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Growing 'Green Chemisty' Movement Has Deep Roots in Connecticut Labs

What if we could have the products we needed and wanted, produced no toxic substances in the process, and created no environmental or health hazards? Total fantasy? Not at all, say leading green chemists and engineers here in Connecticut.

Julie Zimmerman, acting director of the Center for Green Chemistry and Green Engineering at Yale University, and Evan Beach, program manager at the Center, say a growing global green chemistry movement is making strong, real-world progress in its drive to equip chemists with better tools, training and information so they can design safer products for everyday use.

"It's a very different way of approaching things," Beach says. "The typical chemist or engineer, if they are thinking about toxicity at all, is focused on how to control or minimize chemical exposures. With green chemistry and engineering, the chemist or engineer is empowered with new tools and data to address potential problems at the design stage instead of passing them down the line for someone else to deal with later."

"Bad chemicals won't even be on the drawing board," Zimmerman says. "When you sit down to figure out the performance attributes you need for a given product, you will know from the outset how to do it at the molecular level with reduced toxicity." Zimmerman emphasizes that green chemistry affords the opportunity

(See *Green Chemistry*, page 2)



At Yale, recyclable chitosan-titanium dioxide beads are used for sorption of arsenic from contaminated water. [Photo: Harold Shapiro]

News from the National Academies

The following is excerpted from press releases and other news reports from the National Academies (www.national-academies.org).

◆ Roadmap for Earthquake Resilience

The United States will be subject to damaging earthquakes in the future, and some earthquakes will occur in highly populated and vulnerable areas with major effects on the nation as a whole. Efforts to reduce such effects are needed to limit the loss of life, damage to buildings, and economic cost of a major earthquake. A new report entitled "National Earthquake Resilience: Research, Implementation, and Outreach" from the National Research Council presents a 20-year roadmap for earthquake hazard and risk reduction, assessing the activities—and their costs—required for the nation to achieve earthquake resilience. The report identifies 18 specific task elements required to improve national earthquake resilience, and estimates the annual cost of implementing the roadmap to earthquake resilience at \$306.5 million per year for the first five years. These include undertaking additional research to improve understanding of earthquake phenomena and to increase earthquake-prediction capabilities; deploying the remaining 75% of the Advanced National Seismic System,

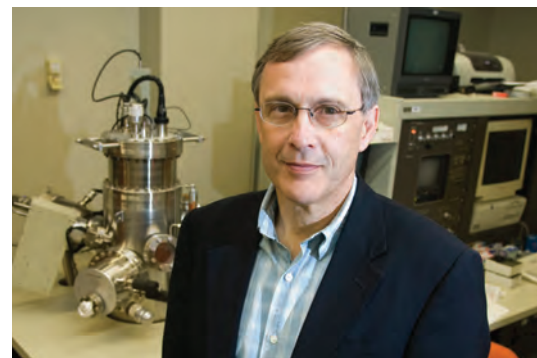
(See *NAS*, page 7)

UConn's Steven Suib Awarded 2011 Connecticut Medal of Science

University of Connecticut Professor Steven L. Suib was awarded the 2011 Connecticut Medal of Science for his impact on the field of catalysis and materials science over the past 30 years. Suib holds 19 US patents. He is a Board of Trustees Distinguished Professor, head of the University's Chemistry Department, as well as Director of the Pratt Center of Excellence in Ceramic Chemistry.

His work focuses on catalysis and materials science and involves the synthesis of novel porous semiconductors used to make new chemicals for use in lithium batteries, oil spills, and other applications. Suib and his team are investigating the creation of synthetic fuels using carbon dioxide—a greenhouse gas—and water, research that could contribute to both reduced greenhouse gases and the development of alternative energy sources. His research team is working closely with VeruTEK Technologies, Inc., a Connecticut company, to clean up contaminated industrial and commercial properties and landfills using microemulsion catalysis that converts hazardous and toxic compounds into harmless materials.

Over the years, Suib has collaborated with many companies in and outside of Connecticut. He has supervised more than 100 PhD students, half of whom serve in research positions in Connecticut industries. A graduate of State University of New York at Fredonia, Suib earned a PhD in chemistry at the University of Illinois at Champaign Urbana, and completed coursework equivalent to a master's degree in geology.



Suib in his UConn laboratory

to make products that will have a competitive edge in the marketplace. There are economic benefits because you will gain efficiencies and reduce long-term liabilities.

The Yale Center is now in its fourth year of operation. Founded in 2007 by Paul Anastas—referred to in the scientific community as the “Father of Green Chemistry”—and Zimmerman, the original Yale group was small, four in all. Beach was also there from the start. Anastas, trained as a synthetic organic chemist, is known for his groundbreaking research on the design, manufacture and use of minimally toxic, environmentally friendly chemicals. He has published 10 books, including “Benign by Design” and his seminal work with co-author John Warner, “Green Chemistry: Theory and Practice.” In January of 2010, he was confirmed as the new Assistant Administrator for Research and Development for the US Environmental Protection Agency (EPA) and science advisor to the agency. He is now on leave from Yale, where he served as director of the center.

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As it continues to build its international reputation, infrastructure and staff—now at about 25—the Yale center publishes papers in top peer-reviewed journals, establishes new research areas and collaborations and has secured grant funding for a number of its projects. It has been active in new curriculum design focused on sustainability, and on outreach to both academe and the general public. Beach believes what sets the Yale center apart from other university programs is its multi-disciplinary approach, which spans the departments of chemistry, engineering and environmental studies. Its advisory board has representatives from multiple Yale schools, including architecture, medicine, law and the school of management. In the lab, chemists and engineers work alongside microbiologists, industrial ecologists, political scientists and geographers. He and Zimmerman believe it is the center’s combination of scientific expertise and broad perspective that has been critical to its success.

The organization is currently applying its green chemistry and engineering knowledge to water treatment in India, Vietnam, Bangladesh and Uganda, including the removal of arsenic from water. According to Zimmerman, “The developing world presents unique challenges because you don’t have adequate resources and the supply chain is not reliable. We are researching plants that can be used as coagulants to remove sediments from water and that’s important because bacteria attaches to sediments.” Having Yale students on the ground in those countries is an important part of the project. “It is important for them to get that on-the-ground perspective and understand the local challenges because conditions in a Yale laboratory are obviously very different,” Beach adds.

Zimmerman explains that while the Center has pilot tested a working system for removing the arsenic from water, it is still thinking about how to optimize the system and scale it up. For example, should it be a centralized well or something else? “It also has to be culturally right,” she adds. “We can clean the water, but it may not taste or smell right to the people of a particular village.”

Back home in Connecticut, the Center has been working with Bloomfield-based VeruTEK, an environmental clean-up company founded in 2005 that uses biodegradable plant-derived substances such as sorghum bran, soybean oil, coconut oil and castor oil to safely remedy soil and groundwater contamination beneath structures such as schools, homes and city buildings. Yale students and staff interact with VeruTEK staff to share expertise and tune the chemistry to attain better performance in environmental clean-up applications. Zimmerman believes VeruTEK is a great example of how technology can be successfully transferred from the lab to the real world to make a significant difference.

According to CASE member George Hoag, VeruTEK’s senior vice president of research and development and a company founder, “We are excited about the Yale Center’s capabilities and their interest in making green surfactants (detergent chemicals that help oily or greasy substances mix with water and are widely used for cleaning, domestic and industrial purposes) that meet our needs and don’t create hazardous waste.” Hoag, who founded and directed the Environmental Research Institute at the University of Connecticut until 2002, says many of VeruTEK’s 30+ employees are UConn graduates.

VeruTEK has diversified considerably since invention of its first technology—Surfactant-Enhanced In-Situ Chemical Oxidation, or S-ISCO® for short. In late June and July of this year, it received its first two patents. The first is for G-nZVI, or Green-nano Zero Valent Iron, a catalyst that will help treat wastewater generated in the oil and gas industry, clean up pesticides and other hazardous substances. VeruTEK and the US EPA developed this

(See Green Chemistry, page 6)

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Science and Engineering Notes from Around Connecticut



Biomedical Research

NEW GENETIC LINKS TO MS PLAY ROLES IN OTHER AUTOIMMUNE DISEASES. Results of the largest genomics study of multiple sclerosis patients ever undertaken have identified more than two dozen new genetic variants linked to disease risk, including some previously implicated in other autoimmune diseases. The study, conducted by an international consortium of researchers from the **Yale School of Medicine** and 129 other institutions, appears in the Aug. 11 issue of the journal *Nature*. Common genetic links between multiple autoimmune diseases were also confirmed in a second study by Yale and Harvard University researchers published contemporaneously in the journal *PLoS Genetics*.

YALE TO OVERSEE UNPRECEDENTED REVIEW OF MEDTRONIC DATA. **Medtronic**, manufacturer of bone growth products including Infuse—a bioengineered material used primarily in spinal fusions—announced a \$2.5 million grant to **Yale University** to oversee a complete review of the study data pertaining to the safety and effectiveness of the product. Under the grant, Yale will assemble a panel of outside experts, who in turn will commission two academically recognized research organizations to review the company's study data. Yale cardiologist and CASE member **Harlan Krumholz**, who will oversee effort, said "This project, including making the data accessible to all researchers, is intended to establish a landmark model for data transparency—a breakthrough in balancing the needs of industry with the public's desire for an independent review of the complete set of data." Medtronic has faced intensifying criticism that researchers funded by the company generated misleading studies about the product, overstating its benefits and asserting that it did not pose risks.



Business & Industry

CARRIER EXPANDS WATSCO TIES. **Farmington's Carrier Corp.** is transferring its Mexico heating-air conditioning-ventilation sales and distribution assets to its joint venture with distributor **Watsco Inc.**, adding about \$80 million a year in sales to the venture. Carrier's HVAC distribution operations in Mexico have 90 employees and six locations. Financial terms of the transaction were not disclosed. Watsco, based in Coconut Grove, FL, owns 60% of the joint venture and Carrier 40%. Watsco is the largest distributor of air-conditioning, heating and refrigeration products in the United States. Carrier is a unit of United Technologies Corp.

HARTFORD HEALTHCARE NAMES NEW CEO. Hartford Healthcare is reshuffling its senior management lineup. The not-for-profit healthcare system has announced that **Jeffrey A. Flaks**, the executive vice president and chief operating officer of **Hartford Hospital** and executive vice president of **Hartford HealthCare**, has been named the president and CEO of Hartford Hospital. Flaks assumes his new role from **Elliot Joseph**. Joseph, who came to Hartford Hospital in 2008 as president and CEO of both the hospital and Hartford HealthCare, will continue to head the healthcare system, which includes **Hartford Hospital, The**

Hospital of Central Connecticut, MidState Medical Center, VNA of Central Connecticut and a number of long-term care facilities. "With a healthcare system made up of 15,000 staff members and more than 80 locations, and with the coming of healthcare reform and the challenges it will bring, we believe we need to follow best practices with a CEO who concentrates on the system as a whole," said **Ramani Ayer**, chairman of the Hartford Healthcare board of directors, which approved the leadership change.



Communication

COMCAST TO OFFER \$10 BROADBAND TO LOW-INCOME HOMES. This fall, as a voluntary condition of its acquisition of NBC-Universal, Comcast will begin offering \$10 broadband to any household making less than \$20,000 a year under a program called "Internet Essentials." According to the company, every household in Comcast's footprint with children who receive free lunches under the National School Lunch Program (NSLP) will qualify to receive Comcast XFINITY Economy broadband service for \$10 a month, the opportunity to buy a PC for \$150, and access to digital literacy training. Comcast says the program will run for "at least three school years," though any household that qualifies during this period will remain eligible for the discounts as long as a child in the household still qualifies for the NSLP.

CHARTER REPORTS DROP IN TRADITIONAL VIDEO VIEWERS. **Charter Communications**, whose Connecticut operation is headquartered in **Newtown**, has reported significant losses of traditional video viewers. Residential primary service units (PSUs) decreased by 54,800 in 2011 as increases in Internet and phone PSUs were more than offset by a decline in video PSUs. Non-video PSUs grew by 40,800—nearly double the growth during last year's second quarter. Bundling over time to maximize retention and customer profitability remains a key strategy, with 61.6% of Charter's residential customers in a bundle compared with 59.2% a year ago. Residential non-digital video customers decreased by 79,900 in the quarter, while digital video customers decreased by 4,900. "Seasonality, disciplined customer acquisition and price competition in the face of generally weak economic conditions all contributed to a lower rate of video acquisition which more than offset higher retention levels compared to the prior-year second quarter," according to company officials.

STATE MOVIE THEATERS OFFER FILM ALTERNATIVES. Some of the state's movie theaters have found alternative ways to make money and are communicating to customers with new streamed digital techniques and different forms of entertainment. Concerts, ballet, opera, Broadway shows, sporting events, video games and one-time screenings of specialty titles are all part of an experiment designed to fill theater seats, particularly during traditionally slow times. "We want to generate products that get people out, particularly in the middle of the week," said Bud Mayo, CEO of Digiplex Destinations, which operates the **Bloomfield 8 Theater**. "One of the ways to get them busier is to play things other than Hollywood movies." Cinemas traditionally fill up on the weekends for Hollywood blockbusters; but on Mondays, Tuesdays, Wednesdays and Thursdays, screenings of the same movies bring far fewer people to the multiplexes. Colorado-based National

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) 571-7143, write the editors at CASE Bulletin, 805 Brook Street, Building 4-CERC, Rocky Hill, CT 06067-3405, or email us at acad@ctcase.org

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Cinemedia Fathom offers a variety of alternative programming to theaters around the nation, including the **Buckland Hills 18 IMAX** in Manchester, the **Branford 12 Stadium**, the **Connecticut Post 14 Cinema De Lux** in Milford, and the **North Haven 12**.



Education & Cognition

PUERTO RICAN DOCUMENTS DIGITIZED. The **University of Connecticut** is digitizing thousands of historical Puerto Rican documents to help make them available to researchers. Library officials said recently that the 5,000 fragile documents they are scanning date as far back as 1844 and detail court disputes over slaves, land and livestock. The documents were acquired by the university's **Thomas J. Dodd Research Center** in 2000. The scanning began in June with a \$15,000 grant from the Chicago-based nonprofit Center for Research Libraries. Library officials say they hope to have all the documents available online by May 2012.

NEW SCIENCE FRAMEWORK RELEASED. The National Research Council (NRC) has released its much-anticipated report that presents a new framework for K–12 science education and identifies the key concepts and practices that all students should learn. *A Framework for K–12 Science Education* offers a new vision for K–12 education in science and engineering, and represents a significant shift in how these subjects are viewed and taught. “This framework emphasizes the importance of engaging students more deeply in the process of doing science, not just learning content,” said National Science Teachers Association Executive Director Francis Eberle.

STEM JOBS OFFER HIGHER PAY. The US Department of Commerce's Economics and Statistics Administration (ESA) has released a new report that profiles US employment in the science, technology, engineering and mathematics (STEM) fields. *STEM: Good Jobs Now and for the Future* offers an inside look at workers who are driving our nation's innovation and competitiveness and helping America win the future with new ideas, new companies and new industries. In 2010, 7.6 million people or 5.5% of the labor force worked in STEM occupations. Key findings from the new report show that over the past 10 years, growth in STEM jobs was three times greater than that of non-STEM jobs, and STEM jobs are expected to continue to grow at a faster rate than other jobs in the coming decade. Meanwhile, STEM workers are also less likely to experience joblessness.

CHEMISTRY CONTEST OFFERED. The American Chemical Society (ACS) is offering students, teachers, and others the chance to win cash cards and an iPad, iPod Touch, and iPod Nano in a contest to fill in empty dates in its IYC-365 online calendar. Called the “365: Chemistry for Life Contest,” it is part of ACS' celebration of the International Year of Chemistry. ACS purposely left some days without content, as an invitation to the public to help fill in the gaps, and participate in the IYC. Entries should consist of the name of a chemistry-related person, place, innovation or everyday item with a 300-400 word description of the entry. The description should be written in non-technical language and include a discussion of how the entry improves and impacts everyday life. Entries accepted for use in the calendar will be eligible for a monthly drawing for a \$50 Visa card, and a December drawing for the iPad, iPod Touch, and iPod Nano.

TEACHER GRANTS AVAILABLE. The National Education Foundation's Nickelodeon Big Help Grants are available in the form

of student achievement grants to K-8 public school educators. The Big Help Grants program is dedicated to the development and implementation of ideas, techniques, and approaches for addressing four key concerns: environmental awareness, health and wellness, students' right to a quality public education, and active community involvement. Proposals for work resulting in low-income and minority student success with honors, advanced placement, or other challenging curricula are particularly encouraged. Practicing US public school teachers, public school education support professionals, and faculty and staff members at public institutions of higher education may apply. The maximum grant amount is \$5,000. Applications are reviewed three times per year.



Energy

16 HYBRIDS PURCHASED BY CTRANSIT. CTTransit has put 16 new Ford Escape hybrid vehicles into service in its Hartford, Stamford and New Haven divisions, continuing the authority's switch to cleaner vehicles. The 16 hybrids replaced 10-year-old non-hybrids with more than 100,000 miles, and will be part of the supervisor fleet. The new hybrids get 20 miles per gallon in the city and 26 miles per gallon on the highway. The total cost of the purchase was \$473,776. CTTransit already has two Prius hybrid vehicles in use in Hartford. For its bus fleet, CTTransit has 33 hybrid-electric buses operating in Hartford, New Haven and Waterbury. Another 10 articulated hybrid-electric buses are expected for Hartford in the fall. The state-owned transit system also operated five hydrogen fuel cell buses and is purchasing a sixth. This is the second largest hydrogen fuel cell bus fleet in the country, behind the system that services greater San Francisco.

SOLAR MAKING CONNECTICUT COMEBACK. Once a solar hotbed because of its state government programs, **Connecticut's** attraction as a solar state waned in the past five years as funding ran dry and businesses sought sunnier pastures. But with passage of a new solar credit program creating more stable ratepayer funding for renewable energy projects, Connecticut is again one of the more progressive states in the nation in encouraging solar development. “Anybody who is paying attention to the solar industry in North America knows a program is about to be implemented in Connecticut,” said **Michael Trahan**, executive director of industry group **Solar Connecticut, Inc.** Solar installation companies are looking at opening Connecticut offices; workforce development programs have begun, so technicians can get the proper certification to make solar projects eligible for state and federal funding. Of the many aspects of the comprehensive energy policy bill passed by the legislature in June, the ones exciting the solar industry are the zero-emissions (ZRECs) and low e-missions (LRECs) renewable energy credits.



Environment

COASTAL OPEN SPACE ACQUIRED. The **Connecticut Department of Energy & Environmental Protection (DEEP)** and the **Avalonia Land Conservancy** today announced that they have jointly acquired a 16-acre parcel of coastal grassland on **Wequetequock Cove** in the Town of Stonington, CT. The acquisition expands what is now a 2.4-mile corridor of contiguous protected open space extending from the Pawcatuck River on the Rhode Island border to Wequetequock Cove adjacent to the State of Connecticut's **Barn Island Wildlife Management Area**, Connecticut's largest and most ecologically significant coastal

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wildlife management area. "The land we are protecting today provides a stunningly beautiful visual gateway to visitors to Barn Island Wildlife Management Area protecting unique and sensitive areas. As a result of this acquisition, over 1,000 acres of contiguous protected open space spans 2.4 miles from the Pawcatuck River to Wequetequock Cove," said **Daniel C. Esty, Commissioner of the DEEP**.

NEW TICK WEAPON SOUGHT. The **Connecticut Agricultural Experiment Station** is working to develop methods of combating ticks without the use of chemical pesticides. The pests can infest backyards as well as the woods and according to CASE member and Station Director **Louis Magnarelli**, scientist **Kirby Stafford** is leading the effort to kill them with natural products such as plant extracts. Stafford said the extracts include a natural compound found in grapefruit.



Food & Agriculture

AG STATION DEVELOPS NEW STRAWBERRY. A new cultivar of strawberry that is resistant to the black vine weevil and a destructive fungus called black root rot has been developed by scientists from **The Connecticut Agricultural Experiment Station**. Station Director and CASE member **Louis Magnarelli** said the station is already seeking a patent for the new strawberry, which has been named Rubicon. Magnarelli credited two station scientists, **Jim LaMondia** and **Richard Cowles**, for developing the new berry, which will hopefully cut down use of pesticides to protect it from both root rot and the weevil. Cowles said the new berry has an intense strawberry flavor and is bright red in color.

FOOD ADS HARM CHILDREN. Children are being exposed to almost one advertisement every day for unhealthy food, beverage, and restaurant brands via product placements on prime-time TV, finds a study from **Yale's Rudd Center for Food Policy & Obesity**. The study—which is the first to categorize, quantify, and report children's exposure to this type of marketing—shows a loophole in the current food industry's self-regulatory pledges to advertise only "better-for-you" foods to children, say the researchers. The study appears in the September issue of the *American Journal of Preventive Medicine*. Researchers analyzed data obtained from Nielsen, a media research company, on how often brands for unhealthy foods, beverages and restaurants appeared on prime-time TV programming during 2008. They found nearly 35,000 food, beverage, and restaurant brands appeared in prime-time TV programming that year. Despite frequent brand appearances for products in several categories, the majority of exposure was for regular soft drinks from just one company, Coca-Cola, which accounted for 71% of product-placement appearances viewed by children and approximately 60% of adult and adolescent exposure.



Health

WRINKLES COULD PREDICT WOMEN'S FRACTURE RISK. Wrinkles are a telltale sign of aging, and they might also be able to predict a woman's bone fracture risk, according to **Yale School of Medicine** researchers who report in a new study that the severity and distribution of skin wrinkles and overall skin quality could tell the story of bone mineral density in early menopausal women. "Skin and bones share common building blocks such as proteins and aging is accompanied by changes in skin and deterioration of

bone quantity and quality," said **Lubina Pal**, associate professor in the **Department of Obstetrics, Gynecology and Reproductive Science** at the Yale School of Medicine. Along with her research team, Pal had hypothesized that in postmenopausal women, the quality of an individual woman's skin—the degree of wrinkling and hardening—will reflect the status of her bones. Pal and her team studied this theory in a subgroup of early menopausal women within three years of their last menstrual period. "We found that deepening and worsening skin wrinkles are related to lower bone density among the study participants," said Pal, who is director of the **Reproductive Aging and Bone Health Program** at Yale. "The worse the wrinkles, the lesser the bone density, and this relationship was independent of age or of factors known to influence bone mass."

WEIGHT GAIN QUANDARY STUDIED. Smokers tend to die young, but they tend to die thinner than non-smokers. A team of scientists led by **Yale School of Medicine** has discovered exactly how nicotine suppresses appetite—findings that suggest that it might be possible to develop a drug that would help smokers, and non-smokers, stay thin. Nicotine activates a small set of neurons in a section of the hypothalamus that signals that the body has had enough to eat, the researchers report in the June 10 issue of the journal *Science*. Nicotine accomplishes this trick by activating a different set of receptors on the surface of neurons than those that trigger a craving for tobacco. "Unfortunately, smoking does keep weight off," said Yale's **Marina Picciotto**, the Charles B.G. Murphy Professor of Psychiatry, professor of neurobiology and pharmacology and senior author of the paper. "Many people say they won't quit smoking because they'll gain weight. Ultimately, we would like to help people maintain their body weight when they kick the habit and perhaps help non-smokers who are struggling with obesity." A research team is working to develop a drug to do just that.

AD CHANGES FAIL TO SLOW OBESITY. In just five years, the food industry launched 13 different voluntary, self-regulatory pledges to limit food and beverage marketing to children around the world; 52 companies signed at least one of them. But in spite of this impressive effort, a study commissioned by the **Rudd Center for Food Policy and Obesity at Yale University** concludes that while the pledges address some types of advertising for the very worst products, they will likely result in few substantive reductions in children's exposure to all unhealthy food marketing. The study appears in *Public Health Nutrition*. The food industry's pledges were made from 2005 to 2009 after the Institute of Medicine recommended that the industry stop marketing products high in added sugar, salt, and fat to children, and stated that if the industry was unable to voluntarily do so, Congress should intervene with legislation, since childhood obesity is a growing national problem.

DIET MAY STOP SEIZURES. A high-fat, low-carbohydrate "ketogenic" diet can stop seizures in mice by activating adenosine receptors, a finding that will serve as a catalyst for the development of adenosine-based therapies for epilepsy and other neurological disorders, according to a study featured on the cover of the July 2011 issue of *The Journal of Clinical Investigation*. Ketogenic diets have been used successfully to treat epilepsy in people, primarily children, since 1921, and can sometimes stop seizures even when drugs are ineffective. The ketogenic diet has shown promise in treating diabetes and cancer, particularly brain cancer, in mice and people. It is also being explored for other neurological conditions, including autism and brain injury, and neurodegenerative disorders, such as Parkinson's disease.

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High Technology

NYC CHALLENGES CT FOR TECHNOLOGY COMPANIES. New York is challenging Connecticut and other states by offering incentives to technology companies and universities that invest in a new technology district. New York City Mayor Michael Bloomberg announced that the city will offer nearly free real estate and up to \$100 million in infrastructure upgrades to a university, institution or consortium that commits to creating a world-class science and engineering campus to be built on Governors Island, the Brooklyn Navy Yard or Roosevelt Island. Bloomberg believes that in its first three decades the school could help launch 400 new companies and create more than 22,000 permanent jobs. The announcement comes a week after **Connecticut Governor Dannel P. Malloy** signed the sweeping "Bioscience Connecticut" initiative that aims to make Connecticut a major player in bioscience and biotechnology. Connecticut will invest \$864 million in the renovation of **John Dempsey Hospital**, the construction of a new patient care tower at the **University of Connecticut Health Center**, and the expansion of bioscience research and training facilities in Farmington.

YALE MED STUDENTS TO GET DIGITAL ACCESS, APPS, FOR CLASS, CLINICAL CURRICULUM. **Yale School of Medicine** is giving each of its students an Apple iPad 2 this school year for use in the classroom and clinical training. This initiative will provide first- through fourth-year medical students with complete digital access to all course materials, including slides. Paper-based course materials will be eliminated. The entire preclinical curriculum will be loaded onto the iPad for first- and second-year medical students. For third- and fourth-year students, materials will be downloaded according to their individual concentrations. Students will be provided apps that enable them to highlight or annotate curricular materials; in addition, updates and revisions to lectures can be immediately synced to the iPad. Each student will also receive a Bluetooth wireless keyboard. A unique feature of the Yale initiative is that third- and fourth-year medical students will be able to use their iPads to manage Electronic Protected Health Information related to their clinical responsibilities.



Transportation

RAIL FLEET BIKE RACKS TESTED SOON. The **Connecticut Department of Transportation (ConnDOT)** recently announced

that the state has funded and developed a new prototype bicycle rack system to be tested on the new M-8 rail fleet in the coming months. ConnDOT provided \$100,000 to the Metropolitan Transportation Authority of New York (MTA) and Metro-North Railroad (MNR) to continue the development and management of the prototype bike racks. ConnDOT has been actively investigating options with MNR to test alternative bike rack systems for the M-8 and agreed to provide 100% of the funding. "The Department supports and advocates multi-modal mobility transportation options. Combining public transportation with bike transportation bolsters a natural, seamless, multi-modal integration. To do that, it is necessary to provide a safe and secure method for bicycles to travel on the trains while at the same time providing adequate seating for passengers," said **Acting ConnDOT Commissioner James P. Redeker**. "We hope that this prototype system will accomplish that goal for the first time and we look forward to testing this system with MNR during the coming months."

STATE TO BUY 25 RAIL CARS. Gov. Dannel P. Malloy says Connecticut will buy 25 more commuter rail cars for the heavily used New Haven line into New York City, according to Associated Press reports. Malloy said that the 25 cars will cost about \$93 million and will add to 380 already on order. Last month, a third set of M-8 rail cars was put into service, bringing to 130 the number of train runs operating each week with the cars. Commuters will welcome the new cars, but some have criticized Malloy's proposed 15% fare increase. It would be the first fare increase on Metro-North since January 2005 and is among many state strategies to balance the two-year, \$40.1 billion budget. The New Haven Line is owned by the state and is operated by Metro-North Railroad, a subsidiary of the Metropolitan Transportation Authority of New York.

NYC BUS SERVICE EXPANDED. Peter Pan and Greyhound bus lines, in an attempt to match low-fare competitors, say they will expand their Premium Express service to offer nonstop service to New York City and Boston from Hartford for as low as \$1 for a limited number of seats on each trip. Service to New York City, which started Aug. 16, will be available eight times a day. Service to Boston, which also started Aug. 16, will be available three times a day, but the companies say they plan to add more buses in the future. Premium Express was launched in December 2010 in the Midwest, serving cities such as Chicago and St. Louis. The two companies have operated as a business alliance since December 1999 with coordinated schedules, marketing and ticket sales.

— *Compiled and edited by Robert C. Pollack*

Green Chemistry *(from page 2)*

technology at the EPA's National Risk Management Research Laboratory in Cincinnati, and the company and EPA will share in the royalties. The second patent for the S-ISCO process was issued in July. The S-ISCO process works like a heavy-duty soap to scour bad materials from soil, water and other substances while simultaneously destroying them underground. VeruTEK has more than 30 other patents pending, including a few with CT Medal of Science winner Steven Suib and his graduate students at UConn.

"We don't really know of another company that is doing anything similar to what we are doing anywhere in the world," Hoag says. "The traditional way of dealing with contaminated soil is to dig it up and haul it away somewhere. The deeper you excavate, the more expensive it is. And if you don't know where all the source material is, you'll leave contamination behind. At VeruTEK, we

are creating a new market with our green technology because it treats materials in the ground, or we can dig them up and treat them above ground. We inject safe chemicals, control where they go and how they react, and control the concentrations to effect destruction of solvents and oily-phase contaminants."

The company has successfully remediated many contaminated sites in Connecticut and elsewhere. Hoag said a major company in the state hired VeruTEK to clean up chlorinated solvents, a ubiquitous class of contaminants worldwide and the most common pollutant in groundwater in the United States. Chlorinated solvents are used for commercial and industrial purposes, including as degreasers, cleaning solutions, paint thinners and pesticides. According to Hoag, "They are particularly

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Beardsley Zoo in the Forefront of Conservation Education

Connecticut's Beardsley Zoo is a nationally accredited conservation facility exhibiting more than 130 species—more than 300 animals—from around the world. Several endangered species can be found at the zoo, including the Amur (Siberian) tiger, the Andean condor, the Red wolf, and the Andean (spectacled) bear. Beardsley's four-fold mission is to provide guests and partners with an experience encompassing conservation, education, recreation and research. The Beardsley Zoo is an active leader in conservation, from restoration efforts for endangered Atlantic Salmon in native Connecticut waters to field studies of brown bears along Alaska's Pacific coast. The Zoo's diverse conservation initiatives, which include Trout-in-the-Classroom (students raise and release wild trout) and Kid's & Kritters: Wild Inspirations (kids literally paint with the Zoo's resident Amur Tigers), enhance its education programs for audiences of all ages. Connecticut's Beardsley Zoo delivers 21st century conservation education. Plan your visit today. Visit www.beardsleyzoo.org!



Maggie Sackrider, zoo educator, introduces a ferret to a 4th grade class visiting the zoo. [Photo courtesy Beardsley Zoo]

From the National Academies *(from page 1)*

which provides earthquake alerts that describe a magnitude and location within a few minutes after an earthquake, as well as the basic data required for many of the 18 suggested task elements; and evaluating, testing, and deploying earthquake early warning systems. Among the additional tasks recommended by the report are completion of national and urban seismic hazard maps; development and implementation of earthquake forecasting to provide communities with information on how seismic hazards change with time; development of scenarios to allow communities to visualize earthquake and tsunami impacts; and integration of science, engineering, and social science information in an advanced GIS-based platform to improve earthquake risk assessment and loss estimation.

http://www.nap.edu/catalog.php?record_id=13092

◆ Changing the Conversation in Engineering

The Summer 2011 issue of *The Bridge* from the National Academy of Engineering is devoted to a new phase of the NAE initiative called "Changing the Conversation in Engineering." The goal of this program, funded by the National Science Foundation (NSF), is to excite and inspire young people to go into engineering-related careers—"to interest students in who engineers are and what they do, to ignite a spark of invention and innovation, creativity and imagination to open young minds to the possibilities of becoming engineers. Students need to understand how engineers make a difference in their neighborhoods, communities, and the world by solving problems using science and technology, and that they, too, can join in those efforts," says Ellen Kullman, co-chair of the NAE's Committee on Implementing Engineering Messages. Articles include "Engineering a Change in Perception: Engineer Your Life and Design Squad," "Who Should Be an Engineer? Messaging as a Tool for Student Recruitment and Retention," "Framework for a Coordinated Outreach Campaign," "Rebranding Engineering: Challenges and Opportunities," and "The Image Problem for Engineering: An Overview."

<http://www.nae.edu/Publications/Bridge/51063.aspx>

◆ Leveraging Food Technology for Obesity Prevention

With more than one-third of the US adult population considered obese, behavioral scientists have emphasized building an evidence base for understanding what drives the energy imbalance—particularly with regard to portion size, energy density, and satiety—in overweight and obese individuals. Food scientists have been using this evidence base to improve existing technologies and create new technologies that can enhance the healthfulness of the food supply. For example, scientists have created fat- and sugar-reducing technologies, multiple baking technologies, and fat replacement technologies

through the incorporation of fiber to reduce the energy density of foods. Other technologies, such as portion-controlled frozen meals or snacks and technologies that increase fruit and vegetable intake, also have been developed in an effort to reduce and prevent obesity. The Institute of Medicine's Food Forum held a public workshop in November, 2010 to examine the complexity of human eating behavior and explore ways in which the food industry can continue to leverage modern and innovative food processing technologies to influence energy intake as one method to reduce and prevent obesity. Speakers discussed the associations between certain eating behaviors and weight gain as well as the opportunities and challenges of altering the food in homes and restaurants in order to reduce overeating. A workshop summary was released in July 2011.

<http://www.iom.edu/Reports/2011/Leveraging-Food-Technology-for-Obesity-Prevention-and-Reduction-Effort.aspx>

◆ Global Change and Extreme Hydrology

Climate theory dictates that core elements of the climate system, including precipitation, evapotranspiration, and reservoirs of atmospheric and soil moisture, should change as the climate warms, both in their means and extremes. A major challenge that faces the climate and hydrologic science communities is understanding the nature of these ongoing changes and the apparent anomalies that exist in reconciling their extreme manifestations. The National Research Council (NRC) Committee on Hydrologic Science (COHS) held a workshop in January 2010 that examined how climate warming translates into hydrologic extremes like floods and droughts. The workshop brought together three groups of experts: the first two consisted of atmospheric scientists and hydrologists focused on the scientific underpinnings and empirical evidence linking climate variability to hydrologic extremes. The third group consisted of water managers and decision-makers charged with the design and operation of water systems that in the future must be made resilient in light of a changing climate and an environment of hydrologic extremes.

Global Change and Extreme Hydrology summarizes the proceedings of this workshop, including an overview of the current state of the science. It examines the "conventional wisdom" that climate change will "accelerate" the hydrologic cycle, fuel more evaporation, and generate more precipitation, based on an increased capacity of a warmer atmosphere to hold more water vapor. The report also includes descriptions of the changes in frequency and severity of extremes, the ability (or inability) to model these changes, and the problem of communicating the best science to water resources practitioners in useful forums.

http://www.nap.edu/catalog.php?record_id=13211

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problematic because they only degrade under very specific conditions and if those conditions are not optimal, they can become more toxic and/or carcinogenic. I've worked on sites where the groundwater pollution plume from these solvents was a mile or more long. If public or private wells are downhill from these locations, they can be impacted." VeruTEK's plant-based and non-toxic VeruSOL[®] formulation facilitates the safe destruction of chlorinated compounds. "We were very happy we were able to successfully treat this site in Connecticut and reach closure for the client with the state Department of Environmental Protection," Hoag said.

VeruTEK is now involved in a large remediation project in the New York City borough of Queens across from the United Nations. The site was formerly a coal tar processing facility. From the mid 1800s to the mid 1900s, US plants turned coal, oil and other fuels into gas for cooking, gas lamps and for industrial purposes. But these plants left a swath of contamination across many states because they produced an oily substance known as coal tar, which contains many toxic pollutants. Denser than water, coal tar can sink into groundwater. VeruTEK also was hired by the state of Connecticut to clean up coal tar from a portion

of the Adriaen's Landing site in downtown Hartford.

While the scientists and engineers at Yale University, at VeruTEK and other organizations worldwide continue to demonstrate it is not only possible but also economi-

"I'm confident we'll see our regulations evolve. People educated in this field will go into industry and government and we'll have a more enlightened group of decision-makers. I believe that in the future, all chemistry will be green chemistry."

— George Hoag of VeruTEK

cally feasible to create safer products and use greener remediation processes, most institutions and companies continue to use more traditional means to make new things and "clean up" hazardous waste. So what needs to happen? Zimmerman and Beach at Yale, and Hoag at VeruTEK say education and raising awareness are critical.

VeruTEK will continue to work with the "early adopters" who have shown interest in green remediation technology. Hoag

acknowledges that it is "always helpful when there are guiding regulations that make certain practices preferable to others. Europe and Australia, where we are doing work, push sustainable technologies more than the United States. But I'm confident we'll see our regulations evolve. People educated in this field will go into industry and government and we'll have a more enlightened group of decision-makers. I believe that in the future, all chemistry will be green chemistry. It is really about having constraints placed on those that develop new chemical processes and products so that they will use benign materials from an environmental and health perspective. It is an awareness that folks like Paul Anastas have—he was a pioneer."

"Green chemistry and green engineering are very solutions-oriented," Beach adds. "There are things we can do to ensure a more healthy and sustainable future. We have new tools to change how we make our products."

Zimmerman is also optimistic. "I think you have to be. It is common sense, after all. I don't think anybody is interested in continuing to create more environmental and human health risks." — **Peg Hashem is a freelance science writer**