

Bulletin *of the*

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



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Connecticut's Evolving Innovation Ecosystem

The world has apparently awakened to the value of and need for innovation, as well as the closely related topics of entrepreneurship and commercialization. These are everywhere one looks today—in the media as well as the business, educational and political arenas." Googling" the phrase "innovation" will get you 400 million hits, "entrepreneurship" 70 million and "commercialization" 13 million. According to Nobel Laureate Edmund Phelps of Columbia University, innovation is THE key to sustaining successful communities. In his book, *Mass Flourishing*, Phelps argues that economic well-being, or in his terms, "economic flourishing of the masses," results directly from developing and sustaining an innovative culture—one in which all individuals feel confident enough to try something different regardless of their fields of endeavor. Phelps presents two core concepts: that innovation comes from the grassroots—individuals—and that innovation contributes to individuals' personal growth. Individuals in turn then contribute to their respective cultural, economic and political systems. In his judgment, government's role is to encourage, nurture and resource innovative behavior—to minimize and/or eliminate rules that thwart it. Businesses, educators and communities all have equally important related roles.

What are we doing to prepare the next and future generations to participate in, and contribute to, such a dynamic, innovative ecosystem?

Although Phelps' premise is that nurturing continuous innovation is necessary in ALL areas of human interest, this article will focus on the nation's younger engineers and scientists—both those in the education pipeline and those in early stages of their careers.

To set the stage properly, one must first realize that innovation has become of global importance and impact—enough so that serious attempts are being made to promote and measure it. The World Economic Forum has created an annual qualitative Global Competitiveness Index (<https://www.globalinnovationindex.org/>)

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Yale's Joan Steitz Awarded 2015 Connecticut Medal of Science



Professor Joan Steitz addresses members and guests of the Academy after being awarded the 2015 Medal of Science. [Graphic: Frank LaBanca]

Joan A. Steitz, Sterling Professor of Molecular Biophysics and Biochemistry at the Yale School of Medicine and Investigator, Howard Hughes Medical Institute, is the 2015 recipient of the Connecticut Medal of Science. Steitz received the award—the state's highest honor for scientific and technological achievement—for her seminal contributions to biology. The medal was presented at the annual meeting of the Connecticut Academy of Science and Engineering on May 19, 2015 by Academy president Sandra K. Weller.

Steitz is best known for her pioneering work in RNA and is an international leader in describing the molecular events involved in creation of messenger RNA (mRNA). Messenger RNA transcribes information coded on DNA and delivers it to ribosomes,

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From the National Academies

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

◆ New Report Urges US to Strengthen Innovation, Productivity, Workforce Training

Given that globalization, technological advances, and changing business practices are dramatically transforming employment and operations across the board in manufacturing, US companies, government, and educators should partner to strengthen workforce training and improve innovation and productivity to ensure manufacturers are "making value" for customers, says a new report from the National Academy of Engineering. Making value is the process of using ingenuity to convert resources into goods, services, or processes that create solutions, serving the welfare of humanity and the needs of society. The report includes recommendations as to how businesses, economic development organizations, educational institutions, research organizations, as well as federal, state, and local governments can play a role in this process.

<http://www.nae.edu/129940.aspx>

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userfiles/file/reportpdf/gii-2014-v5.pdf) while *Bloomberg's Business Week* (Jan 19-25, 2015) uses a set of quantitative measures. Many may be surprised to learn that the United States is no longer number one in innovation; it is in fourth or sixth place respectively, behind Finland, Switzerland, Israel and Japan.

Why is innovation so important on a global scale? Because many in leadership roles believe that the commercialization of innovations can produce economic growth and job creation. It is further believed that small startup companies, which depend on innovation and entrepreneurship, are very effective at job creation and economic growth. The result is that many businesses, universities, countries and even local communities are aggressively pursuing innovation, entrepreneurship and commercialization. And they are in need of critical, innovative thinkers on a global scale.

In the United States, promoting innovation has become a national priority. The president has become "Innovator-in-Chief," releasing his updated "Strategy for American Innovation" (<https://www.whitehouse.gov/innovation/strategy>) on February 4, 2011. He has promoted the topic at every opportunity, hosted technology-related White House events and launched programs in numerous federal agencies. Examples include the Department of Commerce's Office of Innovation and Entrepreneurship and the National Advisory Council for Innovation and Entrepreneurship, the National Science Foundation's numerous programs in its Industrial Division for Innovation and Partnerships, and the Energy Department's ARPA-E (Advanced Research Projects Agency-Energy) for innovative energy

production. In March 2015, the National Academy of Engineering, reflecting on increasing global competition, released its report, "Making Value for America: Embracing the Future of Manufacturing, Technology, and Work" [see p. 1, "From the National Academies"]. The report, co-authored by Nicholas Donofrio (Chair of the Connecticut State Colleges and Universities Board of Regents for Higher Education and retired Executive VP of Innovation and Technology at IBM) asserts that "Collaborative actions are needed to encourage the development of new businesses across manufacturing and high-tech value chains to stimulate innovation and job creation."

Many in Connecticut have taken up this call, including the governor, state agencies, businesses and universities. The state has long had Connecticut Innovations Inc., a somewhat unique, quasi-governmental agency supporting innovative startup companies. Additionally, Governor Dannel Malloy has launched numerous related programs through Connecticut's Department of Economic and Community Development, such as the Manufacturing Innovation Program, CT Next, and others all aimed at helping startups and existing companies innovate and grow.

Connecticut businesses' involvement and perspectives on the topic differ according to their size and market needs. Large corporations obviously have different needs and wants than medium-sized or very small ones.

Nurturing Innovation in Large Companies

CASE member Alan H. Epstein of Pratt & Whitney addressed this issue in his recent paper, "Innovation and Value Creation in a Very Long-Cycle Business" (*Research Technology Management*, Nov-Dec 2014), noting that large companies like Pratt & Whitney

... must innovate in a very long-cycle business, one in which the break-even point on an innovation is decades out. This requires the company to create new innovations before customers can even define the requirements for the next generation of engines. As a result, it's critical that the company distinguish between novelty and true innovation.

Pratt & Whitney's Innovation Challenge Program is one recent tool used to stimulate employees to think innovatively. This program poses specific challenges to meet a current or anticipated need and provides support to the winners to explore their ideas in greater depth—some ideas are so good the study phase is skipped and they go right to implementation. While in the past the focus has been on product design, the most recent challenges have been on process improvement.

In the near term, the company's innovative energies are mainly focused on process improvements through the P&W Innovation Challenge Program. This program gives employee teams a challenge to meet a current need and supports them financially to explore their ideas—some of which are so good the study phase is skipped and it goes right to implementation.

A somewhat similar approach is taken at Sikorsky, where Chris Van Buiten heads Sikorsky Innovations, an internal organization established five years ago to tackle the toughest problems of vertical flight. It is going after sustainable change with a goal of demonstrating differentiating change. They realize this could take many years, PhDs, and dollars, so they have picked three focus areas to assure they stay on point: Speed (double the speed of helicopters), Autonomy (make it so sophisticated it can operate with crew of two, one or zero) and Intelligence (integrate all onboard and offboard computations and exploit the data). While Sikorsky employs over 4000 engineers, it needs to recruit a different type of engineer for this work, ones with exposure to innovation and entrepreneurial

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The Connecticut Academy of Science and Engineering

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

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Biomedical Research

CBIF AWARDS ALMOST \$1M. On March 31, the **Connecticut Bioscience Innovation Fund** (CBIF) awarded nearly \$955,000 to university-based biotechnology research projects. **Dianqing Wu**, a professor of pharmacology at the **Yale School of Medicine**, received \$500,000 for a project to develop a targeted antibody approach for colorectal cancer treatment, and **Robert Clark** of the **UConn Health Center**, received almost \$455,000 to work with **Frank Nichols** to further develop a multiple sclerosis blood-based biomarker diagnostic test to distinguish healthy individuals from those with the disease.

NEW IMMUNOARRAY OFFERS LOW-COST CANCER BIOMARKER DETECTION. Recently, researchers in the lab of **UConn** professor and CASE member **James Rusling** successfully developed an automated, microprocessor-controlled, microfluidic array to detect small protein panels, potentially providing a simple, automated, low-cost method to detect cancer biomarker proteins in patients. The **UConn** team achieved ultra-low detection limits and high accuracy for prostate cancer patient samples.

UB FACULTY RESEARCH DAY DRAWS RECORD PARTICIPANTS. The 5th Annual Faculty Research Day at the **University of Bridgeport** (UB) on March 27 saw its most submissions yet, with 129 posters accepted from faculty and students. The annual event provides a platform to showcase research conducted by faculty and assisted by students. Over 300 individuals turned out to view the posters and talk with faculty researchers like **Xingguo Xiong**, associate professor of electrical and computer engineering, whose development of a smart drug delivery system earned a faculty research prize. Projects ranged from biomedical innovations to solutions for big data, poverty alleviation policy analysis and much more. More than 300 Submissions represented 11 of UB's 13 schools and colleges, constituting 29 departments.

YALE TO LEAD CLINICAL TRIAL FOR METASTATIC MELANOMA. **Yale University** this spring launched a multicenter clinical trial, sponsored by Stand Up to Cancer and the Melanoma Research Alliance, using personalized medicine technology to treat metastatic melanoma. Yale is the lead site for the trial, which will enroll patients lacking a particular genetic mutation for whom immune therapy did not work or was not an option. Almost half of all patients with metastatic melanoma have an altered BRAF gene, a target for certain immune therapy drugs. However, for patients whose tumors lack the BRAF alteration, and for whom immunotherapy fails, other options are required. This trial uses molecular sequencing techniques to match targeted drugs to the unique genetic alterations present in tumors missing the BRAF mutation. Patients will be enrolled through the **Smilow Cancer Hospital at Yale-New Haven Hospital**.

STEMCONN 2015 HELD IN HARTFORD. The **StemConn 2015** conference was held April 27 in Hartford, creating a forum to share research and hold discussions among scientists, policy makers, and bioscience industry partners. One discussion focused on the role of adult stem cells that, according to scientists at **Multiclinal Therapeutics**, a startup hosted in **UConn's Technology Incubation Program**, may be instrumental in regenerating body tissues. Unlike

embryonic stem cells that haven't yet developed into specific cell or tissue types, adult stem cells are committed to the particular organ or tissue from which they were taken. When adult stem cells are cloned, they can reconstruct tissue almost indistinguishable from the tissue from which they came. **Multiclinal Therapeutics** is working with adult stem cells to repair lung tissue damaged by chronic obstructive pulmonary disease.



Business & Industry

NEWTOWN FIRM TO MARKET 'GREEN' TECHNOLOGIES. Newtown-based **McKenney Mechanical**, a heating, ventilation and air conditioning (HVAC) specialist, recently signed a national distribution contract to market and sell **Go Green Global Technologies'** **Sonical™** products, which use patented technology for both non-chemical water treatment and fuel combustion applications, to commercial, industrial and municipal customers. **Sonical™** is a cost-efficient and easily installed device that makes existing fuel and water systems run cleaner and more efficiently. **McKenney's** customers include hospitals, sports complexes, universities, K12 schools, large office complexes, and plant facilities.

P&W UNVEILS UPDATED MIDDLETOWN FACILITY. In February, **Pratt & Whitney (P&W)** opened its updated, state-of-the-art production facility in Middletown, which will be used to support manufacturing of the **PurePower® PW1100G-JM** engine for the **Airbus A320neo** and the **F135** engine for the **F-35 Lightning II Joint Strike Fighter**. The upgrades, which include the world's largest linear friction welding machine—a 400,000 pound behemoth standing 20 feet tall from **Manufacturing Technology, Inc.**, of South Bend, Indiana—are the result of significant capital investments. "We're investing more than \$1 billion worldwide to prepare for production increase of the **F135** engine and **PurePower** engine family, including significant investments in our **East Hartford** and **Middletown** facilities..." said **Joe Sylvestro**, vice president of manufacturing operations for **P&W**.

LORD JOINS SIKORSKY-BOEING TEAM. North Carolina-based **LORD Corporation** announced April 1 that it joined the **Sikorsky-Boeing** team to develop and build the **SB>1 DEFIANT™** technology demonstrator for the **US Army's Joint Multi-Role (JMR) Technology Demonstrator** program. **LORD** is responsible for active vibration control systems and tension-torsion rotor head components. The **Sikorsky-Boeing SB>1 DEFIANT™** technology demonstrator is based on **Sikorsky's X2 Technology™** rotorcraft design. Last year, the **Army** selected the **Sikorsky-Boeing** team as one of two industry teams to develop the demonstration aircraft.



Communication

NEW ONLINE TOOL FOR CONSUMERS. In March the **Connecticut Department of Consumer Protection** launched an online tool providing consumers with information to quickly and safely get medicine, supplies, or treatment during a natural disaster, storm or other type of emergency. "**Business Finder**" (<http://businessstatus.ct.gov>) allows pharmacies, dialysis centers, and oxygen suppliers to update business information in real time before and during an emergency.

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, or contact us at acad@ctcase.org.

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FUEL CELL TO POWER COMCAST MAIN FACILITY. Comcast Cable this spring began using a 400-kilowatt fuel cell to cover 80% of the electricity load its master facility in Berlin, used for receiving and processing television signals. The fuel cell, provided by California-based Bloom Energy, will generate 3 million kilowatt hours of electricity annually, offsetting the 80,000-square-foot facility's carbon emissions—equal to removing 185 cars from the road.

COMCAST LAUNCHES NEW ETHERNET SERVICES. In April, Comcast launched its multi-Gigabit Ethernet services throughout six towns in New London County. Comcast joined Frontier, which currently offers up to 10 gigabytes of Ethernet services to all commercial customers in eastern Connecticut.

Education & Cognition

UCONN TEAM TO EXAMINE ROLE OF ADHD IN CREATIVITY. UConn, with funding from the National Science Foundation's Research in Engineering Education program, is initiating a study to compare the difference in creative thinking between engineering students with attention deficit hyperactivity disorder (ADHD) and other engineering students. Some studies suggest those with ADHD are more creative and more willing to take risks—traits needed in the field of engineering—but the traditional model of teaching may be driving away these students, according to the UConn team. Arash E. Zaghi, assistant professor of civil and environmental engineering and lead investigator, notes that traditional engineering training rarely takes advantage of these strengths. "It doesn't leave enough room for creativity," says Zaghi, "We're so comfortable with our instruction now that we haven't recognized that we aren't sufficiently fostering creativity."

PROPOSED BILL WOULD FUND PROGRAMS LINKING ENGINEERING EDUCATION, HIGH-TECH MANUFACTURING.

In March, a bill sponsored by US Representatives Paul Tonko and Chris Collins of New York and Elizabeth Esty of Connecticut called the Manufacturing Universities Act was introduced in the US House of Representatives; a companion bill was introduced in the US Senate. The bill would establish a Manufacturing Universities program within the US Department of Commerce's National Institute of Standards and Technology. Colleges and universities with existing engineering programs would be eligible to apply for the Manufacturing University designation, which would include up to \$5 million annually for four years to improve engineering programs with an emphasis on manufacturing, increase the number of joint projects with manufacturing firms, and support students who participate in cooperative education and apprenticeships with manufacturers. UConn provost and CASE member Mun Choi notes that the bill would provide the opportunity for improved connections between students and manufacturing opportunities.

OFFICIALS BRIEFED ON 'GRAND CHALLENGES FOR ENGINEERING.' CASE member Tarek Sobh, dean of the School of Engineering and senior vice president of Graduate Studies and Research at the University of Bridgeport (UB), attended the meeting of the National Academy of Engineering in Washington, DC, on March 24. As part of the meeting, Sobh and leaders of other institutions gathered to brief White House officials and policy makers on the Grand Challenges for Engineering, a national campaign that identifies areas requiring future innovative engineering solutions.



Energy

HYDROGEN, FUEL CELL DEVELOPMENT PLANS FOR US NORTHEAST RELEASED. The Northeast Electrochemical Energy Storage Cluster (NEESC), administered by the Connecticut Center for Advanced Technology, Inc. (CCAT), recently announced release of the 2015 Hydrogen and Fuel Cell Development Plans for Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. The plans address anticipated increases in demand for new electric capacity. Hydrogen and fuel cell technology reduce carbon dioxide emissions, meeting zero emissions vehicle (ZEV) requirements using renewable energy from biomass, wind and photovoltaic power to generate hydrogen.

PLAINVILLE, CROMWELL, FIRST TO IMPLEMENT LED STREET LIGHT CONVERSION. Massachusetts-based ESCO Energy Services recently announced installation of LED street lights in Plainville and Cromwell as part of the Connecticut Conference of Municipalities' (CCM) Municipal Street Light LED Conversion Program. The installation, valued at more than \$1 million, is expected to be completed by late 2015, and will include more than 2,600 street light fixtures with an estimated annual savings of approximately \$225,000. The towns are the first in Connecticut to implement an LED street light conversion under CCM's statewide program.

SOLAR HOME CREDIT ANNOUNCED. In March, Governor Dannel Malloy announced the Solar Home Renewable Energy Credit (SHREC) to support the Class I Renewable Portfolio Standard (RPS) policy, providing access to incentives to increase the affordability of residential solar. Connecticut's Green Bank, which oversees the C-PACE program, allows property owners to pay for these improvements over time through additional charges on property tax bills with the repayment obligation transferred to the next owner if the property is sold. The SHREC program is expected to generate \$537 million in economic activity for Connecticut.

DROP IN GREENHOUSE GAS EMISSIONS REPORTED. UIL Holdings Corporation announced in April the reduction of harmful greenhouse gas emissions by at least 15,000 tons since 2011. Data from 2011 to 2013 reported by UIL to the Connecticut Department of Energy and Environmental Protection shows a 9% reduction in greenhouse gas emissions at The Southern Connecticut Gas Company and a 4% drop at Connecticut Natural Gas Corporation. "In many ways, every day is Earth Day at UIL," said Jim Torgerson, UIL's President and CEO. UIL is also starting work on a 9,000-panel solar array in Bridgeport, located on top of a landfill. The project will generate 2.2 megawatts of renewable power for UI customers.



Environment

GOVERNORS MEET TO TACKLE ENERGY ISSUES. The governors of Connecticut, Maine, Massachusetts, and Rhode Island met at the Connecticut Convention Center April 23 to discuss energy issues facing New England. The governors committed to partnering on improving the energy grid, investing in renewable energy sources and working to cut costs for consumers. Noting that New England residents paid an extra \$7.5 billion over the past two winters on heating and electric bills, more than residents pay in other parts of the United States, the governors, in a joint statement, said, "Continued state attention is urgently needed to achieve clean, affordable, and reliable power on which our families and businesses depend. This problem is greater than any one state can solve

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alone. For this reason, we renew our commitment to coordinated action to address our regional energy challenge.”

HARTFORD LANDFILL CLOSED. The **Hartford** landfill officially closed in March after a synthetic cap installed last June was determined to meet state and federal regulations. The **Connecticut Department of Energy and Environmental Protection** notified the operator, **Materials Innovation & Recycling Authority**, ending the \$30.4 million capping project. The landfill opened in 1940 as an open-burning dump, operating as an incinerator from 1953 to 1977. The **Connecticut Resources Recovery Authority** took over in 1982 and began operating a trash-to-energy plant. The ash from the plant was deposited in the landfill, which received its final delivery in December 2008. The capping project, including installation of 3,993 electricity-generating solar panels, began in 2008.

DEEP APPROVES ENGLISH STATION CLEANUP PLAN. The **Connecticut Department of Energy and Environmental Protection** (DEEP) this spring began plans to remove construction equipment, including a bulldozer and a backhoe, and several trailers from the former **English Station** power plant on **Grand Avenue** in **New Haven**. DEEP approved a decontamination plan, said **Dennis Schain**, a DEEP spokesman, “but there also needs to be a (state) **Health Department** review and approval because some of the trailers involved had been used by a contractor who had been doing work related to asbestos removal at one time and there are things in them that we want to be sure about.” The grounds of the former **United Illuminating Co.** power plant are contaminated with polychlorinated biphenyls, or PCBs, a cancer-causing agent, as well as heavy metals and other contaminants.



Food & Agriculture

SENATOR URGES BAN ON PESTICIDES. Noting that the town of **Branford** has not used dangerous pesticides on local baseball and soccer fields for over 20 years, **State Senator Ted Kennedy, Jr.**, urged all of Connecticut to follow Branford’s pesticide-free example. While Senate Bill 1063 would have banned the use of pesticides on fields at K-8 schools and daycares, Kennedy sought to extend the bill to include municipal playgrounds. The EPA announced its intention to restrict glyphosate, the leading ingredient in Monsanto’s Roundup, because of health concerns and glyphosate is at the top of the list to ban on Connecticut’s fields. The bill was not called for a vote during the just-adjourned General Assembly session.

STUDY SHOWS CHILDREN EATING HEALTHIER AT SCHOOL. A study published March 5 in the journal *Childhood Obesity* from the **Rudd Center for Food Policy & Obesity** at **UConn** reliably measured student consumption of entrees, fruits, vegetables, and milk during lunch and determined that since healthy school meal standards took effect in 2012, children are eating healthier and discarding less food at school.

STATE FACES ECONOMIC RISKS FROM ADVERSE EFFECTS ON BIVALVES. According to a study released in the journal *Nature Climate Change* on February 23, Connecticut was one of 15 states at risk of economic harm from ocean waters becoming more acidic and causing damage to the shell fishing industry due to overflowing wastewater treatment plants, which can lead to hypoxia. The study focuses on bivalves, which appear to be most endangered. Connecticut has invested \$2.5 billion in sewage treatment plant improvements, said **Leah Schmalz**, program director for the **Connecticut Fund for the Environment**.

ENERGY DRINKS FOUND HARMFUL TO KIDS. A study conducted by the **Rudd Center for Food Policy and Obesity**, published in the April issue of *Nutrition Reviews*, demonstrates harm caused by energy drinks to children and adolescents. The study, funded by the Robert Wood Johnson Foundation, notes emergency room visits by 12- to 17-year-olds attributable to energy drinks increased from 1,145 in 2007 to 1,499 in 2011, with deaths also reported. Further, calls to poison centers because of energy drink consumption increased from 672 in 2010 to 3,028 in 2013, with 61% of the calls concerning children 18 and younger with symptoms consistent with caffeine toxicity. The Rudd report advocates policy changes, including prohibiting sales to youth under 18, requiring warning labels, and prohibiting unfair and deceptive marketing practices.

AG STATION GETS USDA GRANT FOR ENHANCED PLANT/PEST ANALYSIS. On March 24, **The Connecticut Agricultural Experiment Station** (CAES) announced receipt of \$293,179 from the USDA to support projects preventing the spread of plant pests, diseases, and pathogens. The CAES projects focus on enhancing plant pest/disease analysis and survey, enhancing mitigation capabilities, and conducting outreach and education. Programs include: Grape Commodity Survey; Orchard Commodity Survey; National Honey Bee Pests and Diseases Survey; Forest Pest Outreach and research on Boxwood Blight, a new disease in the United States. The projects fall under the Farm Bill “Plant Pest and Disease Management and Disaster Prevention Programs.”

SOUTHERN PINE BEETLE SIGHTED IN MULTIPLE COUNTIES. The southern pine beetle was detected in **Wallingford** on March 17 by staff from **The Connecticut Agricultural Experiment Station** and the **Connecticut Department of Energy and Environmental Protection**. Sites in **New Haven County**, **Litchfield** and **Hartford** counties have confirmed positive for the beetle. The southern pine beetle is native to the southeastern United States and a major pest of timber plantations, killing healthy trees. Once an infestation takes hold, there is little that can be done other than removing the trees, said **Claire Rutledge**, assistant agricultural scientist with CAES.



Health

C. DIFFICILE INFECTION RATES STUDIED. A recent study, citing data from 10 nationwide Emerging Infection Program (EIP) sites, including one at the **Yale School of Public Health**, indicates that *Clostridium difficile* (more commonly known as *C. difficile* or *C. diff*), causes close to half a million infections in the United States in a single year, with 29,000 people dying from exposure. Earlier data only identified healthcare-associated cases; new data shows the extent of *C. difficile* infection in the community. The report, published in *The New England Journal of Medicine*, notes that *C. difficile* causes severe diarrhea, the leading cause of gastroenteritis-related death in the United States, and the most common cause of healthcare-related infections. Unnecessary antibiotic use, improper cleaning procedures and a lack of coordination on hospital transfers contribute to the spread of *C. difficile* in acute care settings.

YALE STUDY IDENTIFIES ‘ULTRA-MUTATED’ TUMORS. A **Yale**-led genomic analysis of more than 700 brain tumors finds a subtype of the malignant brain tumor, glioblastoma, possesses thousands of tumor-specific mutations instead of dozens observed in most glioblastoma cases. The findings, recently published in the journal *Neuro-Oncology*, reveal it may be possible to develop personalized treatments including immunotherapy for these ultra-mutated tumors also found in several other cancers. Using complimentary cutting-edge genomic technologies in a clinical environ-

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ment allows for the determination of specific vulnerabilities in the cancer and leverage these for precision treatment.

NEW TICK-BORNE VIRUS IDENTIFIED. CASE member **Theodore Andreadis**, director of **The Connecticut Agricultural Experiment Station**, has identified a tick-borne virus known as Powassan which has been appearing in southern parts of Connecticut. The Powassan virus has symptoms similar to Lyme disease, including headache, nausea and fever. Once the virus is found in the system, it is not treatable and can cause death. No human cases around the area have been reported. "These ticks will transmit this virus when they feed within a matter of hours, whereas with Lyme disease, for example, ticks generally have to feed up to two days before they're capable of transmitting it," reported Andreadis.

HSC AUTISM CENTER NATION'S FIRST PATIENT-CENTERED SPECIALTY PRACTICE. Connecticut's **Hospital for Special Care's (HSC) Autism Center** was recognized in late February by The National Committee for Quality Assurance (NCQA) as the nation's first autism Patient-centered Specialty Practice (PCSP). This honor is based on responsiveness to patients and medical colleagues, cooperation and integration with other healthcare groups, and dedication to continuous improvement. "In just three years, we have gone from seeing our first patients to carefully composing a neighborhood of comprehensive care and services," said **Lynn Ricci**, senior vice president and chief operating officer for HSC.

RESEARCHER HONORED WITH PORTOGHESE LECTURESHIP. CASE member **Nicholas Meanwell**, executive director of discovery chemistry at **Bristol-Myers Squibb** in Wallingford, was recently honored with the Philip S. Portoghese Medicinal Chemistry Lectureship. Meanwell received the lectureship, named after the former editor-in-chief of the *Journal of Medicinal Chemistry*, in recognition of his role leading drug discovery programs in the cardiovascular, neuroscience, and virology therapeutic areas.



High Technology

UConn FIBER OPTIC UPGRADE TO AID RESEARCHERS. UConn recently announced implementation of a 100 gigabit per second fiber connection to support research collaboration and exchange between UConn researchers and their peers around the world. The connection is provided by the **Connecticut Education Network (CEN)**, an all-optic research and education network, in cooperation with UConn and the **State of Connecticut**. The upgrade will enable the computer science and engineering department to conduct wide area network performance research; provide the geography department continuous access to high resolution satellite images; enable the molecular and cell biology department to transfer huge genome sequences within the campus and with external sites; allow the physics department to participate in the Open Science Grid and transfer terabytes of jobs to and from the grid within a day; help the statistics department conduct research on high-dimensional statistical modeling and inference using large data sets produced by health and biomedical studies; and assist UConn Health research quantitative cell biology and simulations.

YALE TEAM ASSESSES 'METAL CRITICALITY.' According to a recent study published by CASE member **Thomas Graedel** of **Yale**, imbalances between metal supply and demand have inspired a concept known as metal "criticality"—the "quality, state, or degree of being of the highest importance." A Yale team has characterized the criticality of 62 metals and metalloids that see significant use in industry. The results show that the limitations for many metals

important in emerging electronics (e.g., gallium and selenium) are largely those related to supply risk; those of platinum group metals, gold, and mercury, to environmental implications; and steel alloying elements (e.g., chromium and niobium) as well as elements used in high-temperature alloys (e.g., tungsten and molybdenum), to vulnerability to supply restriction. The metals of most concern tend to be those available largely or entirely as byproducts, used in small quantities for highly specialized applications, and possessing no effective substitutes.

CT SCIENCE FAIR DRAWS 700 STUDENTS. Approximately 700 students from 126 schools participated in the 67th Connecticut Science & Engineering Fair held at **Quinnipiac University** March 10-14, competing for \$170,000 in prizes and the chance to advance to international competition. **United Technologies (UTC)** was the presenting sponsor of the event, with more than 40 employees volunteering to promote science, technology, engineering and math. UTC sponsors eight awards of common stock valued at \$500 each as part of the awards.



Transportation

CTFASTRAK SERVICE LAUNCHED. On March 27, Connecticut's first bus rapid transit (BRT) system, known as **CTfastrak**, was launched, providing service along a 9.4-mile route from Hartford to New Britain with nine stops, new bridges, streetscaping, and a multi-use trail. The route bypasses heavily congested parts of I-84 west of Hartford. In addition, feeder shuttles will make side trips around downtown Hartford including malls, hospitals, and universities.

CTFASTRAK BUS DEAL. Indianapolis-based Allison Transmission Holdings, Inc., has been selected as the bus manufacturer for **CTfastrak**. The fleet of 48 hybrid diesel-electric buses includes 30-foot Gillig buses to provide neighborhood circulator service and 40-foot New Flyer buses to operate connector routes. The main line service will be operated with 60-foot articulated Nova buses.

NEW BOOK ANALYZES CAUSES, REMEDIES FOR ROAD CONGESTION. Recently, CASE member **Herbert Levinson**, along with **John Falcocchio**, published *Road Traffic Congestion: A Concise Guide*, a book about road traffic congestion in cities and suburbs including strategies for relieving the problem. The book discusses the inter-relationship between transportation technologies and settlement patterns; the different causes, characteristics, and consequences of congestion; and various relief strategies—as well as supply adaptation and demand mitigation—for nonrecurring and recurring congestion with guidelines for congestion relief and an outlook for the future.

CTDOT CAMPAIGN COMBATS DISTRACTED DRIVING. This spring, **CTDOT's Highway Safety Office** launched the "U DRIVE. U TEXT. U PAY" initiative as part of the National Highway Traffic Safety Administration's national effort to crack down on motorists who choose to text, talk, or otherwise distract themselves from the task of driving by using a hand-held mobile phone. CTDOT relied on a specialized federal safety grant to provide funding for state and local police to participate in overtime enforcement of Connecticut's distracted driving laws. Nationwide in 2013, 3,154 people were killed and approximately 424,000 were injured in motor vehicle crashes involving distracted drivers. Under Connecticut's cell phone and texting law, violators will be fined from \$150 for a first offense, \$300 for a second violation, and \$500 for each subsequent violation with steeper fines for work zone violations.

—Compiled and edited by Wendy Swift

◆ FAA Should ‘Reset Expectations’ Says Report

The original vision for the Next Generation Air Transportation System is not what is being implemented today, and the Federal Aviation Administration should “reset expectations” for the program meant to modernize and transform the national airspace, says a new congressionally mandated report from the National Research Council. The report recommends that FAA adopt a system architecture that supports decision making and provides a foundation for managing changes in technology and operations, and says it should incorporate cybersecurity and unmanned aircraft into its planning and design.

http://www.nap.edu/openbook.php?record_id=21721

◆ Battery Technologies for Automotive Applications

Global interest in electrified vehicles is sparked by both environmental concerns and, in practical terms, the relatively recent application of lithium ion battery technology to automotive applications. Mass adoption of automotive batteries will depend on performance improvements, so methods to optimize the prediction and design of this technology for endurance and safety are an area of active research. New analytical test tools and methods are described in this article from the National Academy of Engineering’s latest issue of *The Bridge* (Spring 2015), and their refinement and adoption will enhance the ability of lithium ion technology to supplant liquid hydrocarbon fuels in the transportation sector and thus positively contribute to the global environment.

<http://www.nae.edu/Publications/Bridge/133842/134279.aspx>

◆ ‘Cognitive Aging’ Poses Major Health Issue for Older Americans, IOM Report Finds

Gradual and variable change in mental functions that occurs naturally as people age, not as part of a neurological disease such as Alzheimer’s disease, is one of the most challenging health issues encountered by older adults, says a new report from the Institute of Medicine. Known as “cognitive aging,” the type and rate of change can vary widely among individuals. Some will experience very few, if any, effects, while others may experience changes in their memory, speed of processing information, problem solving, learning, and decision-making abilities. The report presents three top actions individuals can take to help maintain optimal cognitive function with age. These include

- Being *physically active*.
- *Reducing and managing cardiovascular disease risk factors*, including high blood pressure, diabetes, and smoking.
- *Regularly discuss and review health conditions and medications* that might influence cognitive health with a health care professional. A number of medications can have a negative effect—temporary or long term—on cognitive function when used alone or in combination with other medication.

http://www.nap.edu/openbook.php?record_id=21693

◆ Personalized Medical Robots: The Next Generation

Many medical interventions today are limited by human physical and cognitive capabilities. Robot-assisted intervention techniques can extend the ability of humans to perform surgery more accurately and less invasively using novel physical designs and computer control. Hundreds of thousands of surgical procedures are now done annually using robots, such as the da Vinci Surgical System, typically teleoperated by human surgeons. But because of their limited dexterity, high cost, and large footprint in the operating room, there are many scenarios in which current clinical robots cannot be used to perform minimally invasive medical procedures. The next generation of medical robots will be much more personalized—capable of being rapidly designed, manufactured, and controlled for a specific patient and procedure.

<http://www.nae.edu/Publications/Bridge/133842/134329.aspx>

◆ IOM Report Recommends ‘Vital Signs’ to Score Progress on US Health Care

A new report from the Institute of Medicine presents 15 “vital signs” for tracking progress toward improved health and health care in the United States. The committee that carried out the study and wrote the report said the set of core measures should reduce the burden on clinicians of taking measurements, enhance transparency and comparability, and improve health outcomes nationwide. The set of 15 vital signs, which are expected to evolve over time, include life expectancy, well-being, overweight and obesity, addictive behavior, unintended pregnancy, healthy communities, preventive services, access to care, patient safety, evidence-based care, care that matches patient goals, personal spending burden, population spending burden, individual engagement, and community engagement.

http://www.nap.edu/openbook.php?record_id=19402

Steitz (from page 1)

which translate the information needed to produce proteins. Her lab discovered tiny particles in cells called small nuclear ribonucleoproteins (snRNPs) and described their role in splicing, an essential step in creating mRNA. By employing human autoantibodies as probes for the snRNPs in *in vitro* pre-mRNA splicing reactions, she showed that the particular snRNPs carry out precise steps in pre-mRNA splicing, thus demonstrating that snRNPs were essential for making mRNA for the first time. This was a fundamental contribution to biology as it explained a critical step in expression of almost all eukaryotic genes. With estimates that 70% of human genetic diseases can be traced to defects in pre-mRNA splicing, Steitz’s work also has a

significant impact on understanding the pathogenesis of human diseases.

In her lab, Steitz continues to explore RNA structure and function. Her research includes defining the functions of other noncoding RNPs, such as those that guide the modification of ribosomal RNAs and several produced by transforming herpesviruses. Today, her studies of noncoding RNAs include microRNAs.

In addition to her research accomplishments, Steitz is a dedicated teacher of biochemistry to Yale undergraduates and a mentor and research advisor to graduate students and postdoctoral fellows. She is recognized for her commitment to

the training and advancement of women scientists, in particular, and her inspired leadership led to a renaissance at Yale that made the Department of Molecular Biophysics and Biochemistry one of nation’s strongest in molecular biology.

A graduate of the Antioch College, Steitz holds a PhD in biochemistry and molecular biology from Harvard University. She has authored nearly 300 papers, many of them in the highest impact journals (*Science*, *Nature*, *Cell*, and *PNAS*). She is a member of the American Academy of Arts and Sciences, the American Philosophical Society, the National Academy of Sciences, the Institute of Medicine, and the Connecticut Academy of Science and Engineering.

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Innovation *(from page 2)*

concepts. Some of these are put on “viciously” small teams made up of young and senior engineers and given a budget and five goals—the fifth of which is to inspire the next generation of engineers.

At IBM, the story is similar, but with an interesting twist. According to Susan Puglia, VP of University Programs, to underpin its innovation efforts, IBM has been incorporating the “*T*-Shaped” concept since 2003. The concept of *T*-shaped skills, or *T*-shaped professionals, is a metaphor used to describe a person’s abilities. The vertical bar on the “*T*” represents the depth of related skills and expertise in a single field, whereas the horizontal bar is the ability to collaborate across disciplines with experts in other areas and to apply knowledge in areas of expertise other than one’s own. In IBM, the horizontal also suggests the ability for a person to perform critical and analytical thinking across disciplines to innovate and solve problems.

Apparently the earliest reference to the concept is by David Guest in 1991 (see “The hunt is on for the Renaissance Man of computing,” *The Independent*, Sept. 17, 1991). The concept has now spread to other companies and universities and even produced *T*-Summits (<http://tsummit2014.org/>) in 2014 and 2015 co-hosted by IBM and Michigan State University. The *T*-concept is used proactively in the formation of innovation teams to assure the teams reflect a diversity of skills (the *T*-vertical) plus the needed cross disciplinary communications abilities and insights (*T*-horizontal).

At Smaller Companies, a Different Approach to Innovation

For mid- and small-sized companies, the situation is a bit different. According to CASE members Leon Newman and Eric Mueller of Coherent, Inc., mid-sized, high-tech companies have very similar needs when it comes to innovation. However, their smaller workforce usually represents fewer specific in-depth (vertical)

skills—all of which are technical. They therefore find they need to internally train individuals in the related cross disciplines (finance, marketing, etc.), fields to which most young engineers and scientists have little or no exposure in high school or college. This last point was echoed by CASE member David Krohn of Light Wave Venture LLC, a small high-tech company. In small companies, a lack of exposure to business-related knowledge can be problematic for both the company and the individual.

The View from Academia

Connecticut’s universities have begun adjusting to industry’s need for more broadly trained engineers and scientists. For example, the University of Hartford’s engineering curriculum emphasizes entrepreneurship, tech transfer and commercialization, Yale has recently started a Center for Engineering Innovation & Design (<http://ceid.yale.edu/>) and UConn has similarly launched its Entrepreneurship and Innovation Consortium (<http://news.engr.uconn.edu/announcing-uconns-new-entrepreneurship-and-innovation-consortium.php>). As with the *T*-movement at other universities, these efforts are focused on exposing undergraduate and graduate students to cross disciplines and teaming concepts vital for participation in the dynamic industrial innovation movement. It is a bit early to judge to what extent these programs are meeting the evolving needs of the state’s industries, but they are clearly a response to a changing environment, one in which skills in innovation and entrepreneurship are as critical as basic engineering skills.

Overall, it appears the Connecticut’s Innovation Ecosystem, while still a work in progress, is being attended to in a dynamic and responsive manner somewhat consistent with Phelps concepts. As such, one can have some confidence Connecticut will remain a flourishing community.— **Michael Werle, Founder and Senior Technical Advisor, Ogin, Inc., and Past President, CASE**