations at or near 4 mg/L develop severe enamel fluorosis. In areas with 2 mg/L, up to 15% of children have moderate enamel fluorosis, which causes discoloration but no enamel loss or pitting. Moderate enamel fluorosis is rare in populations exposed to water containing less than 2 mg/L of fluoride.

Children are not the only ones at risk of adverse health effects. Most of the committee concluded that a population with lifetime exposure to water with 4 mg/L or higher of fluoride is at increased risk for bone fractures. More research is needed into the question of whether fluoride can cause bone cancer, the committee noted.

About 200,000 Americans have water sources containing fluoride at 4 mg/L or higher, while another 1.4 million have water with 2

mg/L of fluoride. Artificially fluoridated water contains between 0.7 and 1.2 mg/L of total fluoride,

[http://newton.nap.edu/catalog/11571.html?infocus_6.2]

◆ Temperature Data ‘By Proxy’

Climate scientists who want to know how modern temperature fluctuations compare with natural variations that took place before the Industrial Revolution, before meteorologists started using instruments to collect temperature data and when levels of heat-trapping greenhouse gases in the atmosphere were much lower, must rely on “proxy evidence”—tree rings, boreholes, ice cores, corals, and ocean and lake sediments—to reconstruct past temperatures.

The accuracy of such proxy evidence has been the subject of considerable debate within the scientific community, and last year, Congress asked the National Research Council to assess the ability of scientists to reconstruct surface temperatures for the past 2,000 years.

In its report, the committee notes that the warming recorded by instruments in the last century is also reflected in temperature reconstructions derived from borehole measurements, retreating glaciers, and other proxies. The report finds that surface temperature reconstructions for the last millennium are generally consistent, showing relatively warm conditions around AD 1000 and a “Little Ice Age” from roughly 1500 to 1850. Very little confidence can be put in statements about average global surface temperatures earlier than AD 900, the committee added. Proxy evidence that is scarce prior to 1600—especially in the Southern Hemisphere—gets even scarcer before 900.

[http://newton.nap.edu/catalog/11676.html?infocus_6.2]



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