

Bulletin *of the*

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



Volume 32,1 / Spring 2017

Posing 'Grand Challenges': IBM Watson Health is transforming global healthcare

IBM Watson still conjures in the minds of many the robot whose artificial intelligence once analyzed questions and drew from a vast store of knowledge to defeat human trivia experts on *Jeopardy*. At IBM, Watson the television star is seen as a visionary response to just one of a series of "grand challenges" that its vibrant research organization has posed over the years. Deep Blue, the chess-playing technology that defeated world champion Garry Kasparov in 1996, was an earlier example. More recently, IBM developed the Blue Gene, a super computer that can model protein folding, and just last month the company announced that it will be tackling tax preparation in partnership with H&R Block.

"Posing grand challenges is an integral part of our culture of innovation," says CASE member Kathleen McGroddy-Goetz, vice president of IBM Watson Health. The growth and leadership of IBM Watson today, she adds, "can be traced to our commitment to continually challenge ourselves to demonstrate new advances in computing technology."

Inspired by the 2011 *Jeopardy* demonstration, experts both inside and outside of IBM began to imagine how Watson's capabilities—including its advanced natural language processing and question and answer technology—might be applied to a wide range of businesses. Since then, IBM Watson has expanded to address challenges in multiple arenas, resulting in new business units for IBM; partnerships with these divisions are focused on training Watson to provide expertise in industries ranging from banking and insurance to telecommunications, education and health care.

IBM Watson Health, located in Cambridge, MA, and established in April 2015, is the division that thrives on addressing some of the most important problems facing health care today, including exponential increases in data and the staggering costs of health care.

"With the digitization of health data, there is just a flood of information being generated daily," says McGroddy-Goetz, "So analyzing and making sense of that data, or separating the signals from the noise to create valuable

insights, is a major challenge that all stakeholders face."

She adds that about 80% of relevant health data is unstructured, and, therefore, often "invisible." This includes information about a multitude of factors that can have an impact on one's health, such as diet, physical activity, and even the weather. Unwieldy data, such as medical images, also are unstructured and difficult to merge with standard databases. IBM Watson Health designs solutions that integrate both structured and unstructured data, from sources as varied as activity trackers, medical devices, population health data, and electronic health records, to deliver real-time, actionable insights.

Health transformation requires addressing health care costs, says McGroddy-Goetz, particularly those costs that are considered to be waste.

"No one company can do that alone. It really requires people coming together and breaking down traditional silos with the goal of not only measuring but increasing the quality of health care. We're building a vast ecosystem of partners, practitioners, researchers, and patients to help accomplish those goals."

At the core of IBM Watson Health: Cognitive computing

Extracting insights from medical journals, laboratory reports, doctors' notes, clinical trials and other data to solve problems that improve the operations of leading health care systems and technology companies is possible through the extraordinary phenomenon of cognitive computing. At IBM, experts define cognitive computing as the simulation of human thought processes in a computerized model.

"Cognitive technologies," adds McGroddy-Goetz, "are able to consume vast amounts of information through self-learning systems that use pattern recognition and natural language processing to imitate the way the human brain works. The goal of cognitive computing is to create information technology systems

(See Watson, page 2)



Meet IBM's Kathleen McGroddy-Goetz

Kathleen McGroddy-Goetz will present the keynote address at the CASE Annual Meeting on May 22, 2017.

In 2012, Kathleen McGroddy-Goetz was elected to CASE in recognition of her substantial contributions to the information technology industry in a variety of areas, including computer architecture, ASIC design, application of technology to medical imaging, and intellectual property licensing. Her election acknowledged an astonishing range of expertise and intellectual achievement.

The decision to undergo rigorous academic training—including work toward a graduate degree in applied physics at Stanford and a PhD in molecular biophysics at Cornell—prior to developing such expertise came naturally to McGroddy-Goetz.

"I was lucky enough to grow up with a physicist father, who exposed me to technology at a young age," she says. "I was an early user of computers, and by the time I went to graduate school in the late 1980s, I already had a vague idea that I wanted to do something involving computers and health care."

Following a remarkably long and diverse career at IBM, in departments ranging from technology and software to product management, McGroddy-Goetz was finally able to realize ambitions she first had while still a teenager.

(See Meet, page 8)

that can enhance human capabilities by consuming vast quantities of information, learning and making connections. These systems become expert advisors that enable people to do their jobs more effectively.”

In the realm of healthcare, these systems understand and analyze complex questions posed in human language, generate hypotheses, and propose evidence-based answers that can be ranked. These capabilities have been greatly enhanced at IBM Watson Health by more than 4 billion dollars in acquisitions in recent years. The integration of assets from Phytel (patient engagement and care coordination), Explorys (cloud-based population health technologies), Merge Healthcare (medical imaging), Truven Health Analytics (data integrity and advanced analytics), and other entities has significantly deepened IBM’s pool of data and greatly increased its analytical power.

“We are aggregating one of the largest data sets including claims plus electronic medical records plus imaging data in a HIPAA-enabled cloud setting that is incredibly secure. The solution also supports GXP, which means that it meets standards and regulations that apply to a wide range of medical and life-science organizations. And with Watson services now in a public cloud, businesses can come in and leverage these technologies to build their own solutions.”

Tackling cancer

While IBM Watson Health is transforming a range of health care industries, perhaps its most stunning achievements to date have been in

the therapeutic realm of cancer. As with other successes, McGroddy-Goetz says, achievements in this field began when experts at IBM Watson Health started posing new challenges. They considered, for example, the possibility of training Watson to be an oncologist.

Early collaborations with Memorial Sloan-Kettering and MD Anderson Cancer Center provided opportunities to train Watson to become an expert—first on solid tumor cancers, and subsequently on hematologic cancers. Working closely with clinicians and analysts at both institutions, Watson’s cognitive computing system learned to deftly interpret clinical information and help identify individualized, evidence-based treatment plans for cancer patients. Both of these successful partnerships, as well those developed in recent years with more than 18 other cancer centers, have been guided by the intention of training Watson to support, not replace, the expertise of oncologists.

Watson’s work with the University of North Carolina (UNC) Lineberger Comprehensive Cancer Center in Chapel Hill has been so impressive that it was featured on an episode of 60 minutes in October 2016. In an interview with Charlie Rose, Norman Sharpless, MD, the center’s director, told the remarkable story of Watson’s encounter with his center’s molecular pathology tumor board. The board members, who meet weekly to review mutations in patient’s tumors and identify potential targeted treatment options, wanted to discover whether Watson, given access to the same information, could make similarly informed decisions.

Watson’s ability to identify biological drivers of mutations and suggest appropriate on-label and off-label treatment options, as well as available clinical trials, without the weeks of preparation required by human colleagues, so far has been uncanny. Because Watson can enhance their ability to make accurate, timely decisions for their patients, says McGroddy-Goetz, Sharpless and his colleagues have essentially offered Watson a seat on their molecular tumor board.

“We have made phenomenal progress in cancer,” she says. “We have solutions in market now that are being used globally, in countries such as India, China, and Thailand, to provide oncology expertise in places where there aren’t enough oncologists, and provide it right at the point of care. And every month we are extending our solutions by adding new cancers and leveraging the latest scientific findings.”

Collaborations in Connecticut

A number of science and health care entities in CT have played a role in the early history of IBM Watson Health, and future opportunities in the state are unlimited.

In 2015, the Yale Cancer Center was among approximately one dozen leading cancer institutes that announced their plan to collaborate with IBM Watson Health on the use of Watson Genomic Analytics, with the goal of developing personalized treatment options for cancer patients.

In 2016, IBM Watson Health formed a collaboration with the Weitzman Institute in Middletown, CT. The Weitzman Institute is the national research and innovations department of the Community Health Center, Inc. The mission of the Weitzman Institute is to transform primary healthcare with a focus on underserved populations. The goal of the IBM partnership is to train Watson Health’s ability on dermatologic imaging to support clinical decision making by front-line clinicians.

“We know it takes an ecosystem to transform health care,” says McGroddy-Goetz, “so we invite Connecticut businesses, scientists and healthcare leaders who want to learn more about IBM Watson Health to visit our website at <https://www.ibm.com/watson/health>.”

(See Watson, page 8)

The Connecticut Academy of Science and Engineering

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

OFFICERS OF THE ACADEMY

Laura Gabel, President
Wesleyan University

Baki Cetegen, Vice President/President Elect
University of Connecticut

Regis A. Matzie, Secretary
Westinghouse Electric Company (ret.)

Edmond Murphy, Treasurer
Lumentum (ret.)

EXECUTIVE DIRECTOR
Richard H. Strauss

ASSOCIATE DIRECTOR
Terri Clark

ASSISTANT DIRECTOR FOR PROGRAMS
Ann G. Bertini

EDITORS

Leon Pintsov, Executive Editor – Engineering
Pitney Bowes, Inc.

Mike Genel, Executive Editor – Medicine
Professor Emeritus of Pediatrics
Yale University School of Medicine
CASE President, 2008-2010

Amy R. Howell, Executive Editor – Science
Department of Chemistry
University of Connecticut

MANAGING EDITOR
Martha Sherman

The BULLETIN of the Connecticut Academy of Science and Engineering is published by the Connecticut Academy of Science and Engineering, Inc., 805 Brook Street, Building 4-CERC, Rocky Hill, CT 06067-3405. (860) 571-7143. acad@ctcase.org. www.ctcase.org. To subscribe, contact us by phone or email or subscribe on our web site. The Connecticut Academy of Science and Engineering is a private, nonprofit public-service organization established by Special Act No. 76-53 of the Connecticut General Assembly.

COPYING PERMITTED, WITH ATTRIBUTION

IN BRIEF

Science and Engineering Notes from Around Connecticut



Biomedical Research

NEW TECH INCUBATOR LAUNCHED IN GROTON. In November, Cromwell-based **Biological Industries USA** initiated its sponsorship of **CURE Innovation Commons**, a new science and technology incubator in Groton. The arrangement includes: training, substantial product discounts, and stem cell research grants for residents of The Commons throughout 2017. Biological Industries USA develops and manufactures cell culture media, molecular biology tools, human cytogenetics media, and stem cell research.

ZIKA RESEARCH CONSORTIUM FORMED. Farmington-based **CaroGen Corp.**, an emerging immunotherapy company, last fall announced the formation of a consortium with the **University of Connecticut** and **Yale University School of Medicine** to speed development of a Zika vaccine. The consortium includes **John Rose**, a Yale virologist and chairman and scientific advisor of CaroGen; **Paulo Verardi**, associate professor of pathology at UConn; and a team of vaccine development experts at CaroGen. The group will use CaroGen's virus-like vesicle platform technology to develop a vaccine.

NEW FEDERAL LAW INCLUDES LYME DISEASE FOCUS. On December 21, while visiting the **Western Connecticut Health Network Biomedical Research Institute** in Danbury, **US Senator Richard Blumenthal** noted passage of a new federal law, the 21st Century Cures Act, that he helped draft. The law includes provisions to support detection and prevention of Lyme disease, as well as public education efforts. "I have been involved in trying to fight Lyme Disease for decades," said Blumenthal, who explained how this disease is underdiagnosed and underreported. Even with treatment, about 10-20% of victims develop joint pain, memory problems, and tiredness for six months. Western Connecticut Health Network is conducting research into this disease and is home to the Lyme Disease Registry, a comprehensive database of patients with Lyme disease that will serve as the basis for multidisciplinary research.

CESI EXPANSION COMPLETED. In December, contractors at **Hartford Hospital** completed work on a 30,000-square-foot addition to the **Center for Education, Simulation and Innovation (CESI)** to enhance training capabilities including surgical and other medical certifications, mock training exercises, and medical device and product testing. Funded with a \$15 million state grant, the center, originally expected to open in 2014, is now due to open in March 2017. The expansion is expected to bring in additional revenue from government training contracts, rental income, philanthropic donations, and manufacturers that want their products evaluated by doctors, as well as creating new relationships with biomedical and medical device companies.



Business & Industry

CI INVESTS IN MOBILE PAYMENT PLATFORM. In December, **Connecticut Innovations (CI)** announced a \$1.5 million investment in **Dream Payments**, a financial technology company providing a cloud-based mobile payment platform for merchants and financial institutions. Dream Payments was awarded the 2016 top investment award from **VentureClash**, Connecticut's global venture challenge managed by CI.

CROWDFUNDING FOR 'SMART FALL' APP. **FallCall Solutions, LLC**, a company founded by two Connecticut physicians, **Shea Gregg** and **Kristin Gregg**, launched a crowdfunding campaign in December on Medstart.com to turn their "smart" fall detection prototype designed exclusively for Apple Watch® into a fully functional application. The app, **FallCall Now™**, was designed in collaboration with physicians and developers to provide seniors with new ways to call for help when they need it most, including manual and automated ways to alert loved-ones and central monitoring agencies as well as smart technology to distinguish between low- and high-level falls.

CT GREEN BANK MARKS FIVE YEARS AND \$1 BILLION. **Connecticut Green Bank** recently celebrated its fifth year, marking a milestone of \$1 billion in capital for clean energy projects in Connecticut. The Green Bank works with homeowners, nonprofits and commercial building owners seeking energy-efficient upgrades. Its commercial arm, known as **Commercial Property Assessed Clean Energy** or C-PACE, has arranged nearly \$100 million in loans for industrial buildings, office buildings, nonprofits and retail buildings. The **Danbury** area has played a major role in the growth of the bank with more than \$5.5 million in financing for projects.

UCONN'S ANALOU TO HEAD TECH INCUBATOR PROGRAM. **Mostafa Analoui**, professor in residence in the **Department of Biomedical Engineering at UConn Health** and a life sciences entrepreneur and investment banker, will head **UConn's Technology Incubation Program (TIP)** while continuing to serve as executive director of venture development at UConn, according to a recent announcement. He assumed this newly created position in October in an effort to successfully commercialize the promising technologies emerging from UConn's labs. There are 35 companies located at TIP's two major locations in Storrs and at UConn Health in Farmington.

EB TO ADD 800 NEW JOBS IN 2017. **Electric Boat** will hire 1,350 employees in 2017, for a net gain of 800 new jobs; the new jobs are a result of a federal spending increase for submarine building. The company said more workers are needed to build two Virginia-class submarines as well as work on the "Virginia Payload Module," a plan to lengthen the boats to add four large-diameter payload tubes, each capable of storing and launching up to seven Tomahawk cruise missiles. Electric Boat spokesman **Dan Barrett** said the new jobs will be in engineering, design, shipyard trades, and support.

NEW SYSTEM CONVERTS CO₂ TO METHANE FUEL. **Sustainable Innovations Inc. (SI)**, an East Hartford-based clean-energy developer, announced it is working on a new, trademarked system, named, **CO₂RENEW**, that converts waste CO₂ to methane fuel, the primary energy carrier in natural gas. Once converted, this fuel can be stored or transported in existing natural gas pipelines. The design uses excess, off-peak renewable power that might otherwise be wasted, and provides electric grid stabilization through energy storage.



Communication

KATZ NAMED TO FCC ADVISORY BOARD. **Governor Dannel Malloy** appointed **Elin Swanson Katz**, Consumer Counsel with the Connecticut Office of Consumer Counsel, to the **Intergovernmental Advisory Board (IAC)** that advises the Federal Communications Commission on telecommunications issues, ranging from cable franchising to broadband access. The board comprises 15 representatives of state, local and tribal governments with expertise in telecommuni-

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.

IN BRIEF

Science and Engineering Notes from Around Connecticut

cations policy. Malloy recognized Katz for her work to spur broadband investment in Connecticut, leading to more broadband infrastructure development, increased broadband speeds and measures to promote affordable access for underserved communities.



Education & Cognition

BIOLOGY TEACHER IS TEACHER OF THE YEAR. North Branford High School biology teacher **Lauren Danner** was recognized last fall as the 2017 Connecticut Teacher of the Year by **Governor Dannel Malloy** and **Commissioner of Education Dianna Wentzell**. Danner was chosen by a statewide council of former Teachers of the Year and representatives from educational organizations and businesses for her ability to inspire a love for learning in her students. Before starting her teaching career, Danner earned a Bachelor of Science in diagnostic genetic sciences from **UConn** and worked as a cytogenetic technologist at Mount Sinai Hospital and later as a cell culture technologist for **Neurogen Corporation**.

FIVE SCHOOLS AMONG FINALISTS IN STEAM CONTEST. Five Connecticut schools are among the finalists in the Samsung Solve for Tomorrow Contest, a program that encourages students to solve real-world issues using science, technology, engineering, arts and math (STEAM). The five were chosen based on proposals to solve complex issues that affect their communities. They are: **Plainville Community Schools**, for a project to improve access to Rails to Trails paths to encourage physical fitness and wellness; the **Engineering and Science University Magnet School** in Hamden, for a project to protect non-GMO fields by introducing modification to the genome of GMO corn; **David Wooster Middle School** in Stratford, for a project to create a flow sensor to prevent over indulgent water use; **Bassick High School** in Bridgeport, for improvement projects to combat urban poverty; and **Danbury High School**, for a project to educate the community about the **Still River** to protect its damaged natural resources. Three national winners will be named and honored at an awards ceremony in Washington, DC; winning schools will receive a \$150,000 technology grant as well as a \$20,000 donation to their nonprofit of choice.

STUDY EXAMINES LINKS BETWEEN EARLY BIRTH, BRAIN DEVELOPMENT. According to a recent study by **Yale School of Medicine** researchers and their colleagues at the National Institutes of Health (NIH) and Wayne State University and published in the journal *Scientific Reports*, before birth, premature babies may display alterations in the circuitry of their developing brains. The authors state 10% to 11% of American babies are born prematurely, and the factors contributing to their early birth may also impact the brain's development in the womb, resulting in neurodevelopmental disorders such as autism, attention deficit hyperactivity disorder, and cerebral palsy. The team found systems-level neural connectivity localized in left-hemisphere, pre-language regions of the brain, was weaker in fetuses subsequently born preterm.

NEW BOOK TRACES EVOLUTION OF CEREBELLUM. In a recently published book, *Evolution of the Cerebellar Sense of Self*, **David Bodznick**, professor of biology and neuroscience and behavior at **Wesleyan University**, and co-author John Montgomery, professor of biology and marine science at the University of Auckland in New Zealand, discuss the development of the cerebellum, a part of the brain that occupies 10% of brain volume, yet has approximately 69 billion neurons—80% of the nerve cells—in the brain. Early vertebrates also have an additional cerebellum-like structure in the hindbrain. According to Bodznick, “it is likely that the true cerebellum evolved from these cerebellum-like precursors and that their

adaptive filter functionality was adopted for motor control, paving the way for the athleticism and movement finesse that we see in all swimming, running, climbing and flying vertebrates.”



Energy

FUEL CELL PROJECT ON PFIZER FACILITY BEGINS OPERATION. **FuelCell Energy, Inc.**, announced the completion of construction and commercial operation of a 5.6 megawatt fuel cell project located on **Pfizer's** 160-acre research and development facility in Groton. Pfizer will purchase the power and heat generated by the fuel cells under a twenty-year power purchase agreement from a direct subsidiary of FuelCell Energy. The project was engineered, manufactured and commissioned in 2016. Pfizer benefits from on-site power, and its sustainability goals are supported through clean power generation and combined heat and power that generates usable heat along with the power.

\$30M IN MICROGRID FUNDING OKAYED. In November, the **Connecticut State Bond Commission** approved \$30 million in funding to expand the microgrid program to strengthen the state's electric grid against damaging storms. The microgrid program began in 2012, after major storms left thousands of homes and businesses without power for days. The **Connecticut Department of Energy and Environmental Protection** awarded funding for ten microgrids across the state in two previous rounds of funding. Microgrids are smaller electric networks within larger electric distribution networks. They allow connected buildings to receive power even when the larger electric distribution network experiences an outage.

WOODBIDGE GETS TOWNWIDE MICROGRID. **FuelCell Energy, Inc.**, participated in a ribbon cutting ceremony at **Amity Regional High School** in Woodbridge in January to launch a multi-megawatt fuel cell plant owned by **Avangrid** that is configured as a townwide microgrid. The fuel cell plant is generating 2.2 megawatts (MW) of continuous power and usable heat, supplying 2.2 megawatts of continuous power under normal operation and switching to microgrid mode in the event of a grid outage to provide uninterrupted and reliable power to seven of the town's critical facilities.

HIGH COURT RULES FOR STATE IN NATURAL GAS CASE. On December 29, the **Connecticut Supreme Court** ruled in a case brought by **Connecticut Energy Marketers Association**, finding that Connecticut officials did not violate state law in approving a natural gas expansion plan in 2013 without studying potential environmental impacts. The expansion plan that was approved by environmental officials and utility regulators calls for expanding natural gas service to 300,000 more homes and building 900 miles of gas mains over the next decade. **Dennis Schain**, a spokesman for the **Connecticut Department of Energy and Environmental Protection**, said officials were pleased with the ruling.

REPORT URGES PROTECTING FARMLAND, FOREST FROM SOLAR FACILITIES. The **Council on Environmental Quality (CEQ)** has published a draft report stating concerns over the surge in proposals to use farmland and forest for large solar electricity-generating facilities in Connecticut. CEQ Council Chairman **Susan Merrow** stated, “we should not be pitting solar energy against agriculture and forests.” The report suggested the state develop policies to encourage solar photovoltaic power facilities on brownfields, industrial lands, and other disturbed areas. In an average year, the state preserves about 1,700 acres of farmland and forest land. In 2016, the area of farmland and forest selected by the **Connecticut**

IN BRIEF

Science and Engineering Notes from Around Connecticut

Department of Energy and Environmental Protection and/or approved by the **Connecticut Siting Council** for development of solar facilities nearly equaled that amount.



Environment

EPA DESIGNATES DISPOSAL SITE IN SOUND. On November 4, **Governor Dannel Malloy** and **Connecticut Department of Energy and Environmental Protection Commissioner Robert Klee** released a statement regarding the US Environmental Protection Agency (EPA)'s decision to designate a disposal site for dredged material in Eastern Long Island Sound. In his statement, Malloy noted that in the absence of "beneficial reuse of dredged materials... we must maintain the option for well-managed open water disposal. The EPA's decision ensures that the practical, environmentally sound, and cost effective option of open water disposal will remain available for dredging projects in Eastern Connecticut."

FUNDS ALLOCATED FOR DREDGING, BEACH ENHANCEMENT. The **State Bond Commission** approved \$10.3 million in October for a dredging project to deepen the lower end of the **Housatonic River** and enhance one mile of **Hammonasset Beach State Park** for the 2018 summer season. The dredged channels will be an 18-foot deep, 200-foot wide channel from the mouth of the river to Culver's Bar and a 7-foot deep, 100-foot wide channel for 13 miles to Derby and Shelton. Although no federal funds were available, the project is under the guidelines of the Federal River and Harbor Act of 1930 and will be overseen by the US Army Corps of Engineers.

SALTMARSH SPARROW FACES EXTINCTION. The **Connecticut Audubon Society** recently announced that the Saltmarsh Sparrow will become extinct because of sea level rise within the next two decades. "The fact that the salt marshes are changing so rapidly, it's not just about the birds, it's also telling us something about coastal system and it's changing," said **Chris Elphick**, **UConn** professor of evolutionary biology.

TEN GROUPS TO SHARE CONSERVATION GRANTS. Ten state environmental groups will share \$92,000 in grants from the **Connecticut Community Foundation** to conserve and protect natural resources, while supporting the preservation of land, water and wildlife and increasing environmental awareness in **Greater Waterbury** and **Litchfield Hills** regions. The grants were awarded to the **Pomperaug River Watershed Coalition**; **Flanders Nature Center and Land Trust**; **Connecticut Forest & Park Association**; **Connecticut League of Conservation Voters Education Fund**; **East Litchfield Village Improvement Society**; **Friends of the Litchfield Community Greenway**; **Housatonic Valley Association**; **Northwest Conservation District**; **Quinnipiac University**; and the **Watertown Land Trust**.



Food & Agriculture

AG STATION TO SHARE IN CENTER OF EXCELLENCE. In January, the **Connecticut Agricultural Experiment Station (CAES)** announced it will receive \$3.25 million—its share of a \$10 million grant—from the Centers for Disease Control and Prevention to help form a **Northeast Regional Center of Excellence in Vector-Borne Diseases**. The new center will include CAES, Cornell University, Columbia University, Fordham University, the New York Department of Health and the **Connecticut State Department of Public Health**. CASE member **Theodore Andreadis**, director of CAES, is a co-principal investigator on the grant. The center will develop tools and methods for effective vector-borne disease prevention and control.

FEDERAL GRANTS WILL HELP REDUCE FOOD WASTE. A \$50,000 grant from the **US Department of Agriculture** and a \$25,000 grant from the **US Environmental Protection Agency** were awarded to the Massachusetts-based Center for EcoTechnology to help Connecticut businesses and institutions minimize food waste. The center will provide technical assistance to 20 businesses in 2017, diverting 600 tons of wasted food. Additionally, the grant will fund "Don't Waste Bridgeport," a project redirecting wasted food from schools, supermarkets and restaurants to charity organizations in the city.

FEDERAL GRANTS TO FUND CAES PROJECTS. The **Connecticut Department of Agriculture** announced in November that \$240,000 in federal grants from the USDA Specialty Crop Block Grant Program will be used to fund four projects undertaken by scientists at the **Connecticut Agricultural Experiment Station (CAES)**. Projects include efforts to raise disease-resistant strawberries and pumpkins, breed mite-resistant honey bees, increase habitat for specialty crop pollinators, and identify varieties of hops suitable for growing in Connecticut. Projects must produce measurable outcomes for the public and/or the specialty crop industry.



Health

FEDERAL GRANTS TO FUND SUBSTANCE ABUSE PREVENTION. The federal Substance Abuse and Mental Health Services Administration (SAMHSA) recently announced up to \$188,580 in funding for substance abuse prevention programs in Connecticut. Up to four grantees will receive up to \$47,156 each year for up to four years for programs to help prevent and reduce alcohol use among youth ages 12 to 20 under the STOP Act (Sober Truth on Preventing Underage Drinking Act) grants.

OPIOID OVERDOSES CONTRIBUTE TO RISE IN PREVENTABLE DEATHS. A new report by the Centers for Disease Control and Prevention noted that preventable deaths from accidental injuries in Connecticut increased 97% from 2010 to 2014, the sixth-highest increase nationally after Maryland, Massachusetts, New Jersey, New York and Virginia. "The 97% increase ... is disappointing, and from our own data, the drug intoxication deaths are certainly a big part of it," said **Connecticut Chief Medical Examiner James Gill**. Potentially preventable deaths from heart disease fell 51.6% in Connecticut, significantly more than the national average decrease of 4%. Preventable deaths from cancer declined by 87%. Avoidable deaths from stroke also decreased, and preventable deaths from chronic lower respiratory disease increased slightly.

STUDY FINDS 'VERY HIGH PREVALENCE' OF CORROSIVE GROUNDWATER. **Connecticut** is one of 11 states with a very high prevalence of potentially corrosive groundwater, increasing the risk of lead contamination from homes with private wells, according to a study released in December. The study, conducted by the US Geological Survey, was based on nearly three decades of data from more than 20,000 public and private wells nationwide. It found that between 75.3% and 84.9% of wells in Connecticut could contain corrosive groundwater. See Publication No. 24 on the **Connecticut Department of Public Health's** website (www.ct.gov/dph/) for guidance on testing private wells.

STATE OKAYS MEDICAL MARIJUANA PROGRAM. **St. Francis Hospital and Medical Center** recently announced state approval of a first-of-its-kind program to gauge the effectiveness of medical marijuana as a painkiller for traumatic injuries such as broken ribs. The program's goal is to develop medical marijuana as a safer alter-

IN BRIEF

Science and Engineering Notes from Around Connecticut

native to the highly addictive painkillers that often lead to opioid addiction.



High Technology

CT RANKED 6TH IN TECH & SCIENCE INDEX. Based on data from the State Technology and Science Index (STSI), **Connecticut** ranks sixth for 2016—the highest ranking in more than a decade. The STSI evaluates states on science and technology capabilities and broader commercialization ecosystems that contribute to company growth, job creation, and overall economic growth. The top five states in 2016 were Massachusetts, Colorado, Maryland, California and Washington. In the Technology and Science Workforce composite index, Connecticut ranked 10th, showing an improvement from 16th in 2014, 13th in 2012 and 14th in 2010.

CCAT HONORED FOR ENVIRONMENTAL SUSTAINABILITY. The **University of Connecticut Environmental Policy Advisory Council** has named the **Connecticut Center for Advanced Technology Inc.** (CCAT) as an Environmental Partner Finalist for 2013-2016. The award honors CCAT's dedication and contribution to environmental sustainability at UConn. A Preliminary Feasibility Study and Strategic Deployment Plan for Renewable & Sustainable Energy Projects at the UConn campus in Storrs identified and assessed target locations for twelve demonstration-scale renewable and sustainable energy projects: including solar thermal, solar photovoltaic, wind, fuel cells, geothermal, and biofuels.

STUDENT DEVELOPS IMPLANTABLE BIOELECTRONIC DEVICE. **Islam Mosa**, a PhD student working with CASE member **James Rusling** and **Challa Kumar**, professors in the **Department of Chemistry** in the **College of Liberal Arts and Sciences at UConn**, has developed an implantable electronic device that draws power from a supercapacitor thinner than a human hair. In lab tests, the device has also been shown to be non-toxic to living cells as it uses the patient's blood serum as an electrolyte, rather than being powered from a potentially toxic lithium-ion battery. The power system's efficiency allows it to maintain a charge for a long period of time, making it suitable for bioelectronic devices such as implantable neurostimulators, used to treat some patients with Parkinson's disease.

CT RANKS AMONG TOP 10 IN HIGH-TECH. The Information Technology and Innovation Foundation (ITIF) recently released a study ranking Connecticut among the top 10 states in indicators of "innovation-driven" high-tech economy. Connecticut ranked sixth in patent filers per 1,000 workers and seventh in the amount of public funding given businesses for research and development. "The myopic view, that the high-tech economy is only Silicon Valley and a few other bright spots like Boston or North Carolina's Research Triangle, is flat wrong," said ITIF President Robert D. Atkinson.

NEW DEVICE WILL MONITOR ATRIAL FIBRILLATION. CASE member and **UConn** biomedical engineering professor **Ki Chon** and his research team are working to create a small armband worn throughout the day, without wired connection. The device will monitor atrial fibrillation without disrupting a person's everyday activities. Additionally, they are working to create a smartphone app to receive data from the sensors using Bluetooth connections.

CT STARTUP FOCUSES ON QUANTUM COMPUTERS. **Yale** physicist and CASE member **Robert Schoelkopf** co-founded the startup **Quantum Circuits**, a firm dedicated to building quantum computers, along with former IBM applied physicist **Chad Rigetti**. Classical computers encode information as bits that exist in one of two states,

0 or 1; the "qubits" that comprise quantum computers can be in "superpositions" of both at once. This, together with qubits' ability to share a quantum state called entanglement, should enable computers to perform multiple calculations at once, leading to an exponential speed-up. Quantum Circuits is focused on making fully error-corrected machines with more qubits, but able to run sophisticated quantum algorithms.

HEALTH TECHNOLOGY FIRM GETS \$500K GRANT. **Mobile Sense Technologies, Inc.**, a Darien-based wearable health technology company, will receive a \$500,000 grant through **Connecticut Innovations**. The company is developing the first clinical grade, off-the-chest continuous electrocardiogram. The automatic monitoring provides 24/7, 365 days/year continuous detection and reporting of heart arrhythmias directly to the patient and to their doctor.



Transportation

REPORT URGES AIRPORT REMAIN OPEN. In December, the **Legislative Program Review and Investigations Committee** recommended that **Hartford-Brainard Airport** remain open despite statements by some state and local officials that the airport could be redeveloped as a mixed-use site to generate more property taxes for the city. Closure and reconstruction would require "significant public funds," and the report found that the site's highest economic value is likely its current use as an airport.

CTDOT RELEASES 5-YEAR CAPITAL PLAN. The **Connecticut Department of Transportation** (CTDOT) released its \$10.9 billion, five-year capital plan for fiscal years 2017-2021 that includes highways, bridges, public transportation, and bicycle and pedestrian needs. For federal fiscal year 2017, which began Oct. 1, CTDOT plans to spend \$2.2 billion with roughly \$1.3 billion for highway and bridge infrastructure projects and about \$900 million for bus and rail projects. The agency plans to bid 87 projects at a \$570 million in contract value. This is fewer projects compared to 105 in 2016, but at a lesser contract value of \$475 million.

ROUTE 1 REMAINS DEADLY FOR WALKERS. According to a recent report by the **Connecticut Transportation Safety Research Center**, for the eighth year in a row, Route 1 in Connecticut has been named the state's deadliest road for walking. According to the **Orange Assistant Police Chief Anthony Cuozzo**, distracted driving is a top concern as well as access to sidewalks and walkers choosing to cross busy roads at places other than crosswalks.

CARTUS ADDS CHARGING STATIONS. **Cartus Corporation**, Danbury's second largest employer, recently added car charging stations to its Danbury headquarters. Cartus, a leader in corporate relocation services, is a member of the Carbon Disclosure Project (CDP) and the United Nations Global Compact (UNGC) and is now the seventh organization in Connecticut to register for the Department of Energy's (DOE) Workplace Charging Challenge.

SHORE LINE EAST GETS NEW PLATFORM. A new platform opened last fall at the **Branford** railroad station for the **Shore Line East** commuter line. The new platform is on the station's north-bound side with an "up and over" pedestrian walkway, along with elevators and stairs. A new Train Approach Messaging System was also installed. The station includes a bicycle parking area, a new canopy shelter, and parking for approximately 375 vehicles.

—Compiled and edited by Wendy Swift

From the National Academies

Excerpted from press releases and other news reports from the National Academies of Sciences, Engineering and Medicine (www.national-academies.org).

◆ Human Gene Editing: Science, Ethics, & Governance

This report, from the National Academy of Sciences and the National Academy of Medicine, reviews the burgeoning scientific developments permitting more precise editing of the human genome, in particular CRISPR-Cas 9, and stresses the critical need for public education and engagement as well as seven general principles for governance of human genome editing. Critically, the report differentiates between use of the technology to provide somatic cell editing in individuals with serious disorders such as Huntington's Disease, thalassemia, cystic fibrosis and sickle cell disease and use for enhancement and use of the technology in germ line editing, for which it provides rigorous criteria for permitting clinical trials.

<https://www.nap.edu/catalog/24623/>

◆ New Report Examines Role of Engineering Technology

A new report from the National Academy of Engineering finds little awareness of engineering technology (ET) as a field of study or a category of employment in the United States, even though workers in the field play an important role in supporting US technical infrastructure and the country's capacity for innovation.

<https://www.nap.edu/catalog/23402>

◆ Federal Statistics: Combining Data Sources While Protecting Privacy

Federal government statistics provide critical information to the country and serve a key role in a democracy. For decades, sample surveys with instruments carefully designed for particular data needs have been one of the primary methods for collecting data for federal statistics. However, the costs of conducting such surveys have been increasing while response rates have been declining, and many surveys are not able to fulfill growing demands for more timely information and for more detailed information at state and local levels. A new report from the National Academies of Sciences, Engineering, and Medicine examines the opportunities and risks of using government administrative and private sector data sources to foster a paradigm shift in federal statistical programs that would combine diverse data sources in a secure manner to enhance federal statistics.

<https://www.nap.edu/catalog/24652/>

◆ Undergraduate Research Access for STEM Students

There are many ongoing efforts to improve undergraduate science, technology, engineering, and mathematics (STEM) education that focus on increasing the active engagement of students and decreasing traditional lecture-based teaching, and undergraduate research experiences (UREs) have been proposed as a solution to these efforts and may be a key strategy for broadening STEM participation. A new report from the National Academies of Sciences, Engineering, and Medicine examines the evidence on UREs and recommends more well-designed research to gain a deeper understanding of both how these experiences affect different students, and which aspects of UREs are most beneficial to students.

<https://www.nap.edu/catalog/24622/>

◆ New Report Details Accomplishments of US Global Change Research Program

The US Global Change Research Program (USGCRP) has made significant accomplishments to advance the science of global environmental change and improve the understanding of its impact on society through activities such as developing Earth-observing systems, improving Earth-system modeling capabilities, and advancing understanding of carbon-cycle processes, says a new report from the National Academies of Sciences, Engineering, and Medicine. Going forward, the program should continue to build its knowledge base for informing decision makers and the public about rising global challenges, the report recommends.

<https://www.nap.edu/catalog/24670/>

◆ Calculating the Social Cost of Carbon Dioxide

A new report from the National Academies of Sciences, Engineering, and Medicine recommends that the federal government use a new framework to estimate the social cost of carbon dioxide—an estimate, in dollars, of the net damages incurred by society from a 1 metric ton increase in carbon dioxide emissions in a given year—for use in regulatory impact analyses. The new framework would strengthen the scientific basis for such estimates, provide greater transparency, and improve characterization of the uncertainties of the estimates.

<https://www.nap.edu/catalog/24651/>

The Connecticut River Museum: Discover New England's Great River

The Connecticut River stretches from northern New Hampshire to Long Island Sound. The Connecticut River Valley reflects the geography of New England with northern mountains, a central floodplain and coastal tidal marshes. The Connecticut River Museum (CRM), located on the waterfront in historic Essex Village, is dedicated to the study, preservation and celebration of the natural and cultural heritage of the river and its valley. CRM works to connect people to New England's great river through exhibits, programs, and on-water experiences.

The programs and exhibits reflect the ever-changing nature of the river itself. In the winter, CRM celebrates the bald eagle and other wintering wildlife of the lower River Valley. The museum's "Eagles of Essex" exhibit tells the comeback story of the eagles, and winter wildlife and eagle boat tours get visitors out on the water. Bring your binoculars and camera! During warmer weather, visitors can rent a canoe or kayak and paddle the quiet coves of Essex. Museum education staff lead guided paddles and hikes, exploring tributaries and forested areas along the River Valley. The museum also partners with historic sailing vessels to offer daily excursions.

CRM's school workshops reach thousands of students in grades K-12 from across the state, offering them the chance to explore the challenges of pollution and conservation, learn about the river's ecosystem, enjoy a boat trip, collect and analyze microorganisms, and learn about water monitoring processes. CRM is lucky to have a small scholarship fund which allows schools in need to participate at reduced cost. Many of the students who attend programs have never been on a boat before and enjoy the opportunity to get out on the water, help to sail the vessel, and explore the environment.

Summer Adventure Camps offer children ages 6–12 the chance for week-long sessions exploring the history and environment of the river. Weekly day camp themes include Colonial Survival Camp, Life at Sea, River Explorers and River Rangers.

This year, CRM's featured exhibit is "Connecticut's Founding Fish." The exhibition will explore the fishing history, environmental legacy, and biology of the shad. Programs and activities related to the exhibit will happen as well. For more information about the museum, please visit ctrivermuseum.org.

Visit our web site at www.ctcase.org

Watson *(from page 2)*

What's Ahead?

A growing number of healthcare solutions already in the works at IBM Watson Health feature an emphasis on more personalized healthcare. In partnership with Medtronic, for example, Watson's cognitive computing capabilities are being used to personalize solutions related to diabetes management.

"Diabetes is a very data-driven disease," explains McGroddy-Goetz, "And it's also a disease that can be incredibly stressful to manage. People with diabetes must pay careful attention to what they are eating, to how much they are exercising and sleeping, and so forth. And of course, careful monitoring of their medication is critical."

Using more than 125 million days of aggregate data generated from Medtronic devices such as insulin pumps and glucose monitors, researchers at IBM Watson Health have been able to detect patterns that can be used to modify patient behavior and improve individual outcomes. In an early study, for example, they found that they were able to predict hypoglycemic episodes 3 to 4 hours in advance, based on patterns gleaned from retrospective data. Such findings have led to the development of a cognitive computing app called Sugar.IQ, which will function as a personal assistant or coach for people with diabetes.

In partnership with Mayo Clinic, IBM Watson Health also is developing personalized clinical trial matching solutions. Using a system called Watson for Clinical Trial Matching, this partnership is working toward using a patient's individual attributes to quickly and accurately identify trials for which that patient might be eligible. The cognitive computing tool under development is already able to show clinicians how and why inclusion and exclusion criteria for a given patient matched a given trial, and indicate modifiable factors that could potentially increase a patient's eligibility for a trial.

"As we continue to grow, we will refine many of our current projects," says McGroddy-Goetz. "For example, we are now taking a closer look at drug resistance in cancer. We also will continue to explore new therapeutic areas. Billions of dollars have been poured into R&D in an effort to combat Alzheimer's disease, for example, and we are not making progress. We need to examine the data that we are generating and build solutions that will alleviate the suffering of patients and the incredible toll this disease takes on family members and care givers. That is where I would like to see us go in the next few years." — **Susan L. Worley, freelance science and medicine writer (sworley12@outlook.com)**

Meet *(from page 1)*

"It wasn't until 2014, with the decision to launch IBM Watson Health, that I realized all of the skills and different interests and facets of my life were coming together. I feel very fortunate to be in the right place at the right time in my career."

During her keynote address at the CASE Annual Meeting and Dinner in May, McGroddy-Goetz expects to share stories that will illustrate the value of cognitive computing in health care. She'll likely recount, for example, a personal story of a family member who faced a cancer diagnosis in the pre-Watson era. Unlike most people, he was lucky enough to have access to [scientist friends] who could evaluate treatment protocols and help him make the best decisions regarding his treatments.

"Back then I remember thinking it seemed unfair that this kind of assistance was not available to everyone. Now, here we are in 2017, and with our clinical trials matching solution, we can indeed offer that level of assistance to just about everyone. I think that's tremendous." — **Susan L. Worley**