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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)

Nanotechnology: The Huge Impact of a "Lilliputian" Science

An expanded version of this article is available on the Academy's website at www.ctcase.org/bulletin/18_4/nanotech.html

It is touted by some as the world's second industrial revolution. One government study estimates its potential worldwide economic impact will reach the \$1 trillion range in the next 15 to 20 years. It is the scientific world's next "big" thing and Connecticut wants to be a player in this amazing arena.

What is it? Nanotechnology – the science that takes its name from a unit of measurement called the nanometer (one-billionth of a meter or about the size of ten hydrogen atoms laid side by side) — makes it possible to manipulate matter at the molecular level, making products that use silicon, metals, plastics and other materials lighter, stronger, cleaner, less expensive and more precise.

Nearly 200 people representing government, academia and industry gathered at the University of Connecticut on October 16 for the state's first Nanotechnology Symposium. At the event, arranged by the Connecticut Nanotechnology Initiative (www.ctnano.org), leaders in the field discussed not only research being conducted, but also the potential impact on society in areas ranging from manufacturing to medicine. Exhibit booths featured information about nanotechnology efforts at Connecticut-based Brenner, Saltzman & Wallman, LLP of New Haven; Cantor Colburn of Bloomfield; Connecticut Center for Advanced Technology of East Hartford; Connecticut Venture Group of Fairfield; Gerber Scientific Products of South Windsor; Inframat Corporation of Farmington; Praxair of Danbury; UConn and Yale University; and Alcatel Vacuum Products, Inc. of Hingham, MA.

"Our goal is to make Connecticut a leader in nanotechnology," said Wayne Martino,

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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 at www.infocusmagazine.org

◆ Climate Change and Sustainable Surface Transportation

A new report from the Transportation Research Board's Transit Cooperative Research Program (TCRP) presents a review of climate change science and examines key strategies for reducing transportation emissions, including increasing the use of transit, changing land-use patterns, and adopting energy-efficient technologies and fuels in transit fleets. The report and an associated website developed as part of the project (www.TravelMatters.org) also look at the capacity of public transportation to mitigate greenhouse gas emissions.

Both the report and the website present information in a format that is appropriate for and accessible by both transportation professionals and the general public. The TravelMatters website includes interactive emissions calculators that track greenhouse gas emissions for individuals or transit fleets, as well as a series of online geographic information systems maps that illustrate the correlation between land use, auto use, and carbon dioxide emissions. Both present information on land-use factors that generate demand for travel; ways transit agencies can modify current operating systems to maximize potential ridership; and the potential emissions benefits of alternative, low-emissions technologies.

The report is based on a project conducted by the Transportation Research Board's Transit Cooperative Research Program, with the approval of the Governing Board of the National Research Council, and entitled "Combating Global Warming Through Sustainable Surface Transportation

(See National Academies, page 7)

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Nanotechnology (continued from page one)

partner, Brenner, Saltzman & Wallman and founder and president of the Connecticut Nanotechnology Initiative. "We believe that if we adopt a collaborative approach ... we can achieve that goal." According to Martino, "Connecticut has all of the necessary things to be a leader in nanotechnology – an educated workforce, tremendous research institutions, entrepreneurial spirit and financial support and we have the ability to reach into the universities and develop and cultivate the nanotechnology that already exists there and will continue to grow."

National Initiative

James S. Murday, chief scientist, Office of Naval Research, gave an overview of the national nanotechnology initiative. He noted that we are currently in what he referred to as the "birth" phase of nanotechnology. "It's a healthy baby," he said. "It's robust and squirming around like a new baby — everyone wants to touch it and play with it." (www.nano.gov and www.cfn.bnl.gov/)

But, Murday noted, babies grow up and metrics play a more key role in determining what is expected of them. "We are now at the beginning of the transition into adolescence," he said. "The report card is going to be read. We've got to start defining the appropriate metrics for 'teen years' (approx. 2010 to 2015), when nanotechnology will increase in sophistication and complexity. The right metrics will help get our investment strategy correct." The national initiative provides many resources, including an infrastructure of centers designed to serve as a resource for technology development. "What we are trying to do with the initiative is to develop technology options so that when the commercial industry wrestles with a problem or issue, those options can help them work around it," Murday said.

News from New York ... and a Connecticut Connection

Over the last ten years, and with a financial investment of approximately \$2.5 billion, neighboring New York State has taken a proactive approach to developing an infrastructure that's relevant not only to the research world, but also supports the commercialization of the technology. According to Michael Fancher, director of Strategic Development at the Albany Nanotech Center at the University at Albany, SUNY, "We now have several sites around New York City where a nanoelectronics company can break ground quickly."

New Haven-based Genomas is working to use nanotechnology to develop individualized delivery of pharmaceuticals. Gualberto Ruano, president and founder of Genomas, noted that prosthetics or other implantable devices could be one of the first medical applications for nanotechnology.

Nano Nuggets

The conference featured three breakout sessions: Materials, Aerospace, Energy and Defense; Biomedical, Pharmaceutical and Security; and Education and Outreach.

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Science and Engineering Notes from Around Connecticut



Business & Industry

DATA HANDLING. With a 5-year, \$1.2 million grant from the National Science Foundation, a multi-university team headed by **University of Connecticut** computer science and engineering professor **Sanguthevar Rajasekaran** will research more broadly applicable techniques for processing large amounts of data. The researchers will look for techniques, or algorithms, capable of analyzing data from a wide range of areas. Typically, for example, a chain store marketing department would analyze data differently than a biological researcher: a biologist might need to analyze data according to sequence, while a marketer might need to organize data by association-rule algorithms. Rajasekaran and his team will try to develop generic techniques which can be used to extract information in a multitude of fields.

WHERE THERE'S SMOKE ... According to a recent study from the **Yale School of Forestry and Environmental Studies**, the cost of wildfires is seriously underestimated because when federal agencies calculate those costs, they only take three factors into account: total acres burned, structures destroyed and the costs of suppressing the fires. The Yale report suggests that the agencies should also track restoration costs, watershed impacts, lost tourism revenue, private property losses, and human health effects.

DRUGS FOR ALL. Universities should take advantage of their unique position as research centers to help ensure that low- and middle-income countries obtain access to advanced medicines and technologies, according to a report by faculty and students working at the **Yale Center for Interdisciplinary Research on AIDS**. The report recommends that universities attempt to shape licensing and patent strategies for their work that allow a more universal access, and suggests that they refrain from patenting their discoveries in developing countries. It urges that they include clauses in licensing agreements requiring that products be made available in middle- and low-income countries quickly, affordably, and in sufficient quantities. One such agreement between Yale and **Bristol-Myers Squibb** resulted in a 30-fold reduction in the price of a patented AIDS medication in South Africa.



Communication

GOOD NEWS FOR COUCH POTATOES. High definition digital TV is now available to state viewers from **ComCast Cable** as well as from **Cablevision**. ComCast, the state's largest cable company, is offering HDTV service for five channels: WVIT, CPTV, ESPN, HBO, and Showtime. The digital technology provides a better picture and sound than traditional analog signals. Customers who wish to use HDTV must have a special converter installed on their cable box. While many TV stations do not yet offer digital programming, the federal government has ruled that all broadcasters must switch over from analog to digital signals by 2006, or whenever 85% of households in a market are able to receive a digital signal.

HELP, ANYTIME. Seventeen **Connecticut** libraries now dispense online reference help to patrons 24 hours a day, seven days a week. The program, which is run by Bibliomation, a nonprofit library services group, allows library patrons to chat with professional reference librarians in Connecticut or California any time they have a question. "We have found that people who have to do research generally wait to the last minute," says **Sara Munson**, director of the **Berlin-Peck Memorial Library**, which participates in

the program. In Berlin, she says, they've geared the service toward those using home computers, so that patrons can reach a librarian even when the library is closed. The service costs libraries between \$900 and \$6,875 a year, depending on the size of the town, and on whether the town is a member of Bibliomation. Among the other towns offering the service are **Newington** and **Danbury**.

WI-FI. Over the next three years, **SBC Communications** plans to create 20,000 Wi-Fi hotspots at 6,000 locations throughout the country. While company officials have not yet revealed how many of the sites will be in Connecticut, the state is a prime market for the technology, according to **Chris Sanborn**, vice president of consumer sales operations for **SBC SNET**. Wi-Fi, or Wireless Fidelity, allows computer users wireless access to the Internet. While typically Wi-Fi users must remain within several hundred feet of a hotspot, SBC plans to tie the service to Cingular Wireless networks, using a technology that will allow users to maintain their internet connection even if they move out of hotspot range.



Education & Cognition

STEREOTYPES AND THE SAT. Negative stereotypes dramatically enhance the performance of those who are not their targets, according to a study co-authored by **Yale** psychology graduate student **Gregory Walton** and psychology professor **Geoffrey Cohen**. "Our evidence suggests that 'stereotype lift' improves the performance of white men on the Scholastic Aptitude Test (SAT) by, on average, 50 points," says Walton. He suggests that stereotype-inspired social comparisons may help alleviate the self-doubt, anxiety, and fear of rejection that could hamper performance on such intellectual tests. The researchers found that the effect vanished if negative stereotypes were explicitly rendered irrelevant. The results of the study suggest that the seemingly intransigent racial gap in standardized test performance could result in part from situational cues. "If we can learn to control the cues," said Walton, "we may be able to greatly reduce the achievement gap."

WISE CHILD. Twelve-month-old infants can reason about the behavior of others, but six-month-olds cannot, according to a study done at **Yale**. The researchers showed the infants a movie in which a square helped a ball move up and one in which a triangle hindered it. Then, the infants watched movies in which the ball approached the different shapes. "The 12-month-old infants looked longer at the ball approaching the helper than the ball approaching the hinderer, which means they differentiated between the movies," said **Valerie Kuhlmeier**, a psychology postdoctoral researcher, and the study's lead author. The ability to predict and understand the behavior of others has been thought to develop between the ages of three and five.

READING SCORES. School officials in **New Haven** hope to expand the reading program **Breakthrough to Literacy** into all first and second-grade city classrooms by 2005. The program was introduced into city kindergartens last year, and is currently being used in all first grade and 23 second grade classrooms as well. The initiative uses software to track the children as they practice reading skills on the computer. This provides data that teachers can use

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@ix.netcom.com

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to understand each youngster's strengths and weaknesses. So far, the program has given encouraging results: while three-quarters of last year's kindergartners entered school unable to recognize most letters, or to tell if a book was upside-down, by spring, 77% of the children scored above grade level in letter recognition, and 70% were reading at or above grade level.

EATING SAFELY. At **Mary R. Tisko Elementary School**, in **Branford**, the plastic cards that youngsters use to purchase their cafeteria lunches will also enable lunchroom staff to protect kids with food allergies or special dietary needs. When the children buy their meals, the card alerts the cashier, through the computer screen, to any food that the child cannot safely eat. The cashier can then prevent the child from buying that food. If the card system works successfully at Tisko, the school district plans to implement it at the town's other schools.

SCHOOL DOZE. **Wilton** is the first town in Connecticut to allow high school students to sleep late. The town has delayed its high school opening from 7:35 a.m. to 8:15 a.m. The change is a response to research that has found that although teens need about 9 hours of sleep a night — as much as younger children — their biological clock is pushed back, making it hard for them to fall asleep at 9 or 10 in the evening. Research suggests that many teens are sleep-deprived, leading to problems like depression, anxiety, and poorer grades. Schools with later start times have also seen less tardiness and a lower high school dropout rate; one Kentucky study showed that when high-school start-time was delayed, the rate of teenage drivers in car crashes dropped.



Energy

WIND POWER. The **Yale School of Forestry and Environmental Studies** will use wind power to supply 20% of the school's electricity. The school has purchased \$3,500 of energy certificates through a company in Pennsylvania which markets and develops wind-generated power from a facility in New York. Its decision supports a program initiated by Hartford-based **SmartPower Connecticut**, which encourages businesses and residences to use renewable energy. "As an environment school, we should be setting a good example," said **Dean James Gustave Speth**. "Supporting the development and use of clean wind energy is compatible with this goal."

MAKING ITS OWN FUEL. A new type of backup generator developed by **Proton Energy Systems** combines the ability to produce hydrogen with a fuel cell system, making it a generator that's able to make its own fuel. The UNIGEN stores the hydrogen that it produces, and then, during power outages, is able to generate electricity from the hydrogen it has made. The device can produce enough electricity to last for five or more hours; it provides between 1 and 5 kilowatts of power. In tests, the generator started providing power so quickly that electronic equipment did not even respond to the outage, according to **Proton Energy President Larry Sweet**. Company officials say that the UNIGEN, which produces no pollution or noise, offers a better alternative than batteries for power outages lasting between 8 and 20 hours.

SHUTTING DOWN. Encouraging college staff and others to shut down computers when they're not in use has saved **Southern Connecticut State University (SCSU)** \$40,000 over the past two years, and is expected to cut future electricity costs by \$60,000 annually. An energy audit conducted in 2000 found that most computers were left on at night, but a more recent study showed

that, thanks to voluntary efforts by SCSU staff, nearly 79% of college computers are shut down at the day's end. The college has also installed software that sends computer monitors into sleep mode when they've been idle for twenty minutes. Shutting down the machines in the student computer laboratories at night contributed a large part of the savings.

PORTABLE AND TINY. The prototype for an advanced portable fuel cell system has been developed by the **Connecticut Global Fuel Cell Center**, at the **University of Connecticut**. The methanol-based system, which was commissioned by the US Army, is capable of producing 150 watts of power, and could be used on a battlefield for cooling or running electronic equipment. The Center recently received a grant for another Army project: it will be developing a miniature fuel cell, which would be about the size of a battery, and could be used by individual soldiers to power sights for weapons, helmet-mounted video displays, and atmosphere control devices inside special-use uniforms. The eighteen-month-old Center researches all aspects of fuel cells. "The center is taking a wider focus because no one type of fuel cell will be the winner," said the center's operational director **Nigel Sammes**.

GREEN POWER. A \$1.34 million grant from the **Connecticut Clean Energy Fund** will pay for the purchase and installation of New Haven's first fuel cell. The fuel cell will be used at the **Water Pollution Control Authority (WPCA) East Shore** wastewater treatment plant. Officials expect that the device will produce about 10 to 15% of the plant's electricity, for a savings of about \$13,000 a year. In addition, said **WPCA General Manager Raymond Smedberg**, heat generated by the fuel cell will also help run the plant. In certain applications, heat can be a usable fuel cell waste byproduct; in this case, the WPCA will use it in running the sludge incinerator. The project is part of the city's ongoing effort to identify alternative, environmentally friendly energy sources.



Environment

LAKE WEEDS. Maintaining a healthy lake can be tricky, says limnologist **George Knoecklein**, because of the need to maintain a precise balance between too much and too little aquatic plant life. Knoecklein is a consultant for the **Amston Lake Tax District** in Hebron and Lebanon, which is in the midst of a project to remove about 200 cubic yards of plant material and debris that have been encroaching on the lake. Having a large amount of plant life, explains Knoecklein, provides food sources and protection for big fish like bass, but too much can diminish the light and oxygen that a healthy lake needs. Having few plants makes the lake more attractive for swimming, but it can also exacerbate erosion from winds and waves. To avoid the use of herbicides in the cove, the tax district has hired a company that specializes in mechanical plant management. The company uses diesel-powered, paddle-wheel-driven hydro-rakes to thin the lake's biomass.

DEER DISPERSAL. Like most mammalian species in which one sex leaves the area where it was born, male white-tailed deer are expected to disperse, a behavior thought to reduce inbreeding. As part of her study of non-lethal control of deer, **Uma Ramakrishnan** of **The Connecticut Agricultural Experiment Station** has been researching this premise by collecting blood from deer in North Branford. Genetic analysis indicates that some males do not disperse from their natal range. Some bucks have home ranges that are adjacent to or even overlap their mother's home range; there is even evidence of such males mating with related females, demonstrating that dispersion behavior is not universal.

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WESTWARD HO. The sand in Utah's Zion National Park originated in the Appalachian Mountains, according to **Yale** geology assistant professor **Peter Reiners** and graduate student **Jeffrey Rahl**. The two devised a novel technique for tracing the origin of the sand. By measuring the crystallization age of individual zircon sand grains, they were able to tell when the rock formed inside the Earth's surface. By measuring its cooling age, they could determine when it was eroded at the Earth's surface. "The bulk of the zircons analyzed show a combination of crystallization and cooling ages that is consistent with an origin from only one place in North America: the Appalachian Mountains," said Rahl. The researchers speculate that the sand may have been carried across the continent by an ancient, westward flowing river.

MIXING PUZZLE. Two **Yale** geophysicists have proposed a model that may explain a longstanding puzzle: why the Earth's mantle — the section of the planet just above the core — seems to be both mixed and unmixed at the same time. While studies suggest that the mantle's composition ought to be homogeneous, the lava that emerges from mid-ocean ridges, where tectonic plates separate, is lacking in heavy elements like uranium and thorium. But these heavy elements are abundant in the lava that flows from mantle plumes, or "hot spots." **David Bercovici** and **Shun-ichiro Karato** suggest that a hitherto unsuspected filtering mechanism accounts for the difference. They theorize that lava flowing up slowly from mid-ocean ridges partially melts adjacent material, which slowly extracts heavy metals from the lava. Thus, unlike upwelling plumes that rise faster elsewhere, the lava from the mid-ocean ridges becomes poorer in heavy elements. According to their theory, the lava at the mid-ocean ridges rises slowly, allowing time for the filtering mechanism to leach heavy elements from the mix. By contrast, upwelling plumes rise too quickly for this phenomenon to occur.

THE BIRDS. Large predator birds are learning to live and breed in the suburbs, according to **Dwight G. Smith**, chairman of the biology department at **Southern Connecticut State University**. Great horned owls, for example, which are large enough to kill rabbits, can be found in downtown **New Haven**. And breeding pairs of goshawks, which have typically nested inside deep forests, have been found near homes and factories in **Ansonia**, and in **Washington, CT**. Goshawks are nearly 2 feet tall. Smith believes they may be breeding in every county in the state and adapting to life near humans.

Food & Agriculture

FOOD AND COUNTER-TERRORISM. The US Food and Drug Administration and US Department of Agriculture have selected the analytical chemists of **The Connecticut Agricultural Experiment Station** in New Haven to cooperate with them and three other state laboratories to establish the Food Emergency Response Network, or FERN, to address counter-terrorism activities. This initial phase of FERN will set criteria for laboratory admission to FERN and its methods, instrumentation and proficiency testing. The Station work expands the ongoing cooperative agreement between the Centers for Disease Control (CDC) and the **Connecticut Department of Public Health**.

ORGANIC IN NEW BRITAIN. A three-acre farm in the middle of the city supplies organic produce to restaurants and natural food stores across the state. Using greenhouses, **Urban Oaks Organic Farm** grows herbs, salad greens, tomatoes, eggplant, and more. The farm's appeal, says the produce manager of one natural food store, is the quality of its produce and its organic methods, which

are increasingly popular among consumers. Started in 1999, **Urban Oaks** is expanding at a rate of about 15% annually. In addition to its **New Britain** location, it has smaller organic farms around the state, which produce specialty crops like potatoes and garlic.

AND IN NEW HAVEN. As part of **Yale's Sustainable Food Initiative**, nine university undergraduates spent the summer tending a three-quarter-acre organic garden near the university. The Yale Initiative promotes direct contact between consumers and local growers, organic cultivation, composting, and an increased awareness of food; in addition to the garden, a pilot composting system has been set up in several of Yale's dining halls. Guided by organic farmer **Josh Viertel**, the student farmers learned techniques like planting garlic next to strawberries to repel pests and improve flavor and placing green turf between rows to improve nitrogen levels in the soil.

RETHINKING FIBER. While fiber reduces heart-attack causing cholesterol in men and pre-menopausal women, according to a **University of Connecticut** study, some types of fiber may actually increase the risk of coronary heart disease in post-menopausal women. Research by nutritional sciences professor **Maria-Luz Fernandez**, and a former graduate student, **Sonia Vega-López** found that psyllium powder, a fiber used in Metamucil and some cholesterol-lowering food supplements, increased triglyceride levels in older women by 16%. Triglyceride is a marker for cardiovascular disease. By contrast, psyllium lowered triglyceride levels in men by 17%, while in younger women, the levels remained the same. The study, says Fernandez, demonstrates that a patient's gender and hormonal status must be considered when doctors make treatment recommendations.



Health

ESTROGEN: STRONGER BONES. A small amount of estrogen supplement — about one-quarter of the standard dose — seems to increase bone strength in post-menopausal women, and it doesn't seem to cause the ill effects noted in a much-publicized review of estrogen-progesterin therapy. In a study conducted by **Karen Prestwood** at the **University of Connecticut Health Center** in Farmington, one group of older women took 0.25 milligrams a day of estradiol, a supplement that mimics the body's natural estrogen, while a control group took dummy pills. The women taking the estradiol showed higher bone density in the neck, hip, and spine, and a small increase in total body measurements. The women also evidenced fewer bone loss byproducts. Finding that one-quarter dose of estrogen was as effective as full strength in preventing bone loss suggests, says Prestwood, that an even weaker formulation might also work, reducing even more the possibility of side effects.

ESTROGEN: BETTER READING. Post-menopausal women who receive daily estrogen supplements show an improvement in verbal memory and in oral reading, according to a study conducted at **Yale**. The research examined the specific effects of estrogen on reading ability, looking at neurobiological, behavioral, and brain imaging data, according to principal investigator **Sally Shaywitz**, professor of pediatrics and in the Yale Child Study Center. For example, the brain imaging data suggests that estrogen produces brain activation in "a region sensitive to phonological demands and implicated in reading," says Shaywitz. This work, she says, is also important for clarifying areas that estrogen supplements did not affect, such as vocabulary and spatial ability.

FATAL TUMORS: THE SUGAR. **Yale** researchers may have discovered a way to identify which cancer tumors are most likely

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to be killers; this discovery could also be used in treatment. The scientists looked at cells from 22 different tumors, and found that the most lethal cancers carried "branched oligosaccharides," a kind of long sugar that helps cells move through the bloodstream. The likelihood of a cancer metastasizing can apparently be gauged by the sugar content of the original tumor, said **John Pawelek**, senior research scientist at the **Yale School of Medicine** and co-author of the study. Pawelek has already begun to explore ways to use this information to treat cancer.

FATAL TUMORS: THE MUTATIONS. The leading cause of death from cancer is metastasis, when tumor cells migrate from the original cancer site and form new tumors. Researchers at **Yale** have identified the combination of genetic flaws that enable metastasis to occur. **Tian Xu**, vice chair of the **Department of Genetics** at the **Yale School of Medicine**, and a graduate student, **Raymond Pagliarini**, looked at a variety of tumor mutations. They found that while a mutation in one gene, called the Ras gene, caused tumors to form, those tumors would metastasize only when another mutation, affecting cell communication, also occurred. "By finding common sets of gene mutations that can make a tumor metastasize," said Xu, "this guides us to specific biological processes that can be targeted by drugs... It also implies that we may soon have a better ability to detect early on which tumors require the most intensive treatment to stop cancer."

REMEMBER THIS. With 4.5 million Americans currently suffering from Alzheimer's disease, a number expected to rise, researchers at the **Yale School of Medicine's Alzheimer's Disease Research Unit** are investigating possible treatments. Led by **Christopher H. Van Dyck**, the researchers are testing the effects of Zocor, a cholesterol lowering statin, of B vitamins, and of a drug called neramexane. The three treatments take different approaches. Statins seem to reduce Alzheimer's by protecting neurons. B vitamins, including folate, B12 and B6, decrease levels of the amino acid homocysteine; Alzheimer's is known to occur more frequently in those with high levels of homocysteine. Neramexane may help because it blocks a substance that causes neuron death.



High Technology

DEEP EARTH. A 20-processor cluster computer, financed by a \$60,000 National Science Foundation equipment grant, will help **University of Connecticut** geology professor **Vernon Cormier** find out what's going on 2,000 miles underneath the surface of the earth. Cormier analyzes seismic waves generated by earthquakes to look at the interactions at the Earth's core. The new system will use parallel configurations to solve in a couple of hours equations that used to require a whole day. Cormier's work will help determine whether, for example, the tectonic plates that make up the earth's crust descend all the way to the planet's core, and whether the core is the origin-site of mantle plumes, which cause formations like the Hawaiian islands. Cormier's work has also been used to monitor underground nuclear tests for the Comprehensive Test Ban Treaty.

WELL-ROUNDED. A \$7 million biplane-imaging device allows doctors at **Hartford Hospital** to view images of the brain in three dimensions, instead of just two. Making use of the same technology that generates three-dimensional images for computer games, the 3-D images are created by taking numerous x-rays from various positions, and then putting them together. Three-dimensional imaging provides surgeons with details that they cannot otherwise obtain. The device allows surgeons to perform operations that would otherwise be too risky.

FINGERPRINTS, FASTER. An enhanced fingerprint matching system will allow state and local police to complete background checks within twenty-four hours. This update to the Automated Fingerprint Identification System allows police to access the system's database, which already contains over 1.5 million prints, with another 3 million due to be added. The system replaces an older, manual version in which fingerprint IDs had to be done through FBI headquarters, a process which could take up to six months. The system update, which is expected to be completed by October 2004, will cost an estimated \$10 million. When it is complete, all state law enforcement agencies will have access to the database.



Transportation

CAR CHASE. State police officers now can practice driving aggressively without ever getting in a car. With a \$94,000 driving simulator purchased by the **Capital Region Chiefs of Police Association**, officers will be trained to handle high-speed car chases, night pursuits, and other challenging situations. The machine, which has three large screens, a steering wheel, an accelerator, and a brake pedal, could train as many as 2,500 officers from around the state. The device simulates real-life situations like swerving cars and street-crossing pedestrians; it teaches officers to avoid collisions by training them in evasive actions. It also provides a way to evaluate the trainees' driving skills: it records the sessions, which can then be replayed and analyzed.

NO HANDS! **Hamilton Sundstrand** has won a contract to supply the electrical systems for an experimental, pilotless fighter jet. The company will provide the systems for the plane's primary electric power, for its flight-critical power, and for its electric power conversion. The X-45C will use more electrical systems than previous versions of the plane; using electrical systems rather than the more commonly used hydraulic and pneumatic devices should make the X-45C more reliable, more efficient, and lighter. The plane is expected to make its first flight in 2006.

QUIETING DOWN. **Bradley International Airport** has been getting quieter, according to a recent study. The research shows a decrease in the number of areas around the airport that experience severe noise due to aircraft takeoffs and landings. Severe noise is defined as daily noise levels louder than 65 decibels. In part, the decline has occurred because airlines, responding to the poor economy and an increased fear of terrorism, have cut the number of flights. In the process, they've stopped using some of their older, louder planes, such as the Boeing 737s. About 327 houses, in **Windsor Locks, Suffield, Windsor, and East Granby**, are still considered affected by severe noise. The federal government is expected to finance soundproofing for those homes.

FAST AS LIGHT. Using a new, aerodynamic design and a suspension system design borrowed from recent advances in high-performance mountain bikes, **Yale** undergraduates have built a solar-powered car that can zip along at 65 miles an hour. The car, which will compete in its first international race next May, uses less energy than a hairdryer. It features a titanium frame, and a body made in part of carbon fiber. It weighs less than 560 pounds, including the driver. It also has only three wheels. "We did an aerodynamic analysis and found that if you only have one wheel in the front, which houses the motor, you don't disturb the air as much," said team member **David M. Johnson**. The students hope that the next solar car that they design will be able to reach speeds of 70 miles an hour.

—Compiled and edited by Karen Miller

News from the National Academies (continued from page 1)

Policy.” It was produced by the Center for Neighborhood Technology and TransManagement.

Noting that despite some uncertainty in both forecasting and measurement, “a majority of scientists now agree that the Earth’s climate is warming” and that this warming is “thought to be the result of human-generated emissions,” the report warns that “enough is now known ... to warrant prudent actions to moderate or reduce emissions of greenhouse gases (GHGs).” Such actions will not only increase fuel efficiency, but will improve air quality and human health as well, the report adds.

The report, which focuses on transit-related emission reduction measures, outlines a three-part strategy that includes: identifying ways to reduce per capita miles driven by encouraging transit use and promoting transit-supportive land use patterns; implementing energy-efficient transit fuels and technologies; and developing tools to educate individuals, planners, and transit agencies regarding the climatological consequences of travel decisions.

[http://gulliver.trb.org/news/blurb_detail.asp?id=2071]

◆ Better Patient Care Requires National System

In order to significantly reduce deaths and injuries resulting from medical errors, US health care organizations must adopt information technology systems that are capable of collecting and sharing essential patient health information, according to a new report by the Institute of Medicine (IOM).

These systems should operate seamlessly as part of a national network of health information that is accessible by all health care organizations and that includes electronic records of patients’ care, secure platforms for the exchange of information among providers and patients, and data standards that will make health information uniform and understandable to all, said the committee that wrote the report. In addition, uniform formats and data standards for reporting information on “near misses” — mishaps that were caught before harm occurred — must be developed and adopted.

The report outlines a plan to accelerate the development of data standards in three key areas: clinical terminologies, exchange of data among computers, and representation of medical information in computer programs. It also recommends that government health care programs encourage adoption of these national data standards by incorporating them into their contractual and regulatory requirements.

[<http://books.nap.edu/catalog/10863.html>]

◆ Limited Testosterone Studies Recommended

An Institute of Medicine committee has recommended going forward with clinical trials of testosterone therapy to treat age-related conditions in men 65 and older, but with a limited group of participants and in a “stepwise fashion.” Initial studies should focus on determining the efficacy of testosterone therapy in older men and the nature and extent of the potential benefits. A large-scale clinical trial to determine long-term risks and effectiveness should be undertaken only if clinically significant benefits are demonstrated in the initial studies, the report concludes, adding that the studies should involve only older men who have been diagnosed with low testosterone levels and at least one symptom that might be remedied by the therapy, and who are not at high risk for developing prostate cancer.

Testosterone therapy products have been approved by the US Food and Drug Administration for treating a limited number

of conditions. The rapidly growing use of testosterone therapy among men seeking to counter the effects of aging has outpaced the scientific evidence about the therapy’s benefits and risks for users — particularly its possible effects on the prostate, the report notes. Because little is known about the benefits of testosterone therapy and because the number of study participants and amount of time required to assess the therapy’s benefits are far less than those needed to assess its risks, resources should be targeted first at firmly establishing the efficacy of testosterone therapy for older males, according to the report, which was sponsored by the National Institute on Aging and the National Cancer Institute.

[<http://books.nap.edu/catalog/10852.html>]

◆ No Evidence Cloned Livestock Harmful to Eat

A new report from the National Research Council cites the possibility that genetically engineered fish and other animals could escape and potentially introduce engineered genes into wild population as the leading concern associated with advances in animal biotechnology. The report, requested by the Food and Drug Administration (FDA), also noted that no evidence yet exists to indicate that products from cloned livestock are unsafe for human consumption, although the committee that wrote the report found it difficult to identify concerns without additional information about food composition.

Among the concerns the committee noted was the potential for allergenicity, which can occur when new proteins expressed when genes are inserted from another species trigger allergic or hypersensitive reactions. The committee concluded that the uncertainty surrounding new proteins and potential impact on consumers who may be allergic is serious enough to elicit a moderate level of concern. Additionally, the committee expressed concern that adequate controls be in place to ensure restrictions on the use of carcasses from animals genetically engineered to produce non-food products, such as cows that produce drugs in their milk.

[<http://books.nap.edu/catalog/10418.html>]

◆ Minimize Dioxin Exposure

Dioxins and dioxin-like compounds are pollutants that exist in the soil, water and air. Produced by waste incineration, forest fires, and various industrial processes, these compounds are ingested by animals; they then accumulate in the fatty tissues of the animals, where they can persist for many years. The primary source of exposure in humans is consumption of these animal fats.

Studies of exposures to high levels of dioxins indicate that they can cause cancer and affect reproduction, development, and immunity. However, because information on the health effects of smaller amounts is so limited, and tests to quantify dioxins in samples are so expensive, the extent to which low levels of dioxins trigger health problems — and how small an amount still presents a risk — are not yet known. Given these gaps in knowledge, the government should encourage people to minimize their consumption of animal fats to reduce their dioxin exposure while more information is gathered, according to a new report from the Institute of Medicine. The report urges that the federal agencies responsible for food safety encourage Americans, particularly girls and women of childbearing age, to keep their consumption of saturated fat to no more than 10% of their daily calories, as recommended by the US Dietary Guidelines.

[http://books.nap.edu/catalog/10763.html?infocus_3.3]

Nanotechnology (continued from page 2)

During the first session, Steven Suib, Distinguished Professor and chair, Department of Chemistry, University of Connecticut, discussed methods for making nano materials and shared ideas about controlling size, shape and potential uses. He noted the ability to create very pure materials and highlighted the work being done at UConn.

Jack Solomon, director, Technology Assessment, Praxair, Inc. presented information about the Danbury-based company's involvement in an industry-led partnership called Vision 2020. (www.chemicalvision2020.org).

Academy member Mark Reed, Harold Hodgkinson Professor of Engineering and Applied Science, and chair, Department of Engineering and Applied Science at Yale, explored the limitations and challenges in existing microelectronics technology and the potential use of nanotechnology to address these.

Robert Cordery, Principal Fellow at Stamford-based Pitney Bowes Technology Laboratories, discussed potential applications of nanotechnology in real-world applications of mail and document management.

In the second session, Anne Searls De Groot, founder, CSO and CEO of EpiVax, Inc. (www.epivax.com) of Providence, RI, discussed her company's work in providing rapid analysis of the genetic make-up of pathogens, and vaccine components and vaccine candidates.

Hollis D. Kleinert, president and CEO of Protometrix, Inc., in Branford, (www.protometrix.com) discussed his company's products, which enable the very rapid and efficient analysis of proteins on microarrays.

W. Mark Saltzman, professor and chair of Yale's Department of Biomedical Engineering, (www.eng.yale.edu/biomedical) discussed the development of drug-containing coatings with nano-scale microchannels for use inside the human body.

Fotios Papadimitrakopoulos, associate director, Institute of Materials Science and associate professor of chemistry, University of Connecticut (www.ims.uconn.edu), discussed the development of dense arrays of single-wall carbon nanotubes, in combination with transistors, to create sensitive detectors for biomedical applications and electronics interface with biology.

The third session focused on education and outreach opportunities designed to help people understand and learn about nanotechnology. Presenters included Yale's Mark Reed; Carol Lynn Alpert, director, Strategic Projects, and Joel Rosenberg, education associate for Nanoscale Science and Engineering, Museum of Science, Boston; Harry E. Rosvally Jr., chair, Science Department, Staples High School in Westport; and Robert Birge, Harold S. Schwenck Distinguished Chair of Biological Chemistry, University of Connecticut. — **Karen Cohen**

[Karen Cohen is a freelance writer. She owns and operates The Write Stuff, LLC, in Hebron, CT.]

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