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CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



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Activities of the Academy

Following is a list of the most recent major reports of the Academy. Reports are available for a nominal fee from the Academy office or web site; executive summaries of the most recent reports are available on the Academy web site at www.ctcase.org.

“Study Update: Bus Propulsion Technologies Applicable in Connecticut” (2003)

“A Study of Fuel Cell Systems” (2002)

“A Study of Bus Propulsion Technologies Applicable in Connecticut” (2001)

“Study of Radiation Exposure from the Connecticut Yankee Nuclear Power Plant” (2000)

“Efficacy of the Connecticut Motor Vehicle Emissions Testing Program” (2000)

“Indoor Air Quality in Connecticut Schools” (2000)

“Efficacy of MTBE Use in Connecticut” (1999)

“Radon in Connecticut: Quantitative Perspectives about Effects on Public Health” (1998)

“Building Agricultural Biotechnology in Connecticut” (1997)

“Status of Connecticut Critical Technologies” (1997)

“Evaluation of Critical Technology Centers” (1996)

“Science and Technology Policy: Lessons from Six American States” (1994)

West Nile Project Wins Connecticut Brothers Top National Honors



Photo: Justin Allardyce Knight

Jeffrey Schneider, left, and his brother Mark with their first prize trophies during ceremonies in Washington, DC, in December of 2003. (Photo courtesy of the Siemens Foundation)

With more than 9,000 cases of West Nile virus (WNV) reported nationwide in 2003 and more than 200 deaths, the virus is a hot topic in the summer months. Thanks to the efforts of two local students, now WNV is even getting national press coverage in the off-season.

Jeffrey and Mark Schneider, brothers who attend South Windsor High School, captured first prize in the team category at the Siemens Westinghouse Science Competition and earned a \$100,000 scholarship for developing an analytical computer model that may aid entomologists in predicting and reducing the spread of WNV. Since receiving the award in December, the Schneiders have been interviewed by national media ranging from the Cable News Network (CNN) to USA Today and have even been invited to ring the closing bell at the New York Stock Exchange.

(See West Nile, page 2)

News from the National Academies

The following is excerpted from press releases of the National Academies and from *Infocus Magazine*, a news resource of the National Academies, which can be found online at www.infocusmagazine.org

◆ Hydrogen: Fuel for the Future?

A new report from the National Academy of Engineering and the National Research Council concludes that the nation's energy economy could be significantly altered, air emissions reduced and domestic energy resources expanded by increasing the use of hydrogen as a major fuel over the next 50 years. But the report warns that there are significant technical, economic, and infrastructure barriers to overcome first.

Hydrogen can be produced using fossil fuels such as natural gas and coal; renewable energy sources such as wind, organic matter, and sun; or nuclear energy. If hydrogen is to gain widespread use, especially for automobiles, it must be produced cost-effectively, either in large plants or in smaller facilities at or near vehicle fueling stations. If it is produced in large plants, infrastructure must be developed to distribute it to fueling stations, and hydrogen storage technologies must be developed for vehicles, the report states.

Fuel cells—devices that combine hydrogen and oxygen to produce electricity—are one of the most promising power sources for clean, hydrogen-fueled transportation, but they must be made more cost-effective and reliable, the report notes. Because hydrogen is flammable and explosive, safer systems for transporting, storing, and handling it also must be developed, the report says.

Currently, producing hydrogen from coal—a large domestic resource—results in emissions of carbon dioxide into the atmosphere. To reduce these emissions, large-scale production of hydrogen from

(See National Academies, page 7)

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West Nile (continued from page one)

"The reaction to our work has been amazing," Jeff Schneider said. "We had no idea when we started this project that it would go this far. No idea at all."

WNV, a significant health threat, was first discovered in 1937 in the West Nile district of Uganda. In 1999, the first ever occurrence of the virus in the Western Hemisphere occurred in New York City. By 2002, the virus had spread to 44 states and resulted in more than 4000 cases and 284 deaths.

The purpose of the Schneiders' project was to develop an analytical model describing the transmission of WNV. "We developed a computer simulation to evaluate the factors affecting the propagation of the virus using a computer model called STELLA 7.02," Mark said.

According to the Schneiders, one of the most difficult parts of their project was learning STELLA. Fortunately, their mentor and chemistry teacher, David White, had attended a two-week summer institute in 2002 where the STELLA (Structural Thinking Experiential Learning Laboratory with Animation) computer model was taught.

"My goal was to bring computational science into the classroom and the curriculum," White said. "I realized that because of their great desire to tackle this problem, Mark and Jeff would be perfect candidates to learn the basics of STELLA and then use what they learned to develop a sophisticated STELLA model of the West Nile virus propagation."

White spent about ten hours showing Jeff and Mark the program. The brothers then spent hundreds of hours on their own learning how to apply STELLA to their project and many more hours reading pertinent research materials and contacting key researchers throughout the United States.

Their model incorporated four parts: mosquito life cycle, blood meal-egg laying, West Nile virus transmission cycle and avian (bird) population dynamics.

The model was validated against the 2000 WNV outbreak in Staten Island and it closely matched data collected in the field regarding observed crow deaths, peak infection period and fraction of infected mosquitoes. For the year 2002, the model predicted 170 dead crows in Hartford County; the actual number was 184.

Jeff and Mark plan to refine their model, noting that other variables could be added including the effect of mosquito predators such as bats and dragonflies, as well as the impact of drought.

The two also are writing a book with White explaining how to use STELLA for various applications. "Our book will be a kind of Idiot's Guide to Using Stella," Mark quipped. The book is slated to be written by December of 2004.

An Update on WNV in Connecticut

In 1997, The Connecticut Agricultural Experiment Station (CAES) established a 36-site mosquito trapping program in response to the detection of an unusually high level of Eastern Equine Encephalitis (EEE) virus activity in mosquitoes in southeastern Connecticut in September of 1996.

"Because we already had a monitoring program in place in 1999, we collected mosquitoes infected with West Nile virus

(See West Nile, page 8)

IN BRIEF

Science and Engineering Notes from Around Connecticut



Business & Industry

FINDING PATTERNS. Over the past two years, students from 20 states and nine foreign countries have prepared for fields ranging from sports to banking to pharmaceuticals to insurance by taking online data mining courses at **Central Connecticut State University (CCSU)**. CCSU offers the world's only online master's degree program in data mining, according to the university. Using tools that include statistical models, neural networks, and regression trees, data mining can help make sense of massive amounts of available data by identifying non-obvious patterns. About fifty students, many of whom already have advanced degrees, have registered for the program.

COST AND BENEFIT. A recent **Yale** study found that when economic studies of the newer antidepressant drugs are funded by pharmaceutical companies, the studies tend to favor the companies' medications over older drugs more often than when such studies are not funded by the companies. The research, which was conducted by **Bruce Baker**, deputy director of the **Treatment Research Program** at Yale, and assistant professor in the school's Department of Psychiatry, highlights a concern about the effect of funding sources on research results.

SOFTWARE GRANT. The **University of Connecticut (UConn)** has received a contribution of \$146 million worth of computer software from UGS PLM Solutions, a subsidiary of the world's largest independent information technology service. The largest contribution the university has ever received, the software, which includes five different packages, will enable users to design and engineer projects, develop models, and produce prototypes. The university will also use the grant to establish an **Institute for Interdisciplinary Engineering Education, Design and Computing**.

TRAINING KIDS. Workers at **Sikorsky Aircraft Corp.**'s plant in Shelton are serving as mentors for high school students from **Platt Regional Vocational-Technical School**, and **Emmett O'Brien Regional Vocational-Technical School**. The mentoring program allows students to obtain hands-on training in building helicopter components. Introducing high school juniors to a hands-on workplace environment allows them to return with more insight and experience for their senior year, says **Joe Grabinski**, a Teamsters Union representative, and the program's main coordinator.



Communication

SECURE DATA. With a \$3.9 million grant from the National Science Foundation, researchers at **Yale** will look at the problems involved in maintaining the privacy of sensitive information while still allowing that data to be searched and managed. "Sensitive data can be protected by encryption while it is in transmission from source to destination," says Yale computer science professor **Joan Feigenbaum**, an investigator on the study. "This project addresses what happens after the data reaches its destination and has to be decrypted for use." The researchers will develop ways to deal with issues that include identity theft, the security and anonymity of medical health records, and telemarketing "do-not-call" lists. They will look at the legal and social issues involved, as well as the technical problems.

CHEAP LIGHT. A cheaper and faster way to create the special infrared light carried by fiber optic cables has been developed by **Janet Pan**, an assistant professor of engineering at **Yale**. Pan was

able to modify the optical properties of gallium arsenide, which in its conventional form is used as a semiconductor in cell phones and lasers. Typically, the light used by fiber optic cables is expensive to produce. Crystals made of Pan's modified gallium arsenide can provide a less costly source for these signals. Pan is working to make the light source brighter, in order to increase the strength of the signals.

MAINTAINING PRIVACY. Using the computer operating system Linux, Connecticut entrepreneur **Christopher Penner** has developed highly secure instant messaging hardware and software for businesses. Provided through Penner's company, **Deviant Technologies, Inc.**, the product, InterIM, allows employees within a company to exchange messages without worrying that their conversation will be intercepted. The technology, explains Penner, uses 512-bit encryption, which can be expanded to 2,048 bits—far more secure than the 128 bit encryption provided by AOL and Microsoft. Penner's system may be particularly appealing to companies in health care and biotechnology, which often send highly sensitive information through computer networks.

SPEAK UP. Ten projects to study and support languages at risk of extinction have received grants from **Yale's Endangered Language Fund (ELF)**. The projects include recording the heroic epics of a western Siberian people; only one epic singer still remains. Researchers will also create an audio dictionary for the Arapaho language; the audio dictionary will record pitch accents, which are difficult for those who are not native speakers to remember. Another project will use a CD-ROM to demonstrate the complex sound system of Tanacross Athabascan, a native Alaskan language.



Education & Cognition

ELECTRONIC PORTFOLIOS. **Manchester High School** was the first public school in Connecticut to offer students the opportunity to create digital portfolios as a way to document their high school experiences. But it's not the only one. **Middletown High School** has begun testing a digital portfolio program that could be offered to all of its students within five years. At Middletown, the portfolios can be used to fulfill graduation requirements for students unable to pass the state-required CAPT tests. Students can also use the portfolios, which can include sound clips and pictures, as part of their college applications, or to apply for jobs.

MEMORIES... A **Yale School of Medicine** study suggests that medications that enhance the formation of long-term memory in the elderly may inhibit the use of short-term, or working, memory. Working memory is governed by the prefrontal cortex, while long-term memory depends on another part of the brain, the hippocampus. The study showed that these two regions of the brain had very different chemical needs. Activation of the enzyme protein kinase A (PKA) helps strengthen long-term memory, but at the same time, it weakens working memory. Inhibiting the enzyme, on the other hand, improves working memory. "This important study tells us that one size may not fit all when developing treatment strategies for cognitive deficits," said Molly Wagster, of the National Institute on Aging.

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) 527-2161, write the editors at 179 Allyn St., Suite 512, Hartford, CT 06103-1422, or email us at acad@ctcase.org

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Science and Engineering Notes from Around Connecticut

TESTING. Students at **Notre Dame High School**, a private school in West Haven, can take tests using a new technology that allows their teacher to see their answers as they work. With the Classroom Performance System, the tests are shown on a large screen, and each student chooses answers, indicating their choices by pressing buttons on a remote. The answers are forwarded immediately to the teacher's laptop. The technology, which tracks the answers both cumulatively and question-by-question, allows the teachers to know if the students as a class understand the material; it also pinpoints students that may need extra help.

WATER WATCH. Through Project Search, a program run by the **Connecticut Department of Environmental Protection** and the **Science Center of Connecticut**, state high school students help track the quality of state streams. The students monitor about 100 rivers and streams around the state, providing data for about 20% of Connecticut's river miles. Project Search, which is the longest-standing volunteer monitoring program in Connecticut, provides students with a real-world, hands-on science experience, giving them the opportunity to "produce physical, chemical and biological water quality data for local, state, and federal management officials," said **Michael Beauchene**, volunteer monitoring coordinator for the state **Bureau of Water Management**.

VENUS AND MARS. Last year, women earned 59% of all college degrees in Connecticut, according to a report by the state **Department of Higher Education**. According to **John Pothier**, the study's author, since 1976 the number of men attending college has dropped by 5%, while the number of women earning degrees has increased by 38%. In community colleges, there are about twice as many women as men. This trend, he says, follows the trend in high schools, which graduate more girls than boys. During the same period, Pothier notes, many elite schools have had to lower their admission standards for men in order to admit a balance of men and women. The reason for this trend is not yet clear.



Energy

BIODIESEL. A **New Haven** gas station will be the first in the state to offer environmentally-friendly biodiesel fuel. Trucks will be able to use the unmanned, automatic **Santa Fleet Services** filling station twenty-four hours a day, making it much easier for users to obtain the fuel. Previously companies who chose to use biodiesel had to have the fuel shipped directly to their tanks. Biodiesel fuel is made of 80% low sulfur diesel fuel and 20% soybean oil. The fuel's manufacturer states that biodiesel lubricates motors better, cuts down on emissions, reduces smoke and odors, and reduces cancer-causing byproducts by up to 90%.

NESTING TIME. Nests built by monk parakeets are causing an average of six power outages a year in Connecticut's shoreline communities. The birds, who began appearing in the state about thirty years ago, build communal nests that can weigh as much as 100 pounds. "The nests get very large on utility poles, and create shorts," said **Anita Steeves**, a **United Illuminating (UI)** spokeswoman. Some nests have caught on fire. According to Steeves, most of the problems have occurred in **Milford** and **West Haven**. Removing the nests, she said, is not effective, because the birds are quick to rebuild them. UI and the state **Department of Environmental Protection** are exploring ways to solve the problem, such as making the utility poles less suitable for nesting.

HIGH EFFICIENCY. Connecticut's first high-efficiency fuel cell has been installed at the **Environmental Science Center** near **Yale's Peabody Museum**. The 250-kilowatt fuel cell will provide about 25% of the building's electricity, and heat from the fuel cell will be used to manage the building's temperature and humidity. The fuel cell, which cost \$1.25 million, was produced by **FuelCell Energy** of Danbury. The fuel cell is about 45% efficient, and making use of the waste heat adds another 20%, for a total efficiency of 65%, said **Steve Brown**, manager of field operations for FuelCell Energy. A diesel generator of comparable size might reach about 30% efficiency. FuelCell Energy has 25 fuel cells in operation; they provide power to customers that range from the US Coast Guard to the Kirin Brewery in Japan.



Environment

FISHY SUBJECT. Scientists from the **University of Connecticut's (UConn) National Undersea Research Center** are helping to explore the New England seamounts, a chain of about 35 underwater mountains that extend from the Georges Bank to northeast of Bermuda. Because the seamounts are so isolated, they have remained relatively untouched by human activities. By studying the seamounts before human impact occurs, the researchers hope to gain a better understanding of how individual organisms interact with their environment. The researchers have explored the seamounts in a small research submersible capable of carrying three people nearly two and a half miles beneath the water's surface. UConn researchers **Peter Auster** and **Ivar Babb** were among those participating in the dives as part of the Census of Marine Life (www.coml.org). In addition to collecting, photographing and filming specimens, researchers used a multibeam sonar to create three-dimensional maps of each seamount.

GETTING HIGHER. Erosion doesn't just wear away mountains, it also causes them to rise higher, according to a **Yale** study. Using a low temperature radioisotopic dating technology that is able to track how fast erosion brings bedrock to the earth's surface, assistant professor of geology and geophysics **Peter Reiners** and his colleagues found evidence that heavy rainfall causes the uplift of underlying bedrock. "People have long thought that the scale and pattern of rock uplift is mostly controlled by deep, plate-tectonic forces," said Reiners. "Based on our findings, it's not too much of a stretch to say the pattern of bedrock uplift is closely tied to climate, through erosion." The study looked at the effects of erosion on the Washington Cascades mountain range in the Pacific Northwest over a period of millions of years.

FONDNESS FOR BEETLES. Volunteers with the **Quinnipiac River Watershed Association** are helping to control the invasive plant purple loosestrife by raising and releasing the *Galerucella pusilla* beetle, which feeds on loosestrife. The loosestrife has been replacing cattails and other native plants from the river, which provide habitat for birds and other wildlife. About 20,000 of the beetles were released in three Quinnipiac Watershed test sites about five years ago. "The bugs have successfully munched away a lot of the plants," says **Mary Mushinsky**, the association's executive director. "They don't seem to have a taste for our own natural plants. You could see the cattails and other plants coming back." It can take from five to ten years for the bugs to control a loosestrife infestation, depending on how large the infestation is. State entomologist and Academy member **Louis Magnarelli** of **The Connecticut Agricultural Experiment Station** approved the initial introduction of the beetles because other states had found them specific to loosestrife, and he has received no reports of any adverse outcomes.

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MEADOWLANDS. The **Connecticut College Arboretum** has begun a project to convert a 12-acre tract of forest habitat to the increasingly rare native meadow and shrub habitat. The multi-step project, which is scheduled to continue through the summer of 2005, will include clearing five acres of white pine and deciduous forest, removing rocks, and planting native grassland species. Invasive species, such as Oriental bittersweet, multiflora rose, Japanese barberry, and Asian honeysuckles, will also be removed. Native meadows in Connecticut have been largely replaced by forestland, causing a decline in the types of creatures that thrive in open meadows. The restoration will take place at the Arboretum's **Matthies Tract in Waterford**; the site will be used for teaching by Connecticut College ecologists.

TIDAL WETLANDS. Efforts to restore tidal wetlands in Connecticut have been working so well, says **Arthur J. Roque, Jr.**, commissioner of the state's **Department of Environmental Protection**, that the state has exported its techniques to other such restoration projects nationwide. Over 450 acres of marshland have already been restored on Long Island Sound, where the goal is to restore 2,000 acres by 2008. One restoration site, at **Lynde Point Marsh in Old Saybrook**, had been a tidal wetland until it was filled with sediment dredged from a navigational channel in the **Connecticut River**. Returning the 10-acre marsh to its original state will make the site part of an important feeding and stopover area for migratory birds. It will also improve surface water flow, water purity, and flood control.



Food & Agriculture

DIET LOSS. The damaging effects of ephedra, a key ingredient in a popular weight-loss product, is magnified by one of the other herbal ingredients in the mix, according to research done at the **University of Connecticut (UConn)**. The product, **Metabolife 356**, lists eighteen ingredients, and it is not yet known which of those exacerbates the problem. In the UConn study, which looked at fifteen people, those taking **Metabolife** experienced a longer period between the electrical signal that initiates the heart's contraction, and the heart's return to its post-contraction state. This represents an increased risk for a potentially fatal heart rhythm problem that affects the bottom half of the heart, explained **Brian F. McBride**, a UConn researcher and the study's lead author. Those taking the product may also have an increased risk of stroke.

NUTS TO YOU. A dwarf chestnut tree that's being developed by **Sandra L. Anagnostakis**, a researcher at **The Connecticut Agricultural Experiment Station** in New Haven, could prove a boon to commercial growers. Although native American chestnuts were destroyed long ago by a chestnut blight, Anagnostakis has been working to develop a variety of blight-resistant hybrids. One promising dwarf variety, she says, has nuts with great flavor and good size. They are also excellent for cooking, and they peel easily. If continued study shows that the tree retains its small size, which is preferred by commercial growers, and the nuts retain their flavor, then it could be made available to nurseries.

GENE EXPRESSION. **Yale** researchers are working on a four-year project to analyze the expression patterns of every gene in every cell type in rice. The project, funded by \$4.5 million National Science Foundation grant, will use such specialized tools as laser capture microdissection and whole-genome microarrays. Researchers, led by **Timothy Nelson**, professor of molecular, cellular, and developmental biology, will collect data for each of the several dozen cell types in a variety of developmental and environ-

mental conditions. "Rice is closely related to other important cereal grasses, such as corn, rye, barley, and wheat," said Nelson. "It has a simpler genome, but much of what we learn in rice can be applied to these other species." The results of the study will be accessible to researchers and agricultural specialists around the world.

DEBUGGING. Researchers at **Yale** have identified a mosquito smell receptor that could lead to the development of better insect repellents. Using mutant fruit flies that had been bioengineered to express mosquito odor receptor genes, the researchers tested the receptors for their sensitivity to the different components of human sweat. "We looked for compounds that could activate or inhibit [the receptors]," said Yale professor **John Carlson**, the paper's senior author. "It is a system that could be used to identify chemicals that might act as insect repellents or as attractants in insect traps." Mosquitoes find hosts primarily by detecting the carbon dioxide they exhale. When they close in on their host, they accept or reject the host by detecting such chemicals as lactic acid on the skin.



Health

HEAVY STUFF. A pilot obesity prevention program in **East Hartford** is serving as a model for a statewide effort. Financed by the US Centers for Disease Control and Prevention, the town's plan, says program coordinator **Alison Case**, takes a multicultural approach in order to encourage members of minority groups, who are often at particular risk, to learn more about obesity prevention. The program, which took three years and \$100,000 to develop, will include restocking vending machines in town buildings, schools, and participating work sites with healthy snacks instead of high calorie ones, labeling the vending machines with nutrition guides, and distributing maps and trail guides to encourage town residents to walk more. The program's goal is to lower the rates of chronic disease and mortality that are associated with obesity.

EASING PAIN. **Yale** researchers may have found a way to ease the burning, vise-like pain experienced by most people with spinal cord injuries. Such injuries often cause hypersensitivity in the pain-signalling nerve cells within the spinal cord. This hypersensitivity means that normal stimuli can be experienced as very painful. Working with rats, neurology post-doctoral student **Bryan Hains** found that after an injury, the number of sodium channels used to conduct nerve signals increased in pain-signalling nerve cells, causing hypersensitivity. Hains and Academy member **Stephen Waxman**, professor and chair of the department of neurology, treated the rats with molecules that blocked production of the sodium channel. "The results demonstrate for the first time that an easily targeted molecule can have dramatic effect on pain after spinal cord injury, which is very exciting," said Hains.

SEROTONIN FINDINGS. In the strongest evidence so far that psychiatric disorders can result from a genetic mutation, Yale researchers **Gary Rudnick**, professor of pharmacology, and **Fusun Kilic**, working with colleagues from the National Institutes of Mental Health, have found a rare form of obsessive-compulsive disorder (OCD) that is associated with a mutation. The researchers found that the defect affects the neuronal protein human serotonin transporter, hSERT. This protein is responsible for the uptake of the neurotransmitter serotonin back into the cell; the mutation allows hSERT to perform this task more efficiently. In essence, that makes serotonin less available as a neurotransmitter. Some drugs used to treat depression, anxiety, OCD, and other disorders work by inhibiting the uptake of serotonin, which increases its

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availability. "Our finding focuses on the serotonin transporter for mood and behavior and ties it to a specific behavioral disorder," said Rudnick.

BETTER SKIN GRAFTS. Yale researchers have developed a new type of artificial skin that is expected to improve overall skin graft performance. A team led by **Jeffrey Schechner**, assistant professor of dermatology, designed a method of producing artificial skin with both skin cells and cells from the lining of blood vessels. Skin produced in this way developed its own blood vessels, which means it can obtain the oxygen and nutrients that it needs, enabling it to survive for longer periods of time. The engineered skin currently used for grafts lacks blood vessels, and does not succeed in the long term. Skin grafts are used to treat burns, trauma wounds, non-healing ulcers, and more. The new technique could prove especially useful in healing patients with impaired blood vessel development, such as diabetics, and the elderly.

EARLY DETECTION. A team of researchers at the **University of Connecticut Health Center** has discovered a gene mutation that causes parathyroid cancer, a rare but often fatal form of the disease. The defect in the HRPT2 gene, says Academy member **Andrew Arnold**, the paper's senior author, "indicates that the mutation is not just a marker of the cancer, but [is] with virtual certainty a causative mutation." The cancer is usually not detected until it is too far along to treat. However, Arnold and his team found that several of the patients had the mutation in a form that could be passed on. "Our discovery changes the clinical management of these patients' relatives, since we can now identify their potential risk for developing the disease," said Arnold. "We can monitor them for the development of parathyroid tumors and treat them in the early stages before the cancer has a chance to metastasize."



High Technology

DIAGNOSING AUTISM. Researchers from **Yale's Child Study Center** and its **Department of Computer Science** are working together to develop a humanoid robot that can detect autism in a child's first year of life. The robot, which will match the size, speed, and range of motion of a one-year-old child, will respond to the social cues given by the youngster, including tone of voice, direction of gaze, proximity, and gestures. The robot will respond with various social cues, which can be controlled by the researchers. The child's reactions to the robot can be measured, so that observers can see how the youngster responds to the cues that show that the robot should be treated as a person, compared to those that indicate it should be treated as a machine.

MAPS FROM SPACE. With the help of infrared and visible light pictures taken by NASA Landsat satellites over the past twenty years, **University of Connecticut (UConn)** researchers have compiled detailed maps showing land-use change in Connecticut. Using the NASA images as a base, researchers at **UConn's Center for Land Use Education and Research (CLEAR)** added a digital database of the state's road system, double-checking the results with aerial photographs, topographic maps, and other data. The CLEAR data shows that between 1985 and 2002, developed land as a whole grew by 15%, double the rate of population increase. The maps are available at <http://clear.uconn.edu>.

NEW GENES. Yale researchers are participating in an international project that will test high-throughput methods that can be used to identify parts of DNA that have functions other than making proteins. The three-year effort will examine approximately 30 mega-

bases, or about 1%, of the human genome. "We are looking for any new coding information, including coding for new transcripts, which, in some cases, will be new genes," said Yale professor **Michael Snyder**, who will lead the Yale team. The \$36 million project is funded by the National Human Genome Research Institute.

CUTTING EDGE. Now, patients at **Hartford Hospital** can have their minimally invasive surgeries done by a three-armed robot. The \$1.2 million da Vinci Surgical System can handle prostate and other urological procedures, abdominal, and some heart operations; Hartford Hospital is the first in the state to offer the device. The robot's 'hands,' which are controlled by joysticks, can hold a number of surgical tools, such as grabbers for pulling tissue aside, or cauterizing devices for burning through flesh and controlling bleeding. According to **Joseph Wagner**, who performs operations using the robot, the device can mimic the flexibility of the human wrist, which standard laproscopic tools cannot do, and makes surgical tasks, such as suturing, much easier. It can also shorten the time that operations take to perform.



Transportation

SPEEDY ENGINE. A pulse-detonation engine under development by East Hartford-based **Pratt & Whitney** could theoretically propel aircraft at four times the speed of sound—about six times as fast as today's jet airliners. This new form of propulsion uses an almost instantaneous form of combustion, in which an explosive detonation of a fuel-air mixture sends a supersonic pulse wave down a metal tube many times a second, according to Thomas Bussing, head of Pratt's Seattle Aerospace Center, where the engine is being developed. The engine, which is expected to be used first in military applications, will be lighter, easier to maintain, and will burn less fuel. Bussing expects that a hybrid jet engine, which would rely partially on pulse-detonation tubes, could be available as early as 2015.

PUBLIC TRANSPORTATION. A fleet of newly deployed buses is making it easier for physically disabled users and others to use public transportation in **New Haven**. The 42 new buses, which are part of a fleet of 110 buses in the region, have no stairs. Instead, bus riders use a ramp to get on and off the bus. The ramp, which extends mechanically from the bus to the ground and can be operated manually if necessary, will allow wheelchair users to use the same entrance as everyone else. And the alteration benefits more than just wheelchair users. "Stairs make it more difficult to get on and off the bus, if you're carrying bags, if you're elderly, if you have handicaps," says **David A. Lee**, **CTransit** general manager. Another 40 of the new buses will be added to the fleet over the next year at a cost of about \$22.87 million. The state will pay \$4.57 of that, and the federal government will cover the rest.

FAIR TEST. To help ensure accountability for Connecticut's new emissions testing program, high-tech procedures will be used to monitor the process. In this new program, run by **Agbar Technologies**, car owners can have their car checked at any of 258 registered garages around the state; this replaces a more centralized program, in which testing could only be done at a few locations. To protect the integrity of the process, Agbar's procedures include iris scanners, which ensure that only licensed mechanics perform the emissions tests; Web cams that scan the cars being worked on; and a secured website, monitored by Agbar and the state, on which mechanics record their work. The program is expected to test about 90,000 cars each month.

— *Compiled and edited by Karen Miller*

From the National Academies (from page 1)

coal would need to incorporate captured and stored carbon, the report says. The US Department of Energy should accelerate development and early evaluation of carbon capture and storage technologies and further investigate production methods that do not result in emissions, such as wind, the sun, and nuclear heat processes.

[<http://books.nap.edu/catalog/10922.html>]

◆ New Guidelines for Water, Salt, Potassium Intake

A new report from the Institute of Medicine (IOM) sets new recommendations for adequate daily intake levels for water, salt and potassium.

The report recommends a daily average intake of approximately 2.7 liters, or 91 ounces, of “total water” (including water contained in beverages and the moisture in food) for women and 3.7 liters, or 125 ounces, for men. Most healthy individuals meet these levels through what panel chair Lawrence Appel, professor of medicine, epidemiology and international health at Johns Hopkins University, describes as “normal drinking behavior—consumption of beverages at meals and in other social situations—and by letting their thirst guide them.”

The report recommends that healthy adults between 19 and 50 years of age consume 1.5 grams of sodium and 2.3 grams of chloride each day (or 3.8 grams of salt). A tolerable upper intake level (UL)—a maximum amount that people should not exceed—is set at 2.3 grams of sodium (5.8 grams of salt) per day. Older individuals, African Americans, and people with chronic diseases including hypertension, diabetes, and kidney disease should consume less.

Adults should consume 4.7 grams of potassium per day, according to the report, to lower blood pressure and reduce the effect of salt and the risk of kidney stones and bone loss.

[<http://www.nap.edu/books/0309091691/html/>]

◆ US-Russia Science Partnership Yields Results

A partnership between the US National Academies and the Russian Academy of Sciences (RAS) to strengthen links between Russian researchers and private companies is showing promising results, according to a recent announcement from the US National Academies. An increasing number of Russian companies are now providing tens of millions of dollars annually for applied research that is overseen by RAS. In addition, Russian businesses are financing hundreds of grants each year for young researchers working in cutting-edge fields.

Under the interacademy program, US and Russian specialists have concentrated on two major efforts—the development of a new innovation center at the RAS Institute of Geology and the expansion of an established center at the RAS Institute of Control Sciences. The program aims to strengthen connections between the centers’ researchers and existing or potential industrial clients through workshops, consultations, and improved electronic networking capabilities.

[<http://www4.nationalacademies.org/news.nsf/isbn/12172003b?OpenDocument>]

◆ Potassium Iodide Recommendations

In a new report, the National Research Council recommends that potassium iodide pills be made available to everyone 40 or younger—especially children and pregnant and lactating

New AAAS Center Hopes to Foster Better Understanding Between Scientists and Public

The American Association for the Advancement of Science (AAAS) recently launched its new Center for Public Engagement with Science and Technology, designed to promote better understanding between scientists and the general public on the increasingly complex scientific issues that affect citizens on a daily basis, and to enhance the public’s input into scientific research agendas by creating opportunities for dialogue among policymakers, the public and the scientific community.

The Center’s inaugural project, a town hall meeting on marine science issues held in February 2004 in Seattle, WA, drew a capacity crowd of 250.

“We need to rise above the traditional scientific paternalism that says the public doesn’t understand,” said Alan I. Leshner, chief executive officer of AAAS and executive publisher of *Science Magazine*, speaking at a briefing to announce the new center. “We have to recognize the legitimate views of the public and engage in the dialogue. We can provide technical information, but don’t presume the appropriate explanation. We have to recognize the public has some core understanding of many issues, and can weigh in with an opinion.”

According to a national survey of 2,400 adults, commissioned by the AAAS and conducted in preparation for the town hall meeting, most Americans believe that human activity is endangering the Earth’s oceans, yet less than one-third feel empowered to influence positive change.

Although only 31% of all survey respondents said they feel their actions could actually affect the health of the oceans, the survey also showed that Americans are nevertheless willing to try to do so. For example, nearly two-thirds of the respondents said they would eat less of certain kinds of fish if it would help the marine environment, and more than half support the use of public money for research and technology to reduce pollution.

Adults living in the Northeast were significantly more likely (84%) than adults in other parts of the country to believe man-made stresses are leading to long-term damage and serious coastal damage and ocean problems. They were also the most trusting of the motives of scientists, at 38.6%.

Overall, 37.7% of respondents were interested in knowing more about the impact science issues have on their lives.
— M. Sherman

women—living near a nuclear power plant. The pills are not recommended for people over 40 because studies have not demonstrated a risk of radiation-induced thyroid cancer in this group, and their risk of side effects from potassium iodide is higher. Potassium iodide can prevent thyroid cancer caused by exposure to radioactive iodine, a compound that could be released during an accident at a nuclear power plant. Potassium iodide will not protect the body against other types of radioactive isotopes released during nuclear-reactor incidents or those likely to be used in a “dirty bomb,” the report notes.

The report recommends that states and municipalities decide how to stockpile, distribute, and administer potassium iodide tablets, and urges federal agencies to keep a backup supply and be prepared to distribute it to affected areas.

[<http://books.nap.edu/catalog/10868.html>]

West Nile Virus (continued from page 2)

just 10 days after *The New York Times* reported the first human cases of the virus in New York City," said Academy member John Anderson, director of CAES.

The program now comprises 91 permanent trapping stations statewide, one-third of which are located in Fairfield and New Haven counties. In 2003, more than 250,000 mosquitoes were collected, identified to species and tested for a variety of viruses. Researchers at CAES also look for changes that might indicate a more virulent strain of WNV. "To date, the virus we are seeing is quite similar to the strains that were first identified," Anderson said.

The number of human cases of WNV in the state has increased steadily since 1999. To date, there have been 41 human cases and one fatality in Connecticut, with the highest incidence in urban and suburban areas.

"West Nile virus is widely established in our environment and it is likely to be around for quite a while," said Academy member Louis Magnarelli, vice director of CAES and state entomologist.

While the risk of contracting WNV remains low, the disease itself is potentially serious. "Of every 150 people who are bit, only one will develop the virus and of those people who develop the virus only 20% will experience the most severe symptoms of meningitis and/or encephalitis," said Theodore Andreadis, chief medical entomologist at CAES and the head of Connecticut's mosquito trapping program. "But, you don't want to get this if you can avoid it."

Up to 50% of patients diagnosed with severe cases of neuroinvasive disease, including meningitis and/or encephalitis, continue to

have problems for up to a year. In even the mildest cases, known as West Nile fever, the virus can be debilitating with a 104-106 degree fever and severe headache.

A vaccine currently exists for horses and a vaccine for humans is in clinical trials, but Andreadis estimates it is still two to three years away. "It continues to be important for us to maintain the surveillance and trapping program, and for people in our state to continue to take precautions to guard against mosquito bites, especially in August and September," Andreadis said.

CAES scientists are working to improve the surveillance program by evaluating different mosquito trapping systems, various trap locations, and biological controls.

Connecticut universities including Yale University and the University of Connecticut also are carrying out WNV-related activities.

As global trade increases, WNV isn't the only concern, but Connecticut is on the watch. "In addition to our mosquito surveillance program, we are constantly flying over the state's forests and conducting ground surveys to ensure that we are on the forefront of any changes that may indicate the presence of any new exotic pests of trees that might have entered our environment," Magnarelli said. — **Karen Cohen**

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An expanded version of this article is available on the Academy's website at www.ctcase.org/bulletin/19_1/wnv.html

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