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CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



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Quantum Computing: Faster Solutions to Previously Impossible Calculations, Cybersecurity Advances and More

If recent articles in *PC World*, *Forbes*, *The Wall Street Journal*, *Nature*, *The Economist* and *The New Yorker*, among others, are any indication, there is widespread interest in quantum computing (or quantum information science). What is it? Why the broad-based interest? What is going on in Connecticut?

“These systems will revolutionize the concept of computation.”

“Quantum computing is an interdisciplinary field that applies quantum mechanics theory to information processing, storage and dissemination,” said CASE member Steven Girvin, a theoretical physicist and Eugene Higgins Professor of Physics at Yale University in New Haven and a member of the research team at Yale’s Quantum Institute.

Traditional computers store data in bits, which can have a value of either 0 or 1 at any given time. “Quantum computers, based on quantum mechanics theory introduced in the 1920s, store information in quantum bits (or qubits), which can take on values of 0 and 1 simultaneously,” Girvin said. “As a result, quantum computers can do exponentially many calculations at the same time, leading to not only quicker results, but also providing new capability to solve complex problems that are impossible to calculate on today’s computers.”

Yale’s Quantum Institute is home to one of the largest multidisciplinary teams in the world. The team includes about 50 experimentalists and theoreticians who are experts in physics, electrical engineering, mathematics, and computer science. “We are doing some amazing things as we work together to create advanced technologies and hardware that will be incorporated in full-scale quantum computing systems,” Girvin said. “These systems will revolutionize the concept of computation.”

(See Quantum Computing, page 2)

Children’s Museum of Southeastern Connecticut: Where discoveries are made and fun just happens!

The Children’s Museum of Southeastern Connecticut (SECT) is a hands-on, interactive, educational place for children ages 9 and under to let their imaginations soar!

Located on Main Street in scenic Niantic, the Children’s Museum of SECT is excited to be celebrating its 25th Anniversary this year.

(See Children’s Museum, page 8)



Making discoveries — and having fun! [Photo: Children’s Museum of Southeastern Connecticut]

From the National Academies

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

◆ **Strengthening the Disaster Resilience of the Nation’s Academic Biomedical Research Community**

Recent disasters, from hurricanes to cyber-attacks, and their consequences have shown that the US academic biomedical research community can be affected by such events and that the investments of the federal government and of the many other entities that sponsor academic research are not uniformly secure. Events that damage biomedical laboratories and the institutions that house them can have impacts on the safety and well-being of humans and research animals. Disasters can affect career trajectories, scientific progress, and financial stability at the individual and institutional levels.

Strengthening the Disaster Resilience of the Academic Biomedical Research Community, a Consensus Study from The National Academies released this August, offers recommendations and guidance to enhance the disaster resilience of the academic biomedical research community, including steps that institutions, researchers and funding agencies should take. These include (1) designating a qualified, senior individual with oversight responsibility; (2) aligning disaster resilience planning at academic health centers with planning at the local, state and national levels; (3) ensuring preservation of research data, samples and reagents; (4) implementing mandatory disaster training; (5) improving disaster resilience of animal research programs; and (6) convening stakeholders by NIH to guide and support above efforts by the research community.

<https://www.nap.edu/catalog/24827/>

(See NAS, page 7)

Experts agree that a small quantum computer of 30 qubits will be so powerful that its operation cannot be simulated on a today's conventional supercomputers. Technology developed at Yale is being used in development programs at large commercial and private enterprises all over the world, including those at Google and IBM.

Since the 1980s, experts around the world have been working to apply the basic tenets of quantum mechanics to computing. "The main questions have been what technologies and hardware would be needed to build a quantum computer," Girvin said. "Most of those questions have been answered and small-scale research models have been built. The technology is currently in the pre-industrial (startup) stage, and people around the world are working toward building a full-scale system."

What advantages does quantum computing offer?

With the advantage qubits offer comes a significant (and related) challenge. "We will never have perfect qubits because it is difficult to keep them in their desired state for sustained periods of time," Girvin said.

The Yale team working on this issue includes Michel Devoret, the F.W. Beinecke Professor of Applied Physics, and CASE member Robert Schoelkopf, Sterling Professor of Applied Physics and Physics and director of Yale's Quantum Institute, two of the

inventors of superconducting qubits. Since 1998, when the first superconducting qubit was created, the team has successfully expanded the lifetime of qubits, achieving increases of six orders of magnitude. "In the last 15 years, our team has repeatedly held and broken the world record for qubit lifetime," Girvin said. "We sometimes refer to the growth of coherence time by 10x every three years as 'Schoelkopf's Law'."

Even with great increases in coherence times, errors still fundamentally limit the calculations. "We are exploring the physics of quantum error correction, a crucial process needed to build a universal quantum computer," Devoret said.

In 2016, the Yale team developed the first-ever true error correction engine.

"Solving issues like these will make it possible to get nearly perfect operation out of a computer that is built with imperfect parts," Girvin said.

While it is difficult to get a precise dollar value for total US investment in quantum computing and its development, Girvin estimated that in US dollar equivalents, the European Union is investing about \$1 billion in quantum computing and China is investing \$5 billion. "Big companies like Intel, Grumman, Microsoft and Google are investing piles of money in quantum information processing," he said. "There are also start-up companies in which venture capitalists are partnering to place bets on this technology."

One of those start-up companies is Quantum Circuits, Inc. (QCI), founded in 2015 by Devoret and Schoelkopf, along with their Yale colleague Luigi Frunzio, senior research scientist in Applied Physics. QCI is a private venture designed to develop, manufacture and sell the first practical and useful quantum computers based on superconducting devices. According to its website, QCI plans to commercialize the components, devices and software that will accelerate basic research and enable the scaling of quantum computing.

While efforts continue at QCI and Yale, as well as other institutions worldwide, to address complex physics and engineering challenges, the main development framework is clearly in place. "We have demonstrated all the components and all the functions we need," said Schoelkopf. "The next step is getting the technology to the marketplace."

Research prototypes of 20-30 qubits exist and work continues to scale them up in size. Earlier this year, IBM announced the first cloud quantum computing system for commercial use, but experts differ about the timeline for the development of a market-ready quantum computer. According to Girvin, in much the same way that the mainframe was the first usable version of the traditional computer to gain widespread use, the first marketable quantum computers will likely be large, expensive and designed to tackle complex problems. In April, *Newsweek* reported that a company called D-Wave Systems "already sells 2,000-qubit systems, but its systems are different from IBM's and other forms of universal quantum computers so many experts don't consider their development to have reached that quantum finish line. D-Wave Systems's computers are a type of quantum computer called quantum annealers, and they are limited because they can be used only on optimization problems." (*Newsweek*, 4/9/17)

"Some people say market-ready quantum computers already exist (at D-Wave Systems), some people say it will take ten years," Devoret said. "Most of us living now will see it in our lifetime."

(See Quantum Computing, 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."

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Science and Engineering Notes from Around Connecticut



Biomedical Research

STUDY EXAMINES LINK BETWEEN BIOMARKERS, OUTCOMES.

A recent study by **Yale School of Medicine's Behnood Bikdeli** and his colleagues, including CASE member **Harlan M. Krumholz**, and published in *JAMA*, found discrepancies between biomarkers and clinical outcomes in cardiovascular medical research. Their findings suggest surrogate endpoints (biomarkers), regularly used in clinical research to test new drugs, should not be trusted as the ultimate measure to approve new health interventions in cardiovascular medicine. Published surrogate endpoint trials frequently demonstrated high effectiveness of tested drugs; however, less than one third had published clinical outcomes trials of the drug for the same purpose. When there was a subsequent clinical outcomes trial, approximately half failed to validate the positive impact of the drug on the biomarker.

LYME DISEASE BIOBANK EXPANDS. In May, the **Western Connecticut Health Network (WCHN) Lyme Disease Biobank** announced it was expanding its research by adding urine samples from patients with the tick-borne disease in addition to blood samples. It is the only known hospital-based Lyme disease biobank in the nation. Urine-based tests are potentially reliable for showing active infection, and as a result, WCHN is collecting urine samples of Lyme disease patients that will only be shared with specific researchers. In addition, WCHN researchers are developing a blood-based test examining the DNA of Lyme disease-causing bacteria, possibly allowing for earlier detection of the disease.

CROMWELL FIRM PARTNERS WITH NONPROFIT STEM CELL INSTITUTE. In May, it was announced that Cromwell-based **Biological Industries USA** is partnering with Pathways to Stem Cell Science, a California-based nonprofit, to provide hands-on experience in culturing human pluripotent stem cells for early career scientists ranging from high school to college-level students. Biological Industries specializes in stem cell research, cellular reprogramming and regenerative medicine. Pathways to Stem Cell Science programs provide classroom and laboratory-based courses in molecular cell biology, stem cell biology, and regenerative medicine to help students gain a competitive edge in the industry.



Business & Industry

HEROES OF CHEMISTRY NAMED. In May, the American Chemical Society named teams of industrial chemical scientists from six companies including: **Bristol-Myers Squibb**, Corning, Dow Chemical, DuPont Crop Protection, Genentech, and Merck as Heroes of Chemistry. The Bristol-Myers Squibb team is being honored for its development of direct acting antiviral agents, Daklinza (daclatasvir) and Sunvepra (asunaprevir), which have produced hepatitis C cure rates of greater than 95%. CASE member and Squibb scientist **Nicholas Meanwell** is among the Heroes of Chemistry. The Heroes program honors industrial chemical scientists whose work has produced commercially successful products for the benefit of humankind.

ARKANSAS FIRM TO BUILD IN WINDSOR. In May, Governor **Dannel Malloy** announced a new 90,000-square-foot manufacturing facility in **Windsor** for SCA Pharmaceuticals of Little Rock,

Arkansas. The company, led by CEO Gene Graves, makes sterile pharmaceuticals for hospital pharmacies and health care facilities, specializing in sterile admixture services and pre-filled oral syringes. **Connecticut's Department of Economic and Community Development** will support the project with an \$8.5 million loan for leasehold improvements and the purchase of machinery and equipment, once funding is approved by the state bond commission.

EVERSOURCE TO BUY AQUARION. In June, Eversource Energy announced plans to acquire Bridgeport-based **Aquarion Water Co.** for nearly \$1.7 billion. Contingent on approvals from public utility agencies in the three states where they operate, Eversource expects to finalize the acquisition by the start of 2018. Although not common, there have been other instances of electric companies buying water companies in the United States.

ENTRY-LEVEL ENERGY JOBS ON THE RISE. According to the **Connecticut Business and Industry Association's 2017 Survey of Connecticut Energy & Energy Efficiency Workforce Needs**, demand for energy-related jobs in Connecticut is rising. However, business leaders in this sector are struggling to fill entry-level positions due to a lack of qualified candidates. Fifty-seven percent reported difficulty finding qualified entry-level workers for HVAC and plumbing jobs, with 73% citing lack of required technical skills and certifications among the biggest obstacles. The survey reported that Connecticut is home to 63,000 jobs in the energy industry at 5,600 businesses.

ARMY INKS DEAL FOR 257 BLACK HAWKS. In July, the US Army ordered 257 H-60 Black Hawk helicopters from **Sikorsky Aircraft** in a five-year deal valued at \$3.8 billion, marking the ninth time the United States has entered into a multi-year agreement for Sikorsky's H-60 aircraft. Deliveries of the Black Hawk helicopters are scheduled to begin in October and continue through 2022.



Communication

TECH CENTER OPENS IN MIDDLETOWN. **Middletown's Community Health Center, Inc.**, (CHC) opened the **Knowledge and Technology Center** in Middletown on May 1, the 45th anniversary of the organization's founding. The center is located in a 30,000-square-foot building that will house information technology, telehealth, communications, human resources and other support functions for CHC's statewide primary care network. It will also provide space for the **Weitzman Institute**, a community-based research center located in Middletown, for research and workforce development initiatives.

PULSAR360 ADDS FOURTH DATA CENTER. In June, Pulsar360, Inc., announced the addition of their fourth regional data center at **ChimeNet** in Wallingford. Last year, Pulsar360 partnered with Windsor-based **Genie Innovations, Inc.**, to be the service provider for the **Connecticut Capitol Region Council of Governments (CRCOG)** and the **Connecticut Center for Advanced Technology, Inc.** ChimeNet, an affiliate of the **Connecticut Hospital Association**, is a private data network provider offering information technology for businesses. Pulsar360 is a telecommunication provider that specializing cloud PBX and premise based systems, disaster recovery and carrier services.

OLD LYME FIRM WINS COMMUNICATIONS AWARD. In June, **Simpson Healthcare** in Old Lyme won "Best Scientific

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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Communications Agency-CT" at the 2017 Business Excellence Awards, presented by Acquisition International Magazine. Simpson Healthcare is a biopharmaceutical marketing and communications agency, founded in 1998. Acquisition International featured Simpson Healthcare in their Winners Supplement for the 2017 Business Excellence Awards.

FRONTIER UPGRADES FIBER-OPTIC INFRASTRUCTURE.

Frontier Communications Corporation announced in August that it will use Coriant, a supplier of packet optical, IP, and SDN solutions and web-scale Internet operators, to upgrade its fiber-optic transport infrastructure across Connecticut. This allows Frontier to enhance broadband services for residential, business, and wholesale customers while improving network scalability, functionality, and efficiency. The statewide network upgrade is scheduled for completion in the second half of 2017.



Education & Cognition

WALLINGFORD LIBRARY HOSTS SPACE STATION CALL. On July 6, students at the **Wallingford Public Library** in Wallingford spoke with NASA astronauts living and working aboard the International Space Station. The 20-minute, Earth-to-space call aired live on NASA Television's Media Channel and the agency's website. Expedition 52 Flight Engineers Peggy Whitson and Jack Fischer answered questions from students ages 5 and up. Whitson launched to the space station in November 2016, and Fischer was launched to the station in April. Both astronauts are scheduled to return to Earth in September.

DANBURY STEM EDUCATOR HONORED. **Harry Rosvally**, the head of STEM curriculum for the **Danbury Public Schools**, was named this year's recipient of the **Connecticut Science Educator Fellow Award** from the **Connecticut Science Teachers Association**. An educator for more than 25 years, Rosvally oversees Danbury's math and science curriculum programs. He also manages several grants offering opportunities for student growth and teacher professional development.

UCONN, MYSTIC AQUARIUM SIGN PARTNERSHIP. In July, the **UConn** and **Mystic Aquarium** announced a five-year research agreement, allowing Mystic Aquarium's researchers to use laboratory and office space inside the **UConn Department of Marine Sciences**, located at the Avery Point campus on the Long Island Sound. The partnership is intended to provide teaching and learning opportunities to both institutions studying ocean health, biodiversity and the sustainable use of aquatic resources, bringing together some of the best marine scientists in the world to collaborate on projects.

AUTISM STUDY FINDS GAINS, URGES MORE RESEARCH.

Recent research by CASE member **Fred R. Volkmar**, professor at the **Child Study Center, Yale University School of Medicine**, and published in a July report in *Pediatric Annals*, indicates that, although significant gains in resources have helped children diagnosed with autism spectrum disorder, "the overall adult outcome continues to reflect a highly variable and generally poor prognosis." More research is needed in work on anxiety and depression, particularly the use of psychotropic medications; psychosis, especially in the area of associating ASD with schizophrenia or bipolar disorder; bullying, particularly the design of social skills training for these patients; substance abuse, especially on treatment strategies; and postsecondary education, specifically in providing resources to prepare students for this time of their life.



Energy

CT FIRM INVESTS IN OFFSHORE WIND DEVELOPER. In May, **Avangrid Renewables**, a subsidiary of New Haven-based parent **Avangrid Inc.**, acquired 50% ownership interest in Vineyard Wind, an offshore wind energy developer in Massachusetts. Avangrid Inc. is a subsidiary of Iberdrola USA, which merged in 2015 with UIL Holdings Corp. In 2016, Massachusetts required utilities to procure 1,600 megawatts (MW) of clean, offshore wind energy within the next decade. When the 1,600 MW of generation capacity are completed, they will generate enough energy to power the equivalent of more than 750,000 Massachusetts homes every year.

DEEP STUDY EXAMINES ENERGY USE. In July, the **Connecticut Department of Energy and Environmental Protection (DEEP)** released a study reviewing how Connecticut consumes energy and ways to reduce costs. According to the report, rates started to drop between 2009 and 2013, in part because of lower natural gas prices, but started climbing to its peak current status. In response, DEEP wants to invest more in solar and wind. The agency suggests moving towards a community-based grid scale program, rather than a behind-the-meter, or individual, program, and using landfills and farms to offer solar on a competitive market, similar to today's public utilities.

MALLOY CALLS FOR MILLSTONE REVIEW. This summer, Governor **Dannel Malloy** signed Executive Order No. 59 directing the **Connecticut Department of Energy and Environmental Protection** and the **Public Utilities Regulatory Authority** to jointly conduct a resource assessment of the current and projected economic vitality of the **Millstone Power Station** in Waterford; the role of existing nuclear generating facilities, as well as large scale hydropower, in helping Connecticut meet interim and long-term carbon and other emissions targets at the least cost and most benefit to Connecticut ratepayers; the best mechanisms to ensure continued progress towards targets; and the compatibility of such mechanisms with competitive wholesale and retail electricity markets. The findings of the resource assessment are to be reported to the governor, leadership of the **General Assembly's Energy and Technology Committee**, and the **Governor's Council on Climate Change** by February 2018.

CT GREEN BANK PASSES \$100M IN FINANCING. In July, it was announced that the **Farmington Sports Arena**, a 130,000-square-foot, indoor sports facility, brought the **Connecticut Green Bank** over its \$100 million mark in terms of closed financing for energy efficiency and renewable energy projects. The project involves installation of two solar photovoltaic systems that will generate 170 kilowatts of electricity. The solar power generation systems are being installed by 64 Solar, a New York-based company.



Environment

STUDY SHOWS RISK OF ELEVATED ARSENIC AND URANIUM IN CT WELLS. A report published May 3 by the US Geological Survey, in cooperation with the **Connecticut Department of Public Health (DPH)**, reveals that water from some private Connecticut wells registered high levels of arsenic and uranium. Water samples were taken and analyzed from 674 private wells with lab results indicating that 7% of private well samples tested for arsenic or uranium at levels higher than maximum contaminant levels, which are regulated in public water supplies and newly constructed private wells under Connecticut law.

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CT SUES EPA OVER POLLUTION DRIFT. In May, a lawsuit was filed in federal court charging that the US Environmental Protection Agency failed in its duty to stop Pennsylvania air pollution from harming the air quality in **Connecticut**. Last year, state officials sent a petition demanding action be taken to stop pollution from three coal-burning electrical power plants in Pennsylvania's York County from drifting into Connecticut. According to **Robert Klee**, head of the **Connecticut Department of Energy and Environmental Protection**, Pennsylvania's Brunner Island Steam Electric Station is contributing to Connecticut's serious ozone air pollution problems. State Attorney General **George Jepsen** said, "This pollution significantly contributes to the non-attainment of the [2008 ozone pollution standards] in Connecticut, to the detriment of the health and welfare of everyone in our state."

HARTFORD BEGINS TUNNEL TO CAPTURE POLLUTED WATER. In July, the **Metropolitan District of Hartford** (MDC) began building a 4.1-mile-long tunnel 200 feet below **Hartford** to prevent millions of gallons of polluted storm waters and untreated sewage from being flushed into the **Connecticut River** and the Long Island Sound. The tunnel will capture and hold up to 41.5 million gallons of polluted water until it can be cleaned at the MDC's sewage treatment plant. The long-term plan requires spending \$2.4 billion to improve the Hartford area's sewers and treatment systems, using a combination of state grants and funding from MDC ratepayers.

WEST NILE VIRUS FOUND THROUGHOUT THE STATE. According to researchers at **The Connecticut Agricultural Experiment Station**, mosquitoes trapped in 20 towns in Connecticut have tested positive for West Nile virus thus far this summer. "We continue to see increases in the number of mosquitoes carrying West Nile virus with expansion throughout the state. Historically, August and September are the months when the majority of human cases occur and represent the greatest risk for acquiring West Nile virus infection," said CASE member **Theodore Andreadis**, director of the Station. One hundred thirty-one human cases of West Nile virus illness, including three fatalities, have been diagnosed in Connecticut residents since 2000.

ECOLOGIST HONORED FOR ECOSYSTEM RESEARCH. In June, the BBVA Foundation Frontiers of Knowledge Awards honored **UConn** ecologist and CASE member **Gene E. Likens**, Distinguished Professor in the Department of Ecology and Evolutionary Biology and Special Advisor to the UConn President on Environmental Affairs, and ecologist Marten Scheffer with its award in the Ecology and Conservation Biology category for contributions to development of the theoretical underpinnings for a scientific understanding of gradual, abrupt and potentially irreversible ecosystem change in response to pollution and other ecological problems. The Foundation is an international award program recognizing significant contributions in the areas of scientific research and cultural creation.

Food & Agriculture

NEW APP HELPS COMBAT HUNGER. Fed 40, an app that connects the hungry with meals, is now available in Connecticut, delivering meals to residents within a day. The app was developed by Florida-based Feeding Children Everywhere (FCE), an organization dedicated to eliminating hunger. Last year, FCE invested an additional \$5 million in meals for seniors in affordable housing. Fed 40 was launched in Florida and has now expanded to Texas, Oklahoma and Connecticut. Meals are distributed through food pantries, schools, churches and other nonprofits. The program was made available to Connecticut residents thanks to a donation of

more than \$2,600 from the **Ellington Congregational Church** community. To download the app, visit iTunes or Google Play, or visit Fed40.com on the web.

CT SHADE TOBACCO IN DECLINE. The **O.J. Thrall Co.**, once one of Connecticut's premier shade tobacco growers, is selling 325 acres of crop land in **Windsor** and **Windsor Locks**. Shade tobacco, an historic mainstay of Connecticut agriculture, is in a major decline with competition from Honduras and Ecuador. Honduran "Connecticut seed" tobacco for cigar wrappers can sell for \$33 a pound, while Connecticut farmers must sell their product for \$50 a pound to make a profit. State and local officials state the farmland is typically bought by developers for industrial or housing projects. "In this fiscal climate, it would be a very hard sell for [the state] to pay market value for that property.... It's very, very valuable land," said Agriculture Commissioner **Steven Reviczky**.

NEW LAW CREATES CT 'FARM BREWERY' LICENSE. Governor **Dannel Malloy** signed a bill into law in July allowing Connecticut farmers to make, store, bottle, distribute and sell up to 75,000 gallons of beer a year and to advertise their product as "Connecticut Craft Beer." The new law creates a "Farm Brewery" license that lets farmers run breweries offering free tastings and retail sales on and off premises. To be certified as a "Connecticut Craft Beer" a certain amount of hops, barley or other ingredients in the beer must be grown or malted in Connecticut. "Connecticut's growing craft beer industry continues to create good-paying jobs and bolsters local economies across the state," said **Brett Broesder**, co-founder and vice president of The Campaign for Tomorrow's Jobs.



Health

TAMBORLANE HONORED WITH DIABETES AWARD. In May, the American Diabetes Association presented the 2017 Outstanding Achievement in Clinical Diabetes Research Award to CASE member and Chief of Pediatric Endocrinology at **Yale University** and Deputy Director of the **Yale Center for Clinical Investigation William V. Tamborlane**. This award recognizes exceptional contributions in patient-oriented or clinical outcomes research that have a significant impact on diabetes prevention and treatment. Tamborlane's major accomplishments are pioneering studies in the development of insulin pump therapy; demonstration that intensive diabetes treatment impairs counter-regulatory responses to hypoglycemia; development of novel behavioral interventions to improve outcomes for adolescents with type 1 diabetes; and the development of the first registry of youth with type 2 diabetes in the United States.

'COMMIT TO QUIT' In June, the **Connecticut Department of Public Health** (DPH) introduced the "Commit to Quit" program to help state residents quit using tobacco. The program includes two weeks of nicotine replacement therapy, one-on-one assistance, access to a private online community, a quit guide book, and a lifetime membership, free of charge. The program also provides online and telephone support. According to the DPH Tobacco Control Program, research demonstrates that 83% of adult smokers are unable to quit without support, but when using programs similar to Commit to Quit, smokers are nearly twice as likely to quit.

CT AWARDED \$3.1M TO ADDRESS SUBSTANCE ABUSE AND MENTAL HEALTH. Connecticut has received a \$3.1 million, four-year federal grant to develop more sustainable, long-term treatments for children and young adults battling substance abuse and mental health disorders. The funding, awarded by the federal Substance Abuse and Mental Health Services Administration, will

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be used by the **Connecticut Department of Children and Families** and the **Connecticut Department of Mental Health and Addiction Services** to further the efforts of the ASSERT Project (Access, Screening and Engagement Recovery Support and Treatment). In the first year of the grant, recovery services will be offered to adolescents and young adults and their families in **Hartford, Norwich, New London, New Britain, and Waterbury**. The program will expand in the second year to include **Bridgeport** and **New Haven**.

CYBREXA GETS \$6M IN FINANCING. New Haven-based **Cybrexa Therapeutics**, a start-up cancer therapeutics company, recently secured \$6 million in financing through HighCape Partners, **Connecticut Innovations**, and private investors. The Series B funding will allow Cybrexa to work on its facilities and continue to develop tumor-specific drugs. Cybrexa was founded by **Per Hellsund, Kevin Didden** and **Kevin Rakin**. In addition, founding members include **Ranjit Bindra** and CASE member **Peter Glazer** from the **Yale School of Medicine**. Bindra and Glazer are physician-scientists working in DNA repair.

AUTHORS ADVISE OPTIMISM. **Steven Southwick**, CASE member and **Yale School of Medicine** professor of psychiatry, and **Dennis Charney**, resilience researcher and dean of the Icahn School of Medicine at Mount Sinai in New York City, are co-authors of *Resilience: The Science of Mastering Life's Greatest Challenges*, providing important strategies for cultivating resilience in middle age. Southwick advises on the importance of optimism to help cope with stress and suggests surrounding oneself with optimistic individuals, noting "optimism, like pessimism, can be infectious." His advice: "Hang out with optimistic people."



High Technology

UTRC LAUNCHES INNOVATION HUB, NEW RESEARCH FACILITIES. In June, **United Technologies Research Center** (UTRC) announced plans to invest \$115 million in two major new facilities at its East Hartford campus: an **Additive Manufacturing Center of Excellence** (\$75M) and an **Engine Compressor Research facility** (\$40M). UTRC also launched a \$60 million "innovation hub" on the East Hartford campus. New construction was supported by the 2014 Connecticut Aerospace Reinvestment Act (CARA). With Connecticut's investment, UTRC will expand its research and use of "advanced materials, measurement sciences, sensor technologies, environmental sciences, autonomous systems and human-collaborative robotics." UTRC plans to partner with **Pratt & Whitney** to develop and improve upon advanced compressor technologies. According to CASE member **David Parekh**, Corporate Vice President, Research and Director, UTRC, "This investment in our headquarters and our current and future innovators will allow us to remain global leaders for decades to come."

FALLCALL NOW GETS BOOST FROM 'PLANET OF THE APPS'. In June, **FallCall Solutions**, a Connecticut tech startup founded by physicians **Shea** and **Kristen Gregg** that creates communication solutions for elders and caregivers, was selected to appear on Apple Music's new series, "Planet of the Apps." Their app, FallCall Now, is designed to provide "smart" fall detection. It is patent pending exclusively to Apple Watch. Plans are also in place to incorporate machine learning to create personalized fall detection and deep learning to improve fall recognition for users. Since participating in the show, FallCall Solutions has raised seed money from accredited investors and crowd funding to begin building FallCall Now. They have launched a Kickstarter campaign to complete the application.

STATE RELEASES CYBERSECURITY STRATEGY. In July, Governor **Dannel Malloy**, along with the state's Chief Cybersecurity Risk Officer **Arthur House** and Chief Information Officer **Mark Raymond**, released a Connecticut Cybersecurity Strategy outlining current efforts and future plans to manage threats for state government, municipalities, businesses, higher education institutions and law enforcement. Although each state agency is also responsible for its own cybersecurity awareness programs and defense mechanisms, the **Bureau of Enterprise Systems and Technology** in the **Department of Administrative Services** (DAS/BEST) works with agencies, helping with network perimeter safety and firewall management, employee access to unsafe websites, malicious email and antivirus measures and backups.



Transportation

STUDY TO EXAMINE RAIL PERFORMANCE. The **Connecticut Department of Transportation** selected a team of transit engineering specialists this spring to significantly improve the performance of the **New Haven Line** and the statewide rail system. The study will develop service and infrastructure investment strategies and evaluate the optimal strategy for direct service to New York Penn Station as well as to Grand Central. The initial planning phase is funded with \$3 million allocated by the **Connecticut State Bond Commission** as part of "Let's Go CT!", and will help determine future investment including configurations of new stations, rail yard improvements, interlockings and procurement of additional rail cars and locomotives.

PLAN CALLS FOR MORE SPENDING ON ROADS, LESS ON OTHER TRANSIT. The **Connecticut Department of Transportation** held hearings this summer regarding the draft of a four-year Statewide Transportation Improvement Program that calls for more spending on highways, but less on trains and buses. Plans include repairs to about a dozen sections of the Mixmaster interchange in **Waterbury**, overhaul of the I-95 bridge between **New London** and **Groton** and a redesign of Route 9 in **Middletown** to do away with traffic lights. The proposed 2018-21 version calls for \$4.5 billion, with 79% of the funds going to highways and 21% to transit.

NEW CT RAIL HARTFORD LINE ANNOUNCED. TransitAmerica Services and Alternate Concepts have entered into a \$45 million contract with the **Connecticut Department of Transportation** for five years to launch a new commuter rail service linking Springfield's Union Station with **Hartford** and **New Haven**. Service is expected to begin May 2018. The **CTrail Hartford Line** will offer 17 roundtrip trains between New Haven and Hartford each weekday, with 12 of those roundtrip trains continuing to Springfield. Stations stops along the line will be in New Haven at both Union Station and State Street station, Wallingford, Meriden, Berlin, Hartford, Windsor, Windsor Locks and Springfield, with Metro-North tickets available at Union Station in Springfield as well as in New Haven.

ANSONIA RIVERWALK TO EXPAND. A Transportation Alternatives Program grant of \$1.7 million will be used to expand the **Ansonia Riverwalk**, including building the Valley's own light-house, according to city officials. The grant is a combination of funds from the Federal Highway Administration, **Connecticut Department of Transportation**, the **Bridgeport Metropolitan Planning Organization** and the **Central Naugatuck Valley Council of Governments**. The next phase of expansion will connect rail, bus and pedestrian traffic along a retail section of Main Street including a multi-use path and sidewalk improvements.

— Compiled and edited by Wendy Swift

◆ Survey of Income and Program Participation

The Survey of Income and Program Participation (SIPP) is a national, longitudinal household survey conducted by the Census Bureau. SIPP serves as a tool to evaluate the effectiveness of government-sponsored social programs and to analyze the impacts of actual or proposed modifications to those programs. SIPP was designed to fill a need for data that would give policy makers and researchers a much better grasp of how effectively government programs were reaching their target populations, how participation in different programs overlapped, and to what extent and under what circumstances people transitioned into and out of these programs. SIPP was also designed to answer questions about the short-term dynamics of employment, living arrangements, and economic well-being. The Census Bureau re-engineered SIPP—fielding the initial redesigned survey in 2014. This new Consensus Report from the National Academies evaluates the new design compared with the old design, compares key estimates across the two designs, evaluates the content of the redesigned SIPP and the impact of the new design on respondent burden, and considers content changes for future improvement of SIPP.

<https://www.nap.edu/catalog/24864>

◆ Applying Risk Analysis, Value Engineering, and Other Innovative Solutions for Project Delivery

This report from the Transportation Research Board examines the state of the art in managing project development and delivery through application of Value Engineering (VE). VE is a systematic process that combines creative and analytical techniques to achieve a common understanding of project requirements. At the project level, the goal of VE is to achieve balance between project needs and resources.

<http://www.trb.org/main/blurbs/176394.aspx>

◆ Identifying Potential Biodefense Vulnerabilities Posed by Synthetic Biology: A Proposed Framework

Building on an increasingly sophisticated understanding of naturally occurring biological processes, researchers have developed technologies to predictably modify or create organisms or biological components. This research, known collectively as synthetic biology, is being pursued for a variety of purposes, from reducing the burden of disease to improving agricultural yields to remediating pollution. While synthetic biology is being used primarily for beneficial and legitimate purposes, it is possible to imagine malicious uses that could threaten human health or military readiness and performance. Making informed decisions about how to address such concerns requires a comprehensive, realistic assessment. The US Department of Defense, working with other agencies involved in biodefense, asked the National Academies to develop a framework to guide such an assessment, to assess the level of concern warranted for various advances and identify areas of vulnerability, and to prioritize options to address these vulnerabilities. This interim report proposes a framework for identifying and prioritizing potential areas of concern; the framework describes categories of synthetic biology technologies and applications—such as genome editing, directed evolution, and automated biological design—and provides a set of initial questions to guide the assessment.

<https://www.nap.edu/catalog/24832>

◆ Global Health and the Future Role of the US

The United States has long been a leader in global health. Yet resources are not unlimited, and the case for continued commitment must be made. With support from a broad array of federal agencies,

foundations, and private partners, the National Academies of Sciences, Engineering, and Medicine convened an ad hoc committee to identify global health priorities in light of current and emerging global health threats and challenges. In the resulting report, *Global Health and the Future Role of the United States*, the committee provides recommendations to the U.S. government and other stakeholders for increasing responsiveness, coordination, and efficiency in addressing these threats and challenges by establishing priorities and mobilizing resources.

<https://www.nap.edu/read/24737/>

◆ Pain Management and the Opioid Epidemic: Balancing Societal and Individual Benefits and Risks of Prescription Opioid Use

Drug overdose, driven largely by overdose related to the use of opioids, is now the leading cause of unintentional injury death in the United States. The ongoing opioid crisis lies at the intersection of two public health challenges: reducing the burden of suffering from pain and containing the rising toll of the harms that can arise from the use of opioid medications. Chronic pain and opioid use disorder both represent complex human conditions affecting millions of Americans and causing untold disability and loss of function.

In the context of the growing opioid problem, the US Food and Drug Administration (FDA) launched an Opioids Action Plan in early 2016. As part of this plan, the FDA asked the National Academies of Sciences, Engineering, and Medicine to convene a committee to update the state of the science on pain research, care, and education and to identify actions the FDA and others can take to respond to the opioid epidemic. The committee was asked to focus on informing FDA's development of a formal method for incorporating individual and societal considerations into its risk-benefit framework for opioid approval and monitoring.

<https://www.nap.edu/read/24781/>

◆ NSF Urged to Develop Plan Specifying Social, Behavioral, and Economic Sciences Research Priorities

The social, behavioral, and economic (SBE) sciences make significant contributions to the National Science Foundation's (NSF) mission to advance health, prosperity and welfare, national defense, and progress in science, says a new report from the National Academies of Sciences, Engineering, and Medicine. NSF should undertake a systematic and transparent strategic planning process that defines SBE research priorities, the required resources, and how success in addressing SBE priorities will be evaluated over time. Although it is commendable that NSF consults with advisory groups and the broader scientific community to identify needs and opportunities in the SBE sciences, in the absence of a strategic plan, it is unclear how this input is combined and integrated in the agency's SBE research priorities. The NSF should continue to support the development of tools, methods, and research teams that can be used to advance the SBE sciences, facilitate interactions with other scientific fields, and help NSF and other agencies and organizations more effectively address important national needs. The report also includes recommendations for NSF to support training to prepare the next generation of scientists to be more data-intensive, interdisciplinary, and team-oriented, as well as to undertake more systematic efforts to communicate the results and value of the SBE research it supports and how NSF grants advance its mission.

<https://www.nap.edu/catalog/24790>

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Quantum Computing *(from page 2)*

The market is lucrative. Homeland Security Research Corp., an international market and technology research firm, predicts the global quantum computing market will reach \$10.7 billion by 2024, of which \$8.45 billion will stem from product sales and services and \$2.25 billion will take the form of government funding for research, development, test, and evaluation programs.

“Connecticut could perhaps become a high-tech state in this field,” Devoret said, noting that attracting young scientists from overseas and building cost-effective new laboratory space in the state could help make that a reality.

Girvin agreed, saying, “It would be great to see quantum computing be part of New Haven’s technology ecosystem.”

Many significant applications are predicted for quantum computing, and Devoret and others say the full impact won’t be known until the technology is developed and people start using it. “When lasers were developed in the 1960s, no one would have predicted that one of the biggest markets for lasers would be their use in the removal of body hair,” he said. “The same is true for quantum computing, but a very probable guess is that chemical engineering, including drug discovery, will benefit most.” —**Karen Cohen, freelance writer and owner, The Write Stuff, LLC.**

Children’s Museum *(from page 1)*

During a trip to the Museum, children can explore the Discovery Room featuring the resident critters and science-based activities. They can also visit the Imagination Station where they can pilot a fishing boat, build skyscrapers with giant foam blocks, hop into an authentic fire truck cab, climb inside a volcano or explore the global bazaar. In Toddlerland, the youngest visitors have an area of their own to safely investigate using their senses and developing motor skills. There is also an Outdoor Play Area, which features a new Toddler Playspace, a real tree house, an obstacle course, a climbing wall, a kid-sized zip line and bubbles!

The Children’s Museum of SECT offers quality onsite and outreach programming, along with being a unique venue for birthday parties. During the school year, our onsite Toddler, Little Chefs, Little Artists and Little Scientists programs run in 5-week series. Exciting upcoming Museum events include: Celebrating “Worldwide Day of Play” on September 30, “Spooky Science” on October 28, “Election Day Animal Discovery Demos” — Vote for your favorite Museum Critter — on November 7, “Bird Buffet” on November 24, and the annual “Countdown to Noon!” on December 31.

For more information on admission, hours, onsite and outreach programs, memberships and birthday parties, please visit cmsect.org or call 860-691-1111.

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