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Unlocking the Mysteries of Dyslexia; Finding the Keys to Successful Intervention

"Dyslexia is defined as difficulty learning to read in the presence of opportunity, motivation and intelligence," said CASE member Jeffrey Gruen, professor of pediatrics and genetics at the Yale Medical School in New Haven, Connecticut. "It is a complex, polygenic disorder that affects the brain's ability to process and decode written words."

First identified more than 100 years ago, dyslexia affects millions of people around the world today and, according to the International Dyslexia Association, as many as 15-20% of the American population. The Connecticut Department of Education includes dyslexia as a sub-category of Specific Learning Disability (SLD) and says on Page 3 of its IEP Manual and Forms: "For a student to be identified as 'SLD/Dyslexia,' the child must first meet the overall eligibility requirements for SLD and then meet the more specific requirements for dyslexia."

In 2016, the World Literacy Foundation estimated that a lack of literacy costs the US economy approximately \$370 billion. Researchers in Connecticut are among those identifying genetic markers for dyslexia, mapping the brain's ability to process written language, exploring external influences and developing effective intervention strategies. While one article can't begin to capture the

true extent of work in the area of dyslexia throughout the state, nation and world, highlighted below are a few contributions from Connecticut and beyond.

Historical Perspective

"Early explanations of dyslexia, put forth in the 1920s, held that defects in the visual system were to blame for the reversals of letters and words thought to typify dyslexic reading," wrote Sally Shaywitz, co-director of the Yale Center for Dyslexia and Creativity and the Audrey G. Ratner Professor in Learning Development at the Yale University School of Medicine, in her 1996 article "Dyslexia" (*Scientific American*, November 1996). In the same article, Shaywitz went on to note that "Subsequent research has shown ... that children with dyslexia are not unusually prone to reversing letters or words and that the cognitive deficit responsible for the disorder is related to the language system. In particular, dyslexia reflects a deficiency in the processing of the distinctive linguistic units, called phonemes, that make up all spoken and written words."

In a 1990s study, Shaywitz and her colleagues determined that phonological deficits are a significant and consistent cognitive marker of

(See *Dyslexia*, page 2)

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 America's Skilled Technical Workforce

A new report from the National Academies urges US policymakers, employers, and educational institutions to take steps to strengthen the nation's skilled technical workforce. Such steps include helping students complete education and training programs and assisting workers in upgrading their skills throughout their lives. Skilled technical occupations—defined as occupations that require a high level of knowledge in a technical domain but do not require a bachelor's degree for entry—can be found in most occupational groups, from health care to construction to manufacturing and include medical laboratory technicians, installation and repair technicians, and computer support specialists. The term "middle skills" is often used to describe such occupations, but that term fails to capture the high value and dynamism of this segment of the workforce, the report notes.

(See *NAS*, page 7)



2017 Connecticut Medal of Science recipient Robert Schoelkopf, Sterling Professor of Applied Physics and Physics and director of the Yale Quantum Institute, with CASE President Laura Grabel, left, and Connecticut Lieutenant Governor Nancy Wyman. [Photo: Frank Labanca]

Yale's Schoelkopf Honored with 2017 Connecticut Medal of Science

Professor Robert Schoelkopf, Sterling Professor of Applied Physics and Physics and director of the Yale Quantum Institute, was awarded the 2017 Connecticut Medal of Science at the 42nd Annual Meeting & Dinner of the Connecticut Academy of Science and Engineering (CASE) on Monday, May 22, 2017, at the University of Connecticut in Storrs. The medal was presented by Connecticut Lieutenant Governor Nancy Wyman.

Schoelkopf, a leading experimental physicist whose research has helped establish the field of quantum computation with solid-state devices, was honored for his seminal contributions to the entire field of quantum science and to the new field of circuit quantum electrodynamics. Together with his faculty collaborators at Yale, Michel Devoret and Steven Girvin, Schoelkopf has pioneered the approach of integrating superconducting qubits with microwave

(See *Medal*, page 7)

dyslexic children. With her husband, Bennett Shaywitz, she originated the "Sea of Strengths" model of dyslexia, which emphasizes higher critical thinking and creativity. Her best-selling 2003 book, *Overcoming Dyslexia*, provided parents, educators and the general public with tools and strategies to address and overcome dyslexia.

Shaywitz and her husband, Bennett Shaywitz, the Charles and Helen Schwab Professor in Dyslexia and Learning Development and Chief of Pediatric Neurology at the Yale School of Medicine, co-founded the Yale Center for Dyslexia and Creativity, where they continue to conduct groundbreaking research in reading and dyslexia. They are considered "pioneers who opened up the field for the scientific inquiry and discoveries that have followed," says CASE Past President and Professor Emeritus of Pediatrics Myron Genel of the Yale School of Medicine.

Brain Processing

The invention of the functional magnetic resonance imaging (fMRI) technique in 1990, by a group at Bell Laboratories led by Seiji Ogawa, allows researchers to map brain activity by detecting changes associated with blood flow. The fMRI technique is now in use in many laboratories associated with the study of dyslexia.

For example, at Haskins Laboratories in New Haven, Kenneth Pugh and his team have used fMRI to demonstrate that fluent, skilled readers develop a reading response in three broad regions of the brain: the temporal parietal, inferior frontal gyrus and the fusiform word area in the lower left posterior part of the brain.

"What we've seen in many languages and many age ranges is that kids who are struggling with reading, generally fail to show the activity in the left posterior part of the brain," he said. "We often see in the same people a tendency to use other parts of the brain to read. This becomes a biomarker or signature for dyslexia. Based on our research, it seems to be fairly clear that the way in which reading pathways get laid down in the brain is very, very different in people with dyslexia."

Heredity

Case reports of families with dyslexia in multiple members appeared soon after dyslexia was first described more than 100 years ago, but modern, rigorous family and twin studies of dyslexia came much later in the 1970s and 1980s. John De Fries and colleagues at the Colorado Learning Disabilities Research Center, based at the Institute for Behavioral Genetics at the University of Colorado Boulder, conducted these studies, which clearly established that dyslexia runs in families and is moderately heritable. The next obvious question was where are the genes that are responsible for the heritability of dyslexia?

Molecular Genetic Research

In 2005, Gruen and his team were the first to identify DCDC2, a dyslexia gene. "We know this is a genetic disorder, but nobody yet knows how many genes are involved," Gruen said. "Variants of a regulatory element encoded in DCDC2, called READ1 (regulatory element associated with dyslexia1), have been strongly associated with performance on reading and language tasks. Our team has found more than 40 variations (alleles) of READ1 and is identifying which alleles are the most harmful, which ones may be protective and how the variations may affect brain development and functionality."

At the University of Connecticut, R. Holly Fitch and her team are identifying underlying risk factors at the earliest possible stages, before the early foundations of neural circuitry in the growing brain have been established. By altering critical variables in the brains of embryonic mice and rats, they've simulated genetic mutations that can be linked to developmental language disorders (including dyslexia).

"Our animal work has shown that mutations in each of these genes may be linked to disruption of different aspects of cognition that could impact reading," Fitch said. "For example, one gene mutation seems to be more associated with sound processing, which would impact an infant's ability to understand speech sounds. Another mutation seems more related to memory and learning problems, and yet another seems to be related to visual processing of motion. Disruption of any of these skills could obviously impact reading, but maybe through different genes and different aspects of neural processing abnormalities. This information might identify more individualized interventions for at-risk infants from a very early age, based on the specific mutations that can be identified from a simple blood test at birth."

Fitch noted that animal models provide a way to experimentally manipulate genetics, follow brain development from the start and look at behavioral outcomes within a much smaller time window because rats and mice become adults in just a few months. "Although we cannot look at language per se in rats and mice, we can look at the foundational processes that underlie language and reading, providing an incredibly powerful tool that can supplement human behavioral, genetic and fMRI work on dyslexia," she added.

Strategic Interventions

Studies have shown that early identification of dyslexia and adoption of effective intervention strategies are keys to successful mastery of reading. In May, Governor Dannel P. Malloy signed Public Act 17-3 requiring certified employees or employees seeking a new, provisional or professional educator certificate in integrated early childhood and special education endorsement, or comprehensive special education, to complete a program of study in "... the diagnosis and remediation of

(See *Dyslexia*, page 7)

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IN BRIEF

Science and Engineering Notes from Around Connecticut



Biomedical Research

STATE 'WELL POSITIONED' TO LEAD IN PRECISION, GENOMIC MEDICINE. In February, scientists and industry officials presented to the members of the **Connecticut Commission on Economic Competitiveness** and the legislature's **Commerce Committee**, addressing areas of growth and leadership for Connecticut including its role as a leader in precision medicine. The meeting coincided with the release of a report by the **Connecticut Health Data Collaborative** that outlined goals including establishing a **Connecticut Center for Genomic Medicine**. CASE member **Robert Alpern**, dean of the **Yale School of Medicine**, noted that Connecticut is well positioned to be a leader in genomic medicine.

UCONN, ARMI TO SHARE REGENERATIVE TISSUE, LIMB TECHNOLOGIES. The **University of Connecticut (UConn)** recently announced a partnership with the **Advanced Regenerative Manufacturing Institute (ARMI)** to share its human tissue and limb regeneration technologies. The institute, headquartered in New Hampshire, is focused on accelerating the growth and use of engineered human tissues and organs. "We are excited to collaborate with ARMI to lend our expertise to our country and push our regenerative engineering discoveries and breakthroughs closer to the bedsides of soldiers and Americans in need of vital medical care," said CASE member **Cato T. Laurencin**, the 2016 recipient of the Connecticut Medal of Technology, chief executive officer of the **Connecticut Institute for Clinical and Translational Science (CICATS)** at UConn, and director of the **Institute for Regenerative Engineering** and **The Raymond and Beverly Sackler Center for Biomedical, Biological, Physical, and Engineering Sciences** at **UConn Health**. The ARMI initiative is also supported by **Jeff Seemann**, UConn's vice president for research, and CASE members **Bruce T. Liang**, dean of the **UConn School of Medicine**, and **Kazem Kazerounian**, dean of the **UConn School of Engineering**.

'NANO-MESH' HOLDS PROMISE FOR TENDON REGENERATION. In the April 3 issue of the journal *PLOS ONE*, CASE member **Cato Laurencin**, Van Dusen Distinguished Professor of Orthopaedic Surgery at **UConn Health**, reports using a nano-textured fabric seeded with stem cells to regenerate torn rotator cuff tendons in animals. The tendons wrapped in the fabric make a better attachment to the bone, and are stronger, with a cell structure that appears like natural, undamaged tissue. Tendons repaired with a purely surgical technique heal with a more disorganized cell structure, making tendons weaker and more prone to failure. The combination of the "nano-mesh" with stem cells appears critical because the mesh made of a nano-structured polymer combining polycaprolactone and polyphosphazene provides an attractive habitat for stem cells to adapt and send signals directing other cells to align and grow into tendon tissue.

NEW STUDY IDENTIFIES CELL DEFECTS UNDERLYING RARE SYNDROME. A study by **UConn Health** neuroscientist and CASE member **Eric Levine**, using stem cells derived from patients with Angelman syndrome and reported in the April 24 online edition of *Nature*, identifies the underlying cellular defects causing this rare neurogenetic disorder. Levine's study found that, three to five weeks into development, brain cells in unaffected individuals increase electrical activity while cells from Angelman patients do not. Angelman syndrome appears in one out of every 15,000 live

births, resulting in developmental delays, seizures, trouble walking or balancing, and limited speech. The pluripotent stem cells used in Levine's research were derived from skin and blood cells donated by people with Angelman. Levine and his research team at **UConn Health** were able to monitor the cells' development from their earliest stages in vitro to identify ways they differ from control cells of individuals without the disorder.



Business & Industry

CT RANKED NINTH IN TECHNOLOGY INNOVATION. In March, **WalletHub**, a personal finance website, ranked **Connecticut** ninth highest in the country in encouraging technology innovation, based on the company's analysis of 18 key metrics. The state excelled in areas of "human capital," according to **Jill Gonzalez**, an analyst with **WalletHub**, who noted that the state has the eighth-highest AP exam participation in the nation at almost 42%. "It also has the sixth-highest number of utility patents at 8.35 per 100,000 residents," said **Gonzalez**. The **Icahn School of Medicine at Mount Sinai's Branford** research facility, opened in 2014, is an example of Connecticut's growth in biomedical technology; other Connecticut biomedical companies cited in the article include **Neurogen** and **CuraGen**.

CBIA CITES 'MAJOR IMPACT' FROM TRANSPORTATION INFRASTRUCTURE NEEDS. In April, the **Connecticut Business and Industry Association (CBIA)** issued a news release stating that traffic is having a major impact on business development in Connecticut, citing heavy congestion—particularly on I-95 and I-84—repairs needed on roads and bridges and **Tweed New Haven Airport's** limited service. **Bruce Alexander**, **Yale University** vice president for New Haven and state affairs, said improving transportation infrastructure is essential to reversing the "downward spiral" in revenue and jobs the state has lost since the 2008 recession.

NEW DRUG HOLDS PROMISE FOR HEART PATIENTS. It was announced in February that CASE member and cardiologist **Bruce Liang**, dean of the **UConn School of Medicine**, has collaborated with National Institutes of Health (NIH) chemist **Kenneth Jacobson** to invent a new drug to save people in advanced stages of heart failure. The drug is made from a small molecule that can be chemically manufactured rather than grown in a bacterial or animal cell. This drug prevents heart cells from dying by affecting nitric oxide, a signaling molecule, without lowering blood pressure. It has been shown to be effective in mice and in dogs and could soon be tested in humans. The new drug will be launched through **Liang's** start-up, **Cornovus Pharmaceuticals**, pending additional funding and FDA approval for investigational new drug status, in summer 2018.



Communication

CCMC FIRST TO INTEGRATE EHR, DRUG DATABASE. This winter, **Connecticut Children's Medical Center** became the first healthcare organization in the state to successfully integrate its electronic health records system with the state's prescription drug database, allowing the center's physicians to access state-level data in real time from the statewide **Prescription Drug Monitoring Program (PDMP)** to help with clinical decision support and to improve patient safety. In the past, physicians and pharmacists

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had to log into separate websites to retrieve a patient's controlled substance dispensations from a state database and then cross reference that data in other information systems.

NEW TECHNOLOGY CREATES EXTENDED PRIMARY CARE ACCESS. On February 17, the **Western Connecticut Medical Group** (WCMG) announced WCMG-NOW Telehealth and the Night Nurse Service. WCMG-NOW Telehealth is a secure way to receive prompt medical attention for common health conditions and other services. Patients can interact with a provider who can diagnose, treat and prescribe medications if needed using secure and private video chat on their computer or mobile device. This service is offered from 5 pm to 10 pm on weeknights and 10 am to 10 pm on weekends. WCMG-NOW Telehealth is funded by a \$250,000 donation from Danbury resident **John Patrick**, an Internet pioneer and author, and his wife **Joanne**, a retired nurse.

STATE AWARDS SPRINT NEW 5-YEAR TRS CONTRACT. In April, Connecticut awarded Sprint a new, five-year contract to continue operating the **Connecticut Telecommunications Relay Service** (TRS) system, allowing the hearing and speech impaired to place and receive telephone calls through intermediaries who type, speak or sign responses. In 2001, the Federal Communications Commission mandated that all US telephone companies offer 7-1-1 numerical dialing to connect people to TRS interpreters, who relay conversations in real-time on text telephones, computers and other systems, including for Spanish speakers.



Education & Cognition

NEW CANAAN TECH ED TEACHER HONORED. In February, **James Zambarano**, **New Canaan High School's** career and technical education department chair and technology education teacher, was named the **Connecticut Engineering Education Association** (CTEEA) Teacher of the Year. CTEEA President **William McDonough** presented the award at the **New Canaan Board of Education** meeting. Zambarano is one of 50 teachers honored in 2017 and was recognized in March at a national technical education conference in Dallas.

YALE LAUNCHES DEPARTMENT OF STATISTICS AND DATA SCIENCE. In March, **Yale University** announced the transformation of the **Department of Statistics** into the **Department of Statistics and Data Science** (DS squared or DS2), approving a new undergraduate major in statistics and data science. Yale's DS2 department and its associated undergraduate and graduate courses will reflect a range of topics, with departments from anthropology to astronomy offering courses in the major. **Daniel Spielman**, CASE member and Henry Ford II Professor of Computer Science and Statistics and Data Science at **Yale**, commented, "This is just the beginning. We don't exactly know where data science is going to go, but we know we want to be out in front of it, leading the way."

SIEMENS DONATES SOFTWARE TO COMMUNITY COLLEGES. In March, Siemens, a German technology company, donated \$315 million in manufacturing and product design software to Connecticut students studying in the **Advanced Manufacturing Technology Centers** at **Three Rivers**, **Manchester**, **Asnuntuck** and **Gateway** community colleges, with plans to expand availability to all twelve Connecticut community colleges over the next 18 months. Siemens' software assists manufacturers to design, develop and manufacture products in the aerospace, defense, heavy equipment, shipbuilding, medical devices, electronics and semiconductors industries. Siemens employs approximately

300 people in Connecticut, primarily in building technologies and health care businesses, with operations in four locations: **Brookfield**, **Norwalk**, **Cromwell** and **Manchester**.

AMITY STEM STUDENTS GARNER SCIENCE FAIR AWARDS. The **Amity Middle School Bethany (AMSB) Social Robotics & Engineering Research Program** students earned 39 awards at the 69th Annual **Connecticut Science & Engineering Fair** in March. The program, with 28 students from **Woodbridge** and **Bethany**, is geared for students with a strong interest and demonstrated ability in STEM. Projects included: robots as teachers, printed prosthetics, Write-bot (creating and programming a robot that writes), Temp-bot, (a system that protects children and pets from overheating in cars), and Vision Shoe, for visually impaired individuals.



Energy

NEW UNIFORM FEE FOR SOLAR PANEL HOOKUP. In March, the **Public Utilities Regulatory Authority** adopted a uniform fee to hook up residential customers' solar panels to the electric grid. In the past, residents with systems producing up to 10 kilowatts of electricity paid a \$100 connection fee, while those with larger systems paid a \$500 fee. The new guidelines set a \$200 fee for all residential systems up to 20 kilowatts in size. The change is a response to the **Connecticut Green Bank's** incentives for solar, resulting in many more applications for systems in the 10 to 20-kilowatt range.

TOYOTA TO INVEST \$35M IN UCONN COLLABORATION. The Toyota Research Institute (TRI) announced March 30 that it is investing \$35 million to support collaboration with **UConn** to accelerate the design and discovery of advanced materials using artificial intelligence and machine learning. UConn materials scientist and CASE member **Ramamurthy "Rampi" Ramprasad**, a professor in the **School of Engineering**, will lead the effort at UConn over the next four years to identify advanced battery materials and fuel cell catalysts to power zero-emissions and carbon-neutral vehicles.

GRANTS WILL FUND HYDROPOWER STUDIES. In April, **Suffield** and **Windsor Locks** were awarded two grants, one from the **Connecticut Trust for Historic Preservation** and one from the state **Historic Preservation Office** for feasibility studies to determine if the **Windsor Locks Canal** can provide electricity from hydropower. The grant will cover 100% of the cost of a hydropower feasibility study and a capital needs assessment. In 2014 a survey done by the state **Department of Energy and Environmental Protection** determined the canal has the potential to generate more than 28 megawatts of electricity if the **Enfield Dam** is restored.

RGGI EYES 'MORE AMBITIOUS' CARBON ALLOWANCE CAP. In April, the **Regional Greenhouse Gas Initiative (RGGI)**, a regional cap-and-trade market launched in 2008, considered how much lower its nine-state carbon allowance cap should be going forward. Recent clearing prices have fallen to their lowest levels since 2012, reflecting an underestimation of how quickly power plants could reduce emissions. Currently, caps decline 2.5 % annually, while environmental groups have urged RGGI states to decrease to 5%. This year's cap is 84.3 million short tons, which is slated to fall to 78.2 million in 2020.

HARTFORD FUEL CELL MICROGRID COMPLETED. In April, the **City of Hartford**, **Constellation**, a subsidiary of Chicago-based Exelon Corporation, and California's Bloom Energy announced the completion of an 800-kilowatt fuel cell microgrid to generate 100% energy, manage electricity costs and supply emergency

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power for **Hartford's Parkville Elementary School, Dwight Branch Library, Parkville Senior Center and Charter Oak Health Center**. The microgrid will also provide emergency power to a local gas station and grocery store, so residents can purchase essentials. Excess power will reduce electricity costs at four local schools: **Bulkeley High School, Hartford High School, Weaver High School** and the **Sport and Medical Sciences Academy**. The project was developed through a public-private effort and one of the first implemented through the **Department of Energy and Environmental Protection's** Microgrid Grant Program.



Environment

OSPREY POPULATION REBOUNDS. Connecticut's osprey population, once considered endangered with record low counts of only six nests in 1972 when DDT was officially banned, has rebounded to record highs in 2016. The **Connecticut Audubon Society**, which has worked with the state **Department of Energy and Environmental Protection** since 2014 to run Osprey Nation—a program to monitor the osprey population—is looking for stewards to help monitor the population. There are currently too few stewards to track the nests. From 2014 to 2016, the number of mapped nest locations increased from 414 to 606.

DEEP AWARDS \$400K IN TRAIL AND GREENWAY GRANTS. Connecticut's **Department of Energy and Environmental Protection** (DEEP) recently announced \$400,000 in grants for seven projects to plan and design, build, expand, or enhance and improve multi-use trails and greenways across Connecticut as part of its Recreational Trails Program. DEEP expanded the scope of this program as part of Public Act 15-190, which allows the agency to provide funding for an array of multi-use trails and greenways projects, as well as expanding the eligibility list to certain non-profit organizations.

GRANTS TARGET BROWNFIELDS REVITALIZATION. In February, **Governor Dannel P. Malloy** announced the award of \$6.9 million in state grants for assessments and revitalization of brownfields. **Hartford** will receive \$605,000 to remediate a site on Mather Street that will be developed as a secured parking facility supporting 220 units of housing. This and other projects comprise 424 acres of redevelopment as part of an effort to restore blighted properties and foster economic growth. Fourteen cities and towns are affected.

AUDUBON URGES RAIL AGENCY TO ABANDON BYPASS PLAN. In February, the **Connecticut Audubon Society** sent a letter to the Federal Railroad Administration to protest a plan for an **Old Saybrook** to **Kenyon, RI**, rail bypass, stating the plan is "fatally flawed and must be abandoned" because of potential harm to the lower **Connecticut River** estuary. The Society is critical of plans to build a tunnel under the river because of potential damage to the ecosystem with respect to threatened and endangered species including piping plovers, roseate terns, saltmarsh sparrows, and the shortnose and Atlantic sturgeon. In addition, the proposed bypass would bisect several important habitats including large woodlands, farmlands, and fields, said **Claudia Weicker**, chairwoman of the board of directors of the Society's **Roger Tory Peterson Estuary Center**.

DEEP ANNOUNCES NEW RECYCLING OPTION. The Connecticut **Department of Energy and Environmental Protection** announced a new recycling option for plastic bags and wraps in an effort to reduce such wastes 60% by 2024. About 200 stores will participate by providing bins to deposit plastic bags and wraps. The recycled materials will be used to make new grocery bags, benches and decking. Acceptable items include plastic grocery bags, produce bags, bread bags, dry cleaning bags, and zipper bags.



Food & Agriculture

SUFFIELD FARM GETS \$3M IN FINANCING. The Connecticut **Department of Economic and Community Development** recently announced that it will provide \$3 million in financing to **Four Seasons Farm LLC** in Suffield to purchase equipment and machinery for the 10-acre indoor farm. The farm will initially grow tomatoes and create 40 new jobs over the next two years. Other partners include **Joe Geremia**, who runs seven acres of greenhouses in Wallingford, **Henry Froese**, an expert in greenhouse operations, and **Herbert Soroca**, CEO of Stamford's **North Cove Capital Advisors**. The partners expect to create a 43-acre greenhouse complex.

REQUESTS FOR TICK TESTS SURGE. **Goudarz Molaei**, director of Connecticut's tick-testing program at the **Connecticut Agricultural Experiment Station** in New Haven, reports receiving more than 350 ticks in March, compared with 15 in March 2015 and two in 2014. Of the more than 350 ticks, 38% tested positive for Lyme disease; typical Lyme disease rates hover around 28–32%. On March 6, the lab received 65 ticks in one day; 50% of those tested positive for Lyme. The Centers for Disease Control says the number of people infected nationwide by Lyme disease each year is near 300,000, with cases steadily increasing during the last three decades and concentrated in the Northeast. Ticks are now spreading other disease-causing bacteria such as *Babesia* and *Anaplasma*.

FISHING SEASON OPENS AMID SAFETY CONCERNS. The Connecticut fishing season opened in April amid concerns about the safety of eating fish caught in some of the state's rivers, streams and ponds. The **Connecticut Department of Public Health** announced the release of the 2017 edition of "If I Catch It, Can I Eat It? A Guide to Safe Eating of Fish Caught in Connecticut." The guide notes higher levels of fish contaminated with polychlorinated biphenyls (PCBs) in the **Housatonic River** as well as three lakes—**Lillinonah, Zoar** and **Housatonic**—that are fed by the river.



Health

YALE TEAM TO HEAD NIH OPIOID TREATMENT STUDY. Researchers at the **Yale School of Medicine** announced earlier this year that professors **Gail D'Onofrio** and **David Fiellin** will lead a four-year National Institutes of Health-funded study to investigate the implementation and outcomes of new evidence-based treatments for patients with opioid use disorder. This study continues the work of a 2015 study by the same authors that compared treatment strategies for patients who came to hospital emergency departments (ED) for the disorder. That study showed that patients given brief counseling intervention and buprenorphine while in the ED were twice as likely to engage in formal treatment and less likely to use illicit opioids 30 days after treatment.

YALE STUDY EXAMINES CHOICES BY NEUROSCIENCE MAJORS. Findings of a study by **Matthew N. Goldenberg**, assistant professor of psychiatry, CASE member **John H. Krystal**, and **Robert L. McNeil, Jr.**, professor of neuroscience and chair of the **Yale Department of Psychiatry**, published in the February 12 issue of *Academic Psychiatry* online, indicate that brain-based specialties like neurology attract more undergraduate neuroscience majors than psychiatry, a trend the authors believe could be improved with increased early exposure to neuropsychiatry in college. The study, based on an analysis of data from US medical school matriculation and graduation from 2013 and 2014, found that medical students with an undergraduate neuroscience major showed a preference for

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neurology at the start of medical school compared to neurosurgery and internal medicine. Only 2.3% preferred psychiatry.

YALE STUDY RECOGNIZED BY RESEARCH FORUM. This spring, the Clinical Research (CR) Forum, a national organization of senior researchers from the nation's leading academic health centers, recognized **Yale School of Medicine** professor and CASE member **Harlan Krumholz** and then-medical student **Emily Bucholz** with a Top 10 Clinical Research Achievement Award for their study, "Life expectancy after myocardial infarction, according to hospital performance." The study, published in the *New England Journal of Medicine*, utilized the most comprehensive evaluation of hospital quality—the Cooperative Cardiovascular Project—and found that hospital quality impacts life expectancy.

ER VISITS FOR CHILDREN IN 'MENTAL HEALTH CRISIS' UP AT CT HOSPITALS. A recent report in *Clinical Pediatrics* by **Steven Rogers**, medical director of the **Connecticut Children's Medical Center's** (CCMC) emergency department's behavioral health unit, found that Connecticut hospitals are experiencing major increases in emergency room (ED) visits for children in mental health crisis. CCMC has seen a 32% increase in such visits since 2013, while at **Yale New Haven Hospital**, visits are up 81%. CCMC reported nearly 3,300 visits last year, up from less than 12 visits in 2013. Yale witnessed ED visits by children ages 15 and younger increase from fewer than 750 in 2013 to over 1,350 in 2016. Some contributing factors include increased vigilance by schools and parents about suicide, depression and aggressive behavior.

YALE STUDY EXAMINES GLUCOSE CONVERSION 'PATHWAY'
A **Yale** study led by senior author and CASE member **Robert Sherwin** and published February 23 by *JCI Insight* showed that fructose, a form of sugar linked to obesity and diabetes, is converted in the human brain from glucose, raising questions about its effects on the brain and eating behavior. The researchers found cerebral fructose levels rose significantly in response to a glucose infusion, with minimal changes in fructose levels in the blood, surmising that the high concentration of fructose in the brain is due to the polyol pathway that converts glucose to fructose.



High Technology

UTC'S MCQUADE TO CHAIR NEW ADVISORY COUNCIL. The Exascale Computing Project (ECP), a collaboration led by six Department of Energy national laboratories, recently announced the formation of the ECP Industry Council, an external advisory group of executives with collaborative interests in bringing Exascale computing to a range of industry segments. CASE member **J. Michael McQuade**, senior vice president of science & technology at **United Technologies Corporation**, will serve as the first chair of the new council. Exascale refers to computing systems operating at least 50 times faster than the current most powerful supercomputers.

UConn JOINS TWO ENGINEERING RESEARCH CENTERS. **UConn Engineering** joined two Industrial University Cooperative Research Centers, one focused on high voltage and high temperature materials and structures and the other on additive manufacturing. The **UConn Center for Novel High Voltage/Temperature Materials and Structures**, led by Associate Professor **Yang Cao**, will add a new dimension to the existing NSF Industrial University Cooperative Research Center on High Voltage/Temperature. The new UConn center will collaborate with industrial partners to improve the efficiency and reliability of the electrical grid by using next generation materials. UConn is also part of the new **Science**

of Heterogeneous Additive Printing of 3D Materials Center, which will perform research into 3D printing, integrating heterogeneous materials with complex structures and diverse functionalities. The UConn center will be led by Assistant Professor **Anson Ma**.

UConn TO JOIN ROBOTICS MANUFACTURING INSTITUTE. **UConn** researchers will help develop new sensing, software, artificial intelligence, and other technologies to improve the use of robotics in manufacturing for aerospace and shipbuilding industries as part of a new national institute designed to advance robotics manufacturing. The institute, called the **Advanced Robotics Manufacturing Institute**, was announced in January and is the 14th and final national institute created under President Obama's Manufacturing USA initiative, according to CASE member **Michael Accorsi**, senior associate dean of engineering at UConn.

CI LAUNCHES VENTURECLASH CHALLENGE. In March, **Connecticut Innovations** opened the first-round application period for **VentureClash**, Connecticut's \$5 million global investment challenge for early-stage digital health, financial technology, Internet of Things and insurance technology companies. The top award for the challenge will be a \$1.5 million investment. There will be two second-place winners receiving a \$1 million investment, and three runners-up will each receive a \$500,000 investment.



Transportation

'CT TRAVEL SMART' SITE DEBUTS. In February, the **Connecticut Department of Transportation (CTDOT)** introduced a real-time travel information website named, "CT Travel Smart." It is accessible via computer or smart/mobile devices at www.CTTravelSmart.org. The system incorporates data collected from the CTDOT's Statewide Intelligent Transportation System network and Highway Operations Center with real-time travel information, reducing travel time and congestion. Registered users can receive alerts via SMS text or email regarding travel conditions on personalized routes and can select how, when, and for what routes they wish to receive alerts.

BRIDGEPORT STATION UPGRADE NOW COMPLETE. A \$10 million renovation and upgrade project at the **Bridgeport** railroad station is now complete, according to **Connecticut Department of Transportation (CTDOT) Commissioner James P. Redeker**. The project includes real-time electronic signage of arrivals and departures, extended canopies, better lighting, and a resurfaced platform. The Bridgeport train station is part of the **Bridgeport Intermodal Transportation Center**, serving 10,000 customers daily.

STATE RANKS 28th FOR STRUCTURALLY DEFICIENT BRIDGES. According to federal data supplied by the American Road & Transportation Builders Association earlier this year, more than 8% of Connecticut's 4,214 bridges are deficient, including four along I-95 in Fairfield County, that are structurally deficient. Those include the I-95 **Yankee Doodle Bridge** in Norwalk, the I-95 bridge over the **Byram River** in Greenwich and the I-95 bridge over **Route 33 at Exit 17 in Westport**. The study ranked Connecticut 28th nationally among the 50 states for percentage of structurally deficient bridges. A structurally deficient designation means a bridge has reached a point when more repair and rehabilitation is required; however, it is safe for use.

—Compiled and edited by Wendy Swift

From the National Academies (from page 1)

Building America's Skilled Technical Workforce examines the policies and programs that prepare Americans for skilled technical jobs, and provides action-oriented recommendations for improving the American system of technical education, training, and certification.

<https://www.nap.edu/catalog/23472/>

◆ Foundational Cybersecurity Research Strategies

Cybersecurity continues to pose serious challenges to national security, business performance, and public well-being. Modern developments in computation, storage and connectivity to the Internet have brought into even sharper focus the need for a better understanding of the overall security of the systems we depend on. *Foundational Cybersecurity Research*, a new report from the National Academies, focuses on foundational research strategies for organizing people, technologies, and governance. Although this report is aimed primarily at the cybersecurity research community, it takes a broad view that efforts to improve foundational cybersecurity research will need to include many disciplines working together to achieve common goals.

<https://www.nap.edu/catalog/24676/>

◆ Global Health and the Future Role of the US

A joint effort of the National Academies of Science, Engineering and Medicine, this report reflects the increasing attention on "global health security" and what the report terms "reactionary, uncoordinated, ineffective and expensive" US national responses to potential pandemic outbreaks of Ebola, Zika, Coronavirus and influenza. The report provides recommendations on how to increase responsiveness, coordination, and efficiency—both within the US government and across the global health field. The report identifies four priority areas with fourteen recommendations: (1) achieve global health security, (2) sustained response to continuous threats of communicable diseases, (3) save and improve the lives of women and children and (4) promote cardiovascular health and prevent cancer. Notably, the report calls for sustained, or increased, federal funding in areas such as President Bush's Emergency Plan for AIDS Relief, the President's Malaria Initiative and USAID's investments in ending preventable maternal and child mortality.

<https://www.nap.edu/catalog/24676/>

◆ Report Urges Protection of Research Integrity

A new report from the National Academies calls on stakeholders in the scientific research enterprise—researchers, institutions, publishers, funders, scientific societies, and federal agencies—to improve their practices and policies to respond to threats to the integrity of research. The integrity of knowledge that emerges from research is based on individual and collective adherence to core values of objectivity, honesty, openness, fairness, accountability, and stewardship. Integrity in science means that the organizations in which research is conducted encourage those involved to exemplify these values in every step of the research process. The report urges steps to ensure the availability of data necessary for reproducing research, clarify authorship standards, protect whistleblowers, and make sure that negative as well as positive research findings are reported. The report also recommends the establishment of an independent, nonprofit advisory board to support ongoing efforts to strengthen research integrity.

<https://www.nap.edu/catalog/21896/>

◆ Undergraduate Research Experiences in STEM

Many practicing researchers point to undergraduate research experiences (UREs) as crucial to their own career success. 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. UREs have been proposed as a solution to these efforts and may be a key strategy for broadening participation in STEM.

Undergraduate Research Experiences for STEM Students, a new report from the National Academies, provides a comprehensive overview of and insights about the current and rapidly evolving types of UREs, in an effort to improve understanding of the complexity of UREs in terms of their content, their surrounding context, the diversity of the student participants, and the opportunities for learning provided by a research experience. The report provides a set of questions to be considered by those implementing UREs as well as an agenda for future research.

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

Medal (from page 1)

cavities, known as Circuit Quantum Electrodynamics. This Yale architecture, in which quantum information can be distributed by microwave signals on wires, is widely believed to be the most scalable path to useful quantum computers in the near future, and has been adopted by a majority of other groups. Some of Schoelkopf's other inventions include the Radio Frequency Single-Electron Transistor and the Shot Noise Thermometer.

In addition to his scientific accomplishments, Schoelkopf is a dedicated advisor and mentor to graduate and postdoctoral students. Additionally, he is frequently invited to present talks and seminars around the world for the nonscientific community. He is regularly called on to advise industry and federal agencies on the development and commercialization of quantum technologies, and he is a co-founder of Quantum Circuits, Inc., a Connecticut-based company working to deliver the first quantum computers.

Schoelkopf earned a PhD in physics from the California Institute of Technology. A member of the American Academy of Arts and Sciences, the National Academy of Sciences, and the Connecticut Academy of Science and Engineering, he also received numerous awards and honors including recognition as a Fellow of both the American Association for the Advancement of Science and the American Physical Society.

The Connecticut Medal of Science is the state's highest honor for scientific achievement in fields crucial to Connecticut's economic competitiveness and social well-being. Modeled after the National Medal of Science, this award is bestowed by the State of Connecticut, with the assistance of the Connecticut Academy of Science and Engineering, in alternate years. Visit <http://www.ctcase.org/medals.html> to see a list of past winners.

Dyslexia (from page 2)

reading and language arts that includes supervised practicum hours and instruction in the detection and recognition of, and evidence-based structured literacy interventions for, students with dyslexia..."

Empower™ Reading and the Orton-Gillingham Approach are two well-known intervention techniques. Developed in the early 20th century, and in use since the 1930s, the Orton-Gillingham Approach teaches the basics of language through all three learning styles: visual, auditory and kinesthetic. According to the organization's website, the approach "has been rightfully described as language-based, multisensory, structured, sequential, cumulative, cognitive and flexible." The program is based on "time-tested knowledge and practice that has been validated over the past 70 years."

Empower™ Reading is a set of remedial reading programs designed to address the core learning

(See Dyslexia, page 8)

Visit our web site at www.ctcase.org

Dyslexia *(from page 2)*

problems of struggling readers head-on and cover both decoding and word reading and vocabulary and text comprehension. The programs include direct systematic instruction of component skills and knowledge needed for reading development and explicitly teach a set of five decoding and spelling strategies and a set of five reading comprehension strategies. Empower™ also includes a metacognitive organizational structure that is explicitly taught to students, helping them choose which reading strategy to use and how to evaluate whether or not it is working. Empower™ Reading integrates into the remediation direct re-training of a student's negative beliefs and attitudes about learning, maladaptive beliefs that impede the student's motivation for learning and reading.

Maureen Lovett is a professor of paediatrics at the University of Toronto and director of the Learning Disabilities Research Program at the Hospital for Sick Children in Toronto, Canada. She and her team of educators and psychology professionals developed the Empower™ Reading programs over a period of many years. The programs are directly based on results from 30 years of their scientific research on what approaches worked for children and teens with reading disabilities and helped them make the greatest progress.

The New Haven Lexinome Project

Researchers at Yale and elsewhere are studying the potential benefits of treating dyslexia through intense early educational intervention.

In 2015, Gruen and his team kicked off a six-year intervention trial, called The New Haven Lexinome Project, designed to investigate the role of genes in response to intervention. Specially trained New Haven public school teachers are administering Lovett's Empower™ Reading program to two cohorts of impaired readers identified in first grade. These students will be followed through the fifth grade with language and reading assessments, as well as fMRI to track functional changes in the brain as well as efficacy and durability of the intervention over time.

Participating students also will have whole genome sequencing of their DNA. Together with the cultural and family data provided by parents, the goal of the New Haven Lexinome Project is to establish a foundation for "precision education," whereby in the future, interventions for dyslexia can be optimized for individual students.

"Dyslexia is a polygenic disorder (caused by the combined action of many genes), but environmental factors—such as educational experiences and exposure to language—contribute 20 to 40% to the severity," Gruen said. "The New Haven Lexinome Project will be helpful for developing and implementing targeted, highly effective learning strategies."

In his 2017 book, *Language at the Speed of Sight*, author Mark Seidenberg explores what science has proven about how people learn to read and the lack of integration between the science and the classroom. Seidenberg posits: "The successes of reading science create a paradox: if we know so much about reading, why are literacy levels in the United States so low?" His theory is that the classroom hasn't yet caught up with the science.

Bruce Pennington, a professor of psychology and Director of the Development Neuropsychology Lab at the University of Denver, agrees. "Despite what we know about dyslexia, many public schools are still teaching reading in the same way," he said. "To make taxpayer dollars as effective as possible and improve the lives of our students, we need to integrate what science has demonstrated into the classroom." — **Karen Cohen, science writer; owner, The Write Stuff, LLC.** [Author's Note: This article includes information from scientific papers and other resources.]

For links to additional resources, including those noted in this article, see www.ctcase.org/bulletin/32_2/resources.pdf