Bulletin of the Connecticut Academy of Science and Engineering

Volume 22,2 / Summer 2007

Biodiesel Holds Promise as New Energy Source, Economic Boon for Connecticut

[Editor's Note: As of press time, the General Assembly was still in session, and the legislation referred to in this article was still pending.]

James LaMondia, Chief Scientist at the Valley Laboratory of The Connecticut Agricultural Experiment Station in Windsor, stands in a test field of canola. (Photo: P. Gough)

The potential of biodiesel, both as a source of energy and as a boost to business and agriculture in Connecticut, has created a great deal of activity during the past year. A facility that processes soybean oil into biodiesel has opened in Bethlehem, the General Assembly has held several public hearings on biofuels and how to encourage production, and The Connecticut Agricultural Experiment Station (The Experiment Station) and the University of Connecticut (UConn) are pursuing research that could assist the fledgling industry.

At the dedication of the BioPur biodiesel processing facility in Bethlehem on July 5, 2006, Governor M. Jodi Rell said, "This plant will help expand and preserve agricultural jobs throughout Connecticut. The production of biodiesel is an important step in the nation's ongoing efforts to

(Biodiesel, page 2)

Connecticut Science Center Update

It's Not Science Fiction Anymore!

On April 18, the Connecticut Science Center celebrated a historic construction milestone as the building's first steel beam was hoisted into place. In all, nearly 2,500 tons of steel will form the superstructure of the 144,000 square-foot signature building designed by world-famous architect Cesar Pelli. To celebrate this momentous occasion, the Science Center invited the community to sign one of the beams at an event that coincided with the National Bring Your Son & Daughter to Work Day. Hundreds of people joined in the festivities and left their mark behind.

Educator Resources

Although the Science Center won't open until 2008, it has already begun to offer educational resources to teachers and parents. A series of science education videos, "The Science of Building," are offered on the Center's website at www.CTScienceCenter.org, along with classroom activities that support the statewide Connecticut Science Framework. The newest video is all about the science of steel. This five-minute educational video documents the massive, yet incredibly coordinated, job of manufacturing the building's steel. Science of Steel is particularly applicable to 8th grade science learning, because of the bridge-building component to the curriculum, and to 10th grade because of the chemistry focus.

Two Webcams

Construction of the new Connecticut Science Center can now be watched live via a new webcam recently installed at Riverpoint in East Hartford. This webcam, which complements one that is already in place at the Marriott Hartford Downtown, provides an impressive view of the steel superstructure as it begins to rise almost eight stories into the city's skyline.

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.

◆ National Academies Join International Call for World Leaders to Address Global Climate Change and Energy Access Issues

On May 16, 2007, the National Academy of Sciences joined national science academies of a dozen other nations in calling on world leaders — particularly G8 leaders who met in early June — to address global climate change and energy-access issues by promoting low carbon-emission energy systems and more efficient use of energy. The academies also urged leaders to facilitate scientific and technical innovation, and to simplify and enforce a balanced intellectual property regime.

The academies issued joint statements on "Growth and responsibility: the promotion and protection of innovation" and "Growth and responsibility: sustainability, energy efficiency and climate protection." The full text of these statements is available on the National Academies website at www.national-academies.org.

Science Academies' Joint Statement: Promotion and Protection of Innovation

[www.national-academies.org/includes/G8Statement_Innovation_07_May.pdf]

Science Academies' Joint Statement: Sustainability, Energy Efficiency, and Climate Protection

[www.national-academies.org/includes/G8Statement_Energy_07_May.pdf]

◆ New Report Examines Environmental Impacts of Wind Energy Projects

A new congressionally mandated report from the National Research Council finds

(National Academies, page 8)

reduce our reliance on foreign oil and Connecticut is at the forefront of those efforts." According to BioPur founders George Linardos, Sr., and Chris Glynos, the plant will produce 450,000 to 1.5 million gallons of biodiesel annually; it currently produces 3,600-5,000 gallons a day, at or ahead of annual production projections.

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.

◆ Leading Patrons ◆

The Connecticut Light and Power Company • Pfizer

Special thanks to these organizations for their support of the 32nd Annual Meeting and Dinner on May 22, 2007:

Table Sponsors:

Coherent, Inc. • Connecticut Center for Advanced Technology • Connecticut Development Authority • Connecticut Economic Resource Center • Connecticut Innovations Inc. • Gerber Scientific, Inc. • Pitney Bowes • University of Connecticut Health Center • University of Connecticut School of Engineering • Yale University School of Medicine • Yale University

Friend of the Academy:

Connecticut Technology Council

The Connecticut Academy of Science and Engineering

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

Officers of the Academy

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

Myron Genel, Vice President/President Elect
Professor of Pediatrics Emeritus, Yale School of Medicine

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

Peter G. Cable, Treasurer
Applied Physical Sciences Corporation

Executive Director

Richard H. Strauss

Editors

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

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

Managing Editor

Martha Sherman

The *BULLETIN* of the Connecticut Academy of Science and Engineering is published by the Connecticut Academy of Science and Engineering, Inc., 179 Allyn Street, Suite 512, Hartford, CT 06103-1422. Telephone and fax: (860) 527-2161. E-mail: acad@ctcase.org. Web site: www.ctcase.org. To subscribe to the Bulletin, contact us by phone or email or subscribe on our web site.

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

COPYING PERMITTED, WITH ATTRIBUTION

Biodiesel, which comes from processing of vegetable oils instead of from petroleum, has a vast potential market in Connecticut because it can substitute for non-renewable petroleum-based diesel fuel and home heating oil. With the recent surge in the price of these fuels in Connecticut, homegrown energy becomes even more attractive, and there are additional benefits such as reduced emissions of soot and sulfur from biodiesel-powered vehicles.

Country singer Willie Nelson, an investor in biodiesel and proponent of its use, got a well-publicized biodiesel fill up for his tour bus at the Mohegan Sun. A truck delivered 1,500 gallons of B50 biodiesel (50% biodiesel) to a caravan of six tour buses, including ones belonging to Nelson, Merle Haggard, and Ray Price.

Among regular users of biodiesel in Connecticut are shuttle buses on the UConn Storrs campus powered by biodiesel produced from waste cooking oils; the Connecticut United for Research Excellence (CURE) BioBus; and Connecticut Transit buses using a B5 blend in Hartford, New Haven, and Stamford. B5 is 5% biodiesel and 95% petroleum-based diesel fuel. B100 is 100% biodiesel. Biodiesel can power any type of equipment that runs on diesel fuel, such as trucks, buses, tractors, and snowplows. Use of up to B20 does not require modification of existing diesel engines or home oil burners.

During a stop of the CURE BioBus at the Capitol in Hartford on April 26, children made biodiesel from cooking oils they brought from home. As the schoolchildren demonstrated, the process of producing biodiesel, known as transesterification, is not complicated. It starts with a vegetable oil, such as soybean or canola oil. The oil is mixed with methanol (wood alcohol) and potassium hydroxide (lye), which produces biodiesel and glycerol. There is essentially no waste created by the reaction.

"It is a very environmentally friendly process, the oil produced burns at least 40% cleaner than that obtained from petroleum distillates, has no sulfur emissions, and reduces carbon monoxide emissions by 30%. There is no net carbon dioxide gain as the CO2 released by burning was originally captured from the air by the plants," said James LaMondia, Chief Scientist at the Valley Laboratory of The Experiment Station in Windsor.

Production and use of biodiesel is more efficient than use of ethanol produced from corn as an energy source. Ethanol, which is now mixed with gasoline used in Connecticut, produces an estimated 25% more energy than that employed in its production. Biodiesel produces three times the amount of energy used. Further, oilseed plants don't require large inputs of fertilizers or pesticides.

UConn began work with alternate fuels about five years ago when a student who was interested in air pollution became curious about biodiesel. The first five-gallon batch was made from waste cooking oil. Chemistry professor James Stuart followed up with a query to fellow faculty to see who might be interested in biodiesel, and a small laboratory was established to investigate biodiesel production. The Biodiesel Consortium evolved, which in May 2006, in partnership with the Eastern Connecticut Conservation District and the UConn Office of Environmental Policy, presented a workshop on biodiesel fuels, drawing over 100 attendees. Now known as the Biofuels Consortium, the group held a second symposium in January 2007, which attracted 250 people, including producers, scientists, legislators, and others. About a year ago, The Experiment Station started its investigations after Director and CASE member Louis A. Magnarelli received a request from legislators for a study of the potential for soy and rapeseed production in Connecticut to improve the biodiesel market. On April 19, 2007, The Experiment Sta-

(Biodiesel, page 7)

IN BRIEF

Science and Engineering Notes from Around Connecticut

Business & Industry

SIKORSKY DEDICATES NEW CENTER. **Sikorsky Aircraft Corp.** has dedicated its CH-53K program's new Heavy Lift Development Center in Stratford. The 106,000-square-foot building houses the CH-53K program and engineering staff, co-locating 500 team members consisting of Sikorsky, Naval Air Systems Command, Defense Contracting Management Agency personnel, and subcontractors. These members work in teams to design, develop, test and manufacture major systems and subsystems. Sikorsky was awarded a $3 billion System Development and Demonstration (SDD) contract for the United States Marine Corps in April 2006. Under the terms of the contract, Sikorsky will oversee aircraft development, systems integration, test article production and test and evaluation activities on a sole source basis. The SDD contract could lead to the production of 156 CH-53K aircraft to replace roughly an equal number of aging CH-53E SUPER STALLIONs of the Marine Corps.

CT FILES TO OPPOSE LNG PROJECT. Connecticut **Attorney General Richard Blumenthal** has filed documents in New York formally objecting to the $700 million **Broadwater** proposal to anchor a LNG facility near the middle of Long Island Sound. "The project as proposed poses a direct and substantial threat to human health and safety and critical ecosystem resources of national importance in Long Island Sound," Blumenthal said.

CLINICAL TRIALS FOR SPINE STABILIZING DEVICE. **Applied Spine Technologies** of New Haven has raised $28 million to help pay for clinical trials of its spine stabilizing device. The company's Stabilimax NZ Dynamic Spine Stabilization system is designed to treat back and leg pain by stabilizing an injured or degenerated spine without eliminating motion. The device was designed by **Manohar Panjabi** of **Yale**. Human trials started in March and are expected to be conducted at 20 sites nationwide.

FDA PANEL OKAYS NEW PFIZER HIV DRUG. A 12-member Food and Drug Administration advisory panel approved a new **Pfizer, Inc.** drug for HIV. The drug, called maraviroc, was discovered in 1997. Later development and clinical trials were handled by research and development groups in Groton and New London. Maraviroc would be the first in a new class of oral HIV medication in a decade. FDA action on the drug is expected in June.

FLU OUTBREAK WOULD HIT STATE ECONOMY. The Trust for America's Health suggests that a deadly outbreak of flu would have a $10.1 billion impact on the state's economy. That represents a 5.23% loss for Connecticut's $193.7 billion gross domestic product. Businesses would suffer a $5 billion loss due to sickness or employees staying home to avoid the flu or care for sick family members. The arts, entertainment and tourism industry would suffer a projected $367 million loss.

Communication

TELECOMMUTING GAINS POPULARITY. More than 158,000 Connecticut residents work from home at least one day a month, according to a **Telecommute Connecticut** survey. Ninety-five percent of the people surveyed were positive about their telecommuting experiences. Employers cited productivity gains (38.2%), reduced turnover (34.5%) and reduced traffic/congestion (25.5%) as top benefits The survey indicates an 86% increase in telecommuting over the estimated 85,260 in December 2001. The average telecommuter reduces commuting cost by an estimated $2,104 per year.

CONNDOT OKAYS MONOPOLE TOWERS ON RIGHTS OF WAY. The state **Department of Transportation (ConnDOT)** has initiated a Wireless Communications Facilities Program to allow wireless communications providers to build, operate and maintain monopole antenna towers within ConnDOT-owned rights of way. The program has been established in cooperation with the Federal Highway Administration to improve communications for the traveling public and emergency response teams, providing alternatives to locating towers within communities and residential neighborhoods, and to generate revenue for the transportation system. If ConnDOT approves a site, the applicant must also seek approval from the **Connecticut Siting Council.**

STATE LAUNCHES INFORMATION SECURITY PUBLICATION. The **Connecticut Department of Information Technology** has launched a new Information security awareness publication to educate employees and the public about basic information security issues and practices. The first issue has a focus on identity theft, with resources and tips on how to protect personal information. Upcoming issues will cover topics such as cyber-bullying and laptop and PDA security. weblink?????

STUDENT PAPER GOES OFFLINE. The Executive Board of *The Campus Lantern*, the student-run newspaper at **Eastern Connecticut State University**, has voted to reverse a web-only publishing policy. The newspaper, which had recently been distributed only online, is again being distributed on paper. Editor-in-Chief **Tori Saulnier** said, "We made a mistake when we abruptly cancelled the printing presses, and we are now rectifying that mistake by giving students what they want—a newspaper they can hold."

Education & Cognition

LOSS STUDY DEBUNKS ACCEPTED THEORIES. Contrary to accepted theory, yearning and acceptance are the two most salient emotions individuals experience after a significant loss, according to a **Yale School of Medicine** study in the *Journal of the American Medical Association*. The study examined disbelief, yearning, anger, depression, and acceptance. "Acceptance is the norm in the case of natural deaths, even soon after the loss. And yearning, not depression, was the most common potentially adverse psychological response," said lead author **Paul Maciejewski**, assistant professor of psychiatry and director of the Statistical Modeling Core of Women's Health Research at Yale. Disbelief reached its peak immediately following the loss. Yearning, anger and depression reached their respective peaks at four, five and six months post-loss, and acceptance reached its peak beyond six months post-loss. "The persistence of negative emotions beyond six months following the death reflect a more difficult than average adjustment and suggests a need for evaluation by a mental health professional and potential referral for treatment," Maciejewski said.

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

IN BRIEF

Science and Engineering Notes from Around Connecticut

STUDY FINDS URIC ACID, COGNITIVE ISSUES RELATED. Even mildly elevated levels of uric acid in the elderly are associated with slower thinking and memory problems, according to a report in the journal *Neuropsychology* by researchers at the **Yale** and Johns Hopkins Schools of Medicine. The researchers found that elderly individuals with uric acid levels at the high end of the normal range had the lowest scores on tests measuring mental processing speed, verbal memory and working memory. "These findings suggest that high normal concentrations of serum uric acid should be added to the growing list of cardiovascular and metabolic biomarkers of mild cognitive impairment among elderly adults," said **Godfrey Pearlson**, psychiatry professor at Yale and co-author of the study. The researchers said the mechanism linking uric acid levels and cognitive functioning is unknown.

COLLEGES SIGN DISASTER AID PACT. Five Hartford area colleges have signed a mutual aid pact. **St. Joseph College, Trinity College, Goodwin College,** the **University of Hartford,** and **Wesleyan University** agreed to help each other in the event of disasters such as fires, epidemics, or hurricanes. The agreement, believed to be one of the first of its kind in the nation, calls on the five colleges to maintain communications, coordinate transportation, provide aid such as housing and food if needed, and if possible accept students from the other campuses during an emergency.

STATE AP SCORES CONTINUE TO RISE. Connecticut students continued to make significant gains with advanced placement (AP) exams during 2006. From 2005 to 2006, the number of students taking at least one AP exam increased 6.6%, to 15,187. The number of examinations taken by these students increased 6.2%, to 25,305. The number of exams with passing scores increased 6.4%, to 18,189. In 2005-2006, 31,802 students enrolled in AP courses compared with 20,744 students in 2000-2001. In May 2006, 1,228 low income students took an AP exam, an increase of 28.8% over the prior year.

Energy

SECOND COMPRESSION STATION FOR IROQUOIS PIPELINE. **Iroquois Pipeline Operating Co.** officials told **Brookfield** that they planned to file with the Federal Energy Regulatory Commission (FERC) to build a second compression station. The first compression station approved by FERC is expected to be in operation by Thanksgiving 2008. Iroquois Gas hopes to have the second station in operation by November 2009.

CLEAN POWER PROJECTS SELECTED. The **Connecticut Clean Energy Fund** has chosen 11 clean power projects that would generate about 160 megawatts of electricity. Seven of the projects would run on fuel cells supplied by Connecticut companies. Four biomass projects were also selected. A gasification process would be used to burn a mixture of wood and chicken manure in **Bozrah** and wood only at another plant in **Plainfield**. The other non-fuel cell projects are a small biomass facility using cow manure in **East Canaan** and a plant powered by landfill gas in **Norwalk**.

PROPOSALS SEEK TO INCREASE AVAILABLE POWER. The state **Department of Public Utility Control** has selected four proposals for long-term contracts to increase the amount of power available to state residents. Three proposals are for generation projects that will reuse industrial land; they include a 620 MW natural gas-fired station in **Middletown**, a 66 MW oil-fired peak power plant in **Stamford**, and a 96 MW natural-gas fired peak power plant in **Waterbury**. The fourth is a 5 MW state-wide energy efficiency project.

100TH RESIDENTIAL SOLAR PHOTOVOLTAIC SYSTEM. The **Connecticut Clean Energy Fund (CCEF)** announced the installation of the 100th residential solar photovoltaic (PV) system in the state. The installation raises the total installed capacity of residential solar PV systems enabled with financial assistance from CCEF to 417 kilowatts. The program offers rebates through designated participating installers to help defray the cost of installing SV systems. Another 95 residential systems have been approved for rebates when installed. More information on the program is available at www. Ctcleanenergy.com/solar.

REGION'S LARGEST SOLAR POWER INSTALLATION IN KILLINGLY. The six-acre Staples distribution center in **Killingly** now boasts the largest solar power installation in New England. The panels in the roof are flat and flexible, unlike the angled solar panels that are more commonplace, and even produce power when covered with snow. The solar panels provide about 14% of the power used by the facility.

Environment

MERCURY FIND LEADS TO CLEANUP AND PROBE. More than 50 pounds of mercury were found recently along **Putnam Road** in **Killingly,** leading to a cleanup and an investigation by the state **Department of Environmental Protection (DEP)**. The DEP and the **Department of Public Health** warned that fish from the **Fivemile River** between Warsaw Pond dam and the outlet of Ballouville Pond should not be eaten. It could not be determined how long the mercury was at the site, and investigators are still trying to determine the source of the mercury.

STATE LAGGING IN GREENHOUSE GAS REDUCTION. Connecticut is behind in goals aimed at reducing greenhouse gas emissions set two years ago according to the **Connecticut Climate Coalition**. The Coalition report estimates that Connecticut's total greenhouse gas emissions will climb to 48.1 million tons by 2010 and to 56.2 million tons by 2020. In goals set by the General Assembly in 2004, the state was to bring emission levels to 90% of the 1990 level of 39.8 million tons by 2010 and to 75 to 85% of the 1990 level by 2020. According to the report, Connecticut is failing because it has not acted on most of the important steps needed to reduce greenhouse gas emissions.

AGREEMENT REACHED ON HARTFORD LANDFILL. The state **Department of Environmental Protection (DEP), Connecticut Resources Recovery Authority (CRRA)** and the **City of Hartford** have reached an agreement to end waste disposal at the Hartford landfill by December 31, 2008. The agreement commits CRRA to retrofitting of diesel equipment to improve air quality, funding of programs to increase recycling in Hartford, and creation of a citizen's advisory group. The agreement also requires CRRA to provide additional benefits to the city if the state provides $15 million to assist with the closure and post-closure care and monitoring of the landfill. Tentative approval by the DEP calls for installation of the latest technology synthetic cap as the final cover and development of plans for post-closure use of the site.

SHORELINE RESIDENTS ENVIRONMENTALLY CONSCIOUS, BUT UNINFORMED. About 73% of 1,220 respondents in a survey who live within 15 miles of the shoreline said that protecting

the environment was more important to them than encouraging economic growth. But for many, those attitudes are not linked to personal behaviors or accurate knowledge of the problems facing the Sound. The survey was conducted by the **Center for Survey Research at Stony Brook University** for the **Long Island Sound Study**, a partnership of the US Environmental Protection Agency and the states of Connecticut and New York. About 17% of respondents knew how an excess amount of nitrogen is harming water quality in Long Island Sound. Less than half knew that sewage treatment plants and polluted runoff are the primary sources of nitrogen pollution to the Sound. The survey also revealed that a majority—59%—participated in at least one recreational activity at the Sound in the previous summer. Thirty percent reported participating in 3-5 activities. The survey revealed that those who participated in a greater variety of activities were more likely than others to rate the water quality positively and view it as having improved over the last five years. The Survey is available at www.longislandsoundstudy.net/lisspublicsurvey.

Food & Agriculture

SEEKING CLUES TO HONEYBEE DECLINE. Connecticut is one of 23 states affected by a honeybee disease know as colony collapse disorder. Worker bees leave the hive and never return. Since bees are important as pollinators of a number of crops, the search is on for the cause. **The Connecticut Agricultural Experiment Station** is focusing on pathogens or pesticide residues as the possible cause, but **CASE member Louis A. Magnarelli**, director of The Experiment Station, says there may be multiple causes. The population is under pressure from Varroa and tracheal mites, and there are physical factors such as a decline in areas for bees to forage, which provides less nectar. One suspect is a microsporidian from Asia called Nosema ceranae. The Experiment Station is screening honeybees from declining hives for internal parasites and is also looking for traces of imidacloprid, an insecticide used to control grubs in lawns.

WHITE WINE ALSO BENEFICIAL. **Dipak Das**, professor of surgery at the **University of Connecticut Health Center**, and researchers in Italy have published a study in the *Journal of Agricultural and Food Chemistry* that suggests that white wine has the same benefits to the heart as red wine. Previous studies had indicated that red wine, made from pulp and skins, was beneficial in fighting cancer and heart disease because of antioxidants in the skins. White wine, which is made from pulp only, was assumed not to have the same health benefits. "The most important finding in this study is that the flesh and skin of grapes appear to be equally cardio-protective," says Das.

SANITIZING AGENT RESPONSIBLE FOR CONTAMINATION. Testing at laboratories at the **Department of Public Health** and **The Connecticut Agricultural Experiment Station** showed that a food-grade sanitizing agent was responsible for the illness of eight Old Saybrook students who consumed chocolate milk produced by **Guida's Dairy**. The company issued a voluntary recall of all 2,200 cases of milk in the batch. It appears that the sanitizer was not adequately flushed from a packing machine prior to filling the containers, the state **Department of Agriculture** said.

NEW TOOL ELIMINATES GENTICALLY MODIFIED GENES FROM PLANTS. **University of Connecticut** plant biologists have developed a tool, called a "GM-(genetically-modified)-gene-deletor," that could prevent genetically-modified genes from entering into non-biotech crops or weeds. The method may help alleviate public concerns surrounding genetically-modified plants. The technology, developed in associate professor of plant science **Yi Li's** laboratory and published in the March issue of *Plant Biotechnology Journal*, offers a successful method for eliminating all the transgenic genes from pollen and seeds if needed. The GM-gene-deletor technology also could allow farmers to produce non-genetically modified consumer products, such as seeds, fruits and flowers, from transgenic plants. Farmers would need to buy new seeds each year if they want the crops to have genetically-modified traits such as insect resistance or herbicide resistance.

Health

SMOKING AN INDICATOR OF POSSIBLE ALCOHOL MISUSE, STUDY FINDS. Cigarette smoking is an indicator of possible alcohol misuse, according to a study by **Yale School of Medicine** researchers published in the *Archives of Internal Medicine*. "This is the first study to document that individuals who are smokers, but don't smoke every day, have the highest rates of problem drinking," **Sherry McKee**, assistant professor of psychiatry said. "Using smoking status as a 'red flag' for more aggressive assessment of alcohol use is a highly feasible and clinically sensible approach to screening." She and her collaborators analyzed data obtained from 42,374 adults in a national epidemiological survey on alcohol misuse and other related conditions. They found that non-daily smokers are five times more likely to have a problem with alcohol compared to people who have never smoked. Daily smokers are three times more likely to have an alcohol problem.

STATE LAUNCHES WEB-BASED INFANT TRAINING. The **Connecticut Department of Public Health**, in conjunction with the **University of Connecticut Health Center and School of Medicine**, has initiated web-based training for health care providers who care for infants and children. The Newborn Screening in Connecticut training at www.genetrain.org is free and offers continuing education credits and nursing contact hours. State law requires that all babies delivered in Connecticut be screened for selected genetic and metabolic disorders.

UCONN TRUSTEES OKAY NEW HEALTH CENTER HOSPITAL. The **University of Connecticut Board of Trustees** has authorized construction of a new six-story 546,000 square-foot 352-bed hospital on the Health Center's Farmington campus to replace and expand the Health Center's **John Dempsey Hospital.** The expansion project is estimated to cost $495 million, exclusive of financing.

YALE STUDY FINDS BPA MAY AFFECT FEMALE FETUSES. Bisphenol-A (BPA), widely used to make many plastics found in food storage containers and dental products, can have long-term effects in female development, according to a recent study by **Yale School of Medicine** researchers. Lead investigator **Hugh S. Taylor,** associate professor in the **Department of Obstetrics, Gynecology & Reproductive Sciences** at Yale, said the study shows that BPA changes the expression of key developmental genes that form the uterus. Taylor said if pregnant women are exposed to the estrogen-like properties found in BPA, it may impact female reproductive tract development and the future fertility of female fetuses the mother is carrying.

STUDY FINDS VACCINATING KIDS BEST WAY TO CONTROL FLU. The best way to contain a flu epidemic is to ignore current practice and vaccinate children, not the elderly, a **Yale School of**

IN BRIEF

Science and Engineering Notes from Around Connecticut

Medicine researcher reports in the *Proceedings of the National Academy of Sciences*. The lead author, **Alison Galvani,** assistant professor in the **Department of Epidemiology & Public Health**, found that people 65 and over were more likely to be vaccinated for flu than other adults. However, Galvani said, it is children who generally carry the flu virus into the home; adults then carry the flu into the workplace. The elderly are, however, at greater risk of dying if they contract the flu. When a large proportion of a group is immune to a disease, there are fewer people to pass it along and the disease rapidly disappears. Galvani said the flu would be virtually eliminated if most young persons were vaccinated.

High Technology

CONSTRUCTION BEGINS ON LARGE-SCALE HYDROGEN DEMONSTRATION STATION. **FuelCell Energy** of Danbury and a partner from Pennsylvania have started construction of a large-scale hydrogen energy demonstration station that could produce hydrogen, electric power and heat. The US Department of Energy is providing half the $9 million cost and FuelCell Energy and its partner, Air Products, the rest. The companies say the system could supply hydrogen to power 35 fuel-cell vehicles and 250 kilowatts of power a day. The cost of producing hydrogen would also be lower than using current methods, according to the companies, and could eliminate transportation costs for hydrogen.

PORTABLE X-RAY DEVICE COULD AID IN CRIME SCENE ANALYSIS. **Jeffrey Schweitzer,** professor of physics at the **University of Connecticut**, has helped invent and test a device that could help law enforcement personnel locate and identify evidence at crime scenes. The portable x-ray fluorescence instrument will enable police to non-destructively detect and analyze a variety of evidence. The device, about the size of a large hand-held camcorder, can be adjusted to provide maximum sensitivity for specific types of evidence. It identifies specific components, such as iron found in hemoglobin in blood, zinc in semen, or barium and antimony in gunshot residue. The work was funded by the National Aeronautics and Space Administration and the National Institute of Justice.

NEW DEVICE IMPROVES CLONING PROCESS. An automated precision microscopic piercing device developed by researchers from the **University of Connecticut's Advanced Laboratory for Automation, Robotics, and Manufacturing,** and the **Biotechnology Center Transgenic Animal Facility** dramatically improves the nuclear transfer process used in cloning. It also has potential for automation. In state-of-the-art systems today, designers attempt to minimize cell damage with liquid mercury, the high density of which helps dampen the undesired vibration of the pipettes used. Mechanical engineering professor and CASE member **Nejat Olgac's** system, rather than puncturing the cell wall, controls rotational vibration of the pipette, thereby creating a drill effect to bore through the cell wall.

YALE TEAM TARGETS BLOOD VESSELS OF SOLID TUMORS. **Alan Garen**, professor of molecular biophysics and biochemistry at **Yale University**, and his collaborator **Zhiwei Hu** have developed a way to directly target and destroy the blood vessels of solid tumors using nanoparticles, thus destroying the tumors while leaving normal tissue unharmed. The technology uses a synthetic gene encoding an antibody-like molecule that activates an immune response to destroy the tumor blood vessels and associated tumors. Because the molecule that Garen and Hu constructed acts through the blood, it can reach metastatic tumors throughout the body, which is critical for effective cancer therapy.

YALE CHEMISTS MAKE PROTEIN-LIKE MOLECULE FROM NON-NATURAL SUBSTANCES. Chemists at Yale have made a protein-like molecule out of non-natural building blocks, according to a report featured early online in the *Journal of the American Chemical Society*. Alpha-amino acid building blocks assemble the proteins that make life as we know it possible, but the chemists report evidence that a different building block, beta-amino acids, could have been used and show that peptides assembled from beta-amino acids can fold into structures much like natural protein. Since beta-peptides are not processed in the cell like natural peptides or proteins, it may be possible in the future to design beta-peptides that perform better or in more locations than current protein drugs, said principal author **Alanna Schepartz**, professor of chemistry at **Yale.**

STUDENT EXPERIMENTS AMONG PAYLOAD. A 20-foot commercial rocket owned by Farmington-based **Up Aerospace, Inc**. launched a wide range of educational payloads into space on April 28. The SpaceLoft XL vehicle was launched from the world's first purpose-built commercial spaceport in New Mexico. It climbed to an altitude of 72.7 miles before the rocket and payloads landed safely in the pre-established target location at White Sands Missile Range. Over 50 student experiments were on board. The **Connecticut Center for Advanced Technology** and the **National Aerospace Leadership Initiative** flew 44 experiments from student teams from around the United States and the world. Included were experiments by a fourth-grader at **Bishop Woods School in New Haven** and an eighth-grade student at **Two Rivers Magnet Middle School in East Hartford**.

Transportation

FAA PROPOSAL PROMPTS CONCERNS. A Federal Aviation Administration (FAA) proposal for significant changes in air traffic over southwest Connecticut to reduce delays at airports in New York City, Newark, and Philadelphia, has raised both noise and environmental concerns. The proposals would have aircraft bound for LaGuardia Airport begin their descent over Fairfield County and hug the coastline near Stamford and Greenwich before crossing over Long Island Sound to land. Current flight paths take approaching aircraft over Putnam and Westchester counties in New York. Aircraft departing Westchester County Airport in New York would turn back over Connecticut before climbing to higher altitudes. Most departing flights now head west or south. The FAA plans to publish the final Environmental Impact Statement this summer. Additional information about the proposal is available at www.faa.gov/nynjphl_airspace_redesign.

TSA TIGHTENS SCREENING FOR 'INSIDER' THREATS. The Transportation Safety Administration (TSA) has begun screening employees at **Bradley International** and **Tweed-New Haven Airports** to prevent insider threats to air travel. Unless the job takes an employee through a passenger security checkpoint, they won't necessarily go through a metal detector nor will their personal effects be X-rayed. Airport employees, including contractors, will now be subject to random spot checks inside security areas by TSA employees, who will be looking for explosives or dangerous instruments not needed on the job.

— Compiled and Edited by Paul Gough

Biodiesel (continued from page 2)

tion held an open house featuring research on biodiesel, which attracted more than 100 people.

Before Connecticut-produced biodiesel can be widely accepted, it has to meet standards of the American Society of Testing and Materials. ASTM standard D6751 defines what biodiesel is (i.e., a mono-alkyl ester of long chain fatty acid of vegetable oils and animal fats) and identifies the physical and chemical properties that it must meet. There are limits, for example, for elemental components such as sulfur and for physical parameters such as flash point and clouding, which would affect use and safety of the biodiesel.

The Experiment Station and UConn are working together to set up laboratories to do ASTM testing of biodiesel. Walter Krol of The Experiment Station's Department of Analytical Chemistry is concentrating on elemental analyses, while the now-emeritus Stuart at UConn is concentrating on physical characteristics. Gus Kellogg of Greenleaf Biofuels in Guilford told the legislative Environment Committee at a hearing on February 26, "To have the University of Connecticut [and] The Connecticut Agricultural Experiment Station to be able to provide this testing at a low cost to producers is paramount to ensuring quality in the industry and the state."

But before there can be biofuel production, there must be the oils to feed the process. The current feedstocks for biodiesel production in Connecticut come from soybean oil, although other plant oils, such as sunflower, canola, rapeseed, and palm, as well as waste cooking oils could be used.

The Experiment Station's LaMondia has embarked on experiments to find specific varieties and methods farmers could use to grow oilseed crops in Connecticut, rather than have the industry depend upon crops grown elsewhere. LaMondia is trying to identify which varieties of canola and rapeseed yield the highest percentages of recoverable oils from their seeds. In the preliminary extraction in 2006, Krol obtained between 25% and 29% oil from seed after three pressings. And, like the process of producing biodiesel, there is no waste because the remaining solid residue is rich in nitrogen and protein, making it ideal for use as animal feed or plant fertilizer.

LaMondia is also investigating rapeseed as a possible alternate winter crop for Connecticut farmers. He planted a variety to see if it would be feasible for farmers to plant a crop in the fall, after silage and other crops are harvested on dairy farms, which could be ready for harvest of oilseeds in the early spring before the land is needed again for corn or other crops.

There is another intriguing aspect of oilseed production that fits with LaMondia's investigation of methods of controlling nematodes, tiny worms that feed on roots of plants. Canola plants may produce glucosinolates, which in the soil may break down into isothiocyanates, compounds toxic to plant parasitic nematodes and fungi. This integrated pest management aspect of growing canola in Connecticut adds another environmental benefit to oilseed production because it may help avoid the costs and possible adverse effects of the soil fumigants now used.

Mature canola seeds with a penny. (Photo: P. Gough)

At UConn, components of the reaction are pumped into the bottom of the clear cylinder at right, where the reaction takes place. The biodiesel flows from the top into the plastic tank at the left while the glycerol goes to the bottom of the reaction cylinder and is drained through a valve at the bottom. (Photo: Paul Gough)

Richard Parnas, head of the UConn Chemical Engineering Program, has been investigating the process of conversion of plant-derived oil into biodiesel. The current experimental processor he developed consists of a standard glass-lined hot water heater which contains oil heated to 120º F., tanks holding methanol and potassium hydroxide, and pumps and valves that regulate the flow of the materials into a large vertical glass cylinder where the reaction takes place. Biodiesel rises to the top and then overflows into a tank, while glycerol, which is heavier, stays at the bottom and can be drained into a container. Two runs through the processor, each making increasingly purer biodiesel, are anticipated. A third run would dribble water through the biodiesel to remove any remaining methanol and glycerol, and the water will be removed by passing air through the biodiesel in a fourth pass. The process could produce biodiesel continuously if the four processing steps occur in separate units in a line, rather than in the same processor. UConn has filed a patent application for this method of producing biodiesel.

The General Assembly has been considering a comprehensive program to encourage biodiesel through tax and other incentives. The proposed legislation would appropriate $1.3 million to The Experiment Station in FY08 and $800,000 in FY09 for biodiesel crop research and biodiesel testing. In addition to additional funding for UConn and funds for three additional full-time employees and three summer assistants at The Experiment Station, these funds would provide a seed drill and a combine to harvest the research plots, as well as analytical equipment including an inductively coupled plasma optical emission spectrophotometer, which will allow analysis of biodiesel directly without sample preparation, a low sulfur analyzer, and gas chromatograph mass spectrophotometer. The Experiment Station would transfer $490,000 in FY08 and $404,000 in FY09 to the University of Connecticut to undertake its portion of the research.

"Affordable and more environmentally friendly fuels need to be a part of Connecticut's future," said Speaker of the House James Amann. "Biodiesel is a great way to achieve this goal. It provides an opportunity to offset a portion of our dependence on foreign fossil fuels with a homegrown renewable fuel source."

"If 10% of the land of Connecticut—300,000 acres—were employed to produce biodiesel, we would displace 15% of the petroleum use," UConn's Parnas said. If technology and agricultural practices could increase the displacement to 25% nationwide, he noted, "We could essentially eliminate our dependence on Mideast oil and have the capability of altering the geopolitical balance of the world." ***— Paul Gough is a science writer based in Killingworth, CT.***

National Academies (continued from page 1)

that although the use of wind energy to generate electricity is increasing rapidly in the United States, government guidance to help communities and developers evaluate and plan proposed wind-energy projects is lacking, The report offers an analysis of the environmental benefits and drawbacks of wind energy, along with an evaluation guide to aid decision-making about projects. As a case study, the committee that wrote the report looked at the mid-Atlantic highlands, a mountainous area that spans parts of West Virginia, Virginia, Maryland, and Pennsylvania. The report does not examine the impact of offshore wind-energy projects.

[http://books.nap.edu/catalog.php?record_id=11935]

◆ New Science of Metagenomics May Revolutionize Understanding of Microbial World

According to a new report from the National Research Council, the emerging field of metagenomics—where the DNA of entire communities of microbes is studied simultaneously—presents perhaps the greatest opportunity since the invention of the microscope to revolutionize understanding of the microbial world. The report calls for a new Global Metagenomics Initiative to drive advances in the field in the same way that the Human Genome Project advanced the mapping of our genetic code.

Metagenomics will transform modern microbiology by giving scientists the tools to study entire communities of microbes—the vast majority of which are likely to be previously unknown species that cannot be cultured—and how they interact to perform such functions as balancing the atmosphere's composition, fighting disease, and supporting plant growth, the new report says. The Research Council report was requested by several federal agencies interested in the potential of metagenomics and how best to encourage its success. In particular, the committee was asked to recommend promising directions for future studies. It concluded that the most efficient way to boost the field of metagenomics overall would be to establish a Global Metagenomics Initiative that includes a few large-scale, internationally coordinated projects and numerous medium- and small-size studies.

[http://books.nap.edu/catalog.php?record_id=11902]

◆ VA Urged to Revise Its Methods for Evaluating and Compensating Vets for PTSD

To ensure more consistent and appropriate disability compensation for veterans, the US Department of Veterans Affairs (VA) needs to revise how it evaluates former military personnel for service-connected post-traumatic stress disorder (PTSD) and how it determines the payment amounts they merit, according to a new report from the Institute of Medicine and National Research Council. A surge in the number of disability claims for PTSD has revealed inconsistencies in compensation levels awarded across the country, raising questions about the effectiveness of the VA's current methods for assessing and rating this condition, and whether some veterans are getting payments that are too low, too high, or unmerited.

The agency should develop new evaluation methods and rating criteria specific to PTSD to replace current standards that yield a crude and overly general assessment of PTSD disability, said the committee that wrote the report. It urged the VA to base compensation decisions on how greatly PTSD affects all aspects of a veteran's daily life, not just his or her ability to be gainfully employed.

[http://books.nap.edu/catalog.php?record_id=11870]

Visit our web site at www.ctcase.org

Bulletin *of the*
Connecticut Academy of Science and Engineering
179 Allyn Street
Hartford, Connecticut 06103-1422

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