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TechTalk
SERVING THE MIT COMMUNITY

Energy secretary pushes oil alternatives

Deborah Halber
News Office Correspondent

Ethanol made from corn cobs, other agricultural waste and switchgrass will provide up to 5 percent of all motor fuel used in the United States by 2007 and 25 percent by 2012, if the Bush administration has its way, U.S. Secretary of Energy Samuel W. Bodman told an MIT audience on Tuesday, May 9.

Bodman said that while cost-effective methods of producing biofuels are still under development, and incorporating ethanol into the petroleum-based motor fuels infrastructure will be "a massive job," the push is on to increase domestic ethanol production because the United States needs to decrease its dependence on foreign energy sources.

"This country needs a locally grown source of motor fuel. There's a general sense in Congress that we have a lot of incentives to get the industry up and running," he said.

Bodman spoke at the Hoyt C. Hottel Lecture sponsored by the Department of Chemical Engineering and the Energy Research Council. A 1965 MIT graduate, Bodman was an MIT associate professor of chemical engineering before going on to a career as a financier and executive at Fidelity Investments. He was sworn in as energy secretary in 2005.

Bodman said high prices at the pump are on everybody's mind and that the current administration will oppose additional gasoline taxes. "Working families are already struggling under high prices," Bodman said. "I don't think (they're) likely to see enthusiasm for increasing gas prices even higher."

PHOTO / **DONNA COVENEY**

U.S. Secretary of Energy Samuel W. Bodman emphasized the country's need for alternative fuels during his talk on campus Tuesday, May 9. Related photo on page 3.

The $23 billion budget of the U.S. Department of Energy will undergo major reshuffling if the Bush administration succeeds in getting its proposed changes through Congress, Bodman told a packed audience in the Stata Center. While the overall annual budget will not increase, Bodman said the part of the budget devoted to alternative fuels, hybrid vehicles, solar and wind energy, fuel cells and coal as a clean fuel source will increase 22 percent in fiscal 2007.

Nuclear power must play a larger role as a future energy source, Bodman said, and building the new plants to increase its role will take years and cost billions of dollars. The Bush administration has asked Congress for $250 million in 2007 to launch the Global Nuclear Energy Partnership to help meet growing global energy demand, but a repository for nuclear waste needs to be found, and nuclear waste needs to be reduced overall and made less radioactive to pave the way for a new generation of plants.

No new nuclear plants have been built in the United States in 30 years, but six new plants may be up and running by 2015. "We need six new reactors, we need 16, we need 46, but that will only happen if we deal with the question of spent fuel," Bodman said.

PHOTO / **DONNA COVENEY**

Architecture on the move

MIT graduate students carry the frame of a 35-foot mini skyscraper down Massachusetts Avenue on Thursday, May 11, in preparation for its erection in front of the MIT Student Center. The structure weighs about 1,000 pounds. The students are, from left, Rebecca Edson, Peter Schmitt, Philippe Block and Young-Ju Kim. Story, additional photos on page 5.

Picower conference tackles addiction

Deborah Halber
News Office Correspondent

William C. Moyers was a talented, aggressive journalist who never missed a deadline. He sang in his church choir and owned a home on Long Island. For years, he was a closet alcoholic and crack cocaine addict.

"I was physically, emotionally and spiritually bankrupt," he said Monday, May 8, at "On Addiction," the second in the Open Mind Series hosted by the Picower Institute for Learning and Memory and sponsored by CIGNA. "I wanted to die, but I didn't know how to do it," Moyers said. He said he hit rock bottom in 1989 when he was locked in a psychiatric ward in St. Vincent's Hospital in New York.

It took four separate treatments before Moyers "stayed quit." Now, 12 years sober and drug-free, he is vice president of external affairs at Hazelden, a nonprofit headquartered in Minnesota that runs private alcohol and drug rehabilitation centers.

Moyers and other panelists at the daylong MIT conference said that one of the biggest issues facing addiction treatment is the social stigma still associated with substance abuse. While neuroscience offers up new targets for potential anti-addiction drugs, pharmaceutical companies are reluctant to research and develop these drugs, according to panelist Dr. Nora D. Volkow, director of the National Institute on Drug Abuse.

Harvard neurobiologist Dr. Steven E. Hyman, former director of the National Institute for Mental Health; Dr. Robert C. Malenka, a Stanford psychiatry and behavioral sciences professor; and Dr. Wolfram Schultz, professor of neuroscience at the University of Cambridge in England, described the latest neurobiological findings related to addiction.

They pointed to studies that show that addiction changes synaptic connections in the brain in ways that are difficult, if not impossible, to "overwrite." These changes make the addict vulnerable to relapse years after the last exposure to the addictive substance, and occur in brain regions that make repeated cravings for the substance so compelling that the individual often cannot control his or her actions. The brain regions in which addictions take hold are the ones responsible for survival behaviors, making the need for a drug or alcohol akin to a quest for food, safety and other necessities.

Drugs such as cocaine and amphetamine masquerade as neurotransmitters that unleash dopamine. While the brain has ways to fine-tune dopamine levels, cocaine is too powerful for this delicate mechanism. The excess dopamine sets into motion a cascade of events that usurp the brain's innate reward-based system of learning and memory.

According to Susumu Tonegawa, direc-

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Research mathematically confirms that whales have their own syntax.
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Competition 'ignites' clean-energy startups

Energy entrepreneurs in solar power, hydro power and waste processing convinced a panel of industry leaders and venture capitalist judges that their businesses can make clean energy competitive with conventional energy — earning prizes in the 2006 Ignite Clean Energy Business Presentation Competition on Tuesday, May 9.

Started in 2005 by the Energy Special Interest Group of the MIT Enterprise Forum, the Ignite competition provides training, mentoring and coaching, plus $125,000 in prizes and services to clean-energy entrepreneurs, with the goal of building a thriving clean-energy industry in Massachusetts.

Ten start-up companies made it to the finals out of a field of almost 40. The winning team, Stellaris, expects to build a company in Lowell, Mass., to capture its share of the growing $11 billion in annual worldwide solar energy panel sales.

Stellaris addresses the high cost of solar energy systems by decreasing the solar module size by 40 percent while increasing the efficiency of its energy generation by more than 20 percent. The Stellaris PowerTile captures and concentrates indirect light via a translucent panel that can be used in conventional windows, patio tiles and skylights.

Stellaris' chief operating officer, Lee Johnson, presented the team's plan to the judges and an overflow audience of nearly 400 at the Stata Center.

The Stellaris team won $15,000 cash, plus $25,000 in office/incubator space and $7,500 in legal services. The award was presented by Warren Leon, director of the Massachusetts Technology Center's Renewable Energy Trust, platinum sponsor of the competition.

The competition focuses on presentation skills. "Investors are a tough audience," said visiting scholar Linda Plano, the competition chair. "So it's critically important that an entrepreneur be able to catch an investor's imagination and hold it for 10 minutes by getting them excited by the opportunity and confident of the team's ability to execute."

While the finalists' 10-minute presentations were the highlight of the evening, the crowd also took advantage of networking opportunities while viewing 30 exhibits presented by finalists, semi-finalists and sponsors.

Two second-place teams each took home a $5,000 cash award, $25,000 in office/incubator space and $5,000 in legal services: Solasta (the Eagle Axis), a Boston College faculty team developing ultra-high-efficiency solar cells using nanoscale elements; and Feed Resource Recovery, a Babson College student team whose company uses food and other organic wastes to produce biomethane and a highly effective organic fertilizer.

Synergetic Power Systems, one of two MIT student teams in the finals, took third prize with its parabolic concentrating solar collector systems business. The team includes Amy Mueller, Matthew Orosz, Sorin Grama, Ignacio Aquirre, Perry Hung, Elizabeth Wayman and mentor Mark Wolf.

Robert Lifton, CEO of Medis Technologies, provided the keynote address, offering advice from his experience growing Medis from a startup to a business valued at more than $800 million.

PHOTO / **WWW.LKPORTRAITS.NET**

Warren Leon presents the top prize in the 2006 Ignite Clean Energy Business Presentation Competition to representatives of Stellaris, from left, Jim Paull, president and co-founder; Tom Ward, vice president; and Lee Johnson, chief operating officer and co-founder.

AWARDS & HONORS

Six MIT professors are among 116 scientists selected to receive the Sloan Research Fellowship, awarded by the Alfred P. Sloan Foundation. They are **Muhamet Yildiz**, assistant professor of economics; **Kiran Kedlaya**, assistant professor of mathematics; **Dina Katabi**, assistant professor of electrical engineering and computer science; **Fredo Durand**, assistant professor of electrical engineering and computer science; **George Angeletos**, assistant professor of economics; and **Erik Demaine**, associate professor of electrical engineering and computer science. Each will receive a $45,000 grant over a two-year period to pursue independent research projects.

Rohan Abeyaratne, head of the Department of Mechanical Engineering, has been named president-elect of the American Academy of Mechanics, an organization whose objective is "the advancement of the science and profession of mechanics, and whose scope includes all of the disciplines involved in the modeling and study of the response of inanimate and animate matter to forces and environmental effects."

Robert Edwards, the David Sarnoff Professor of Management of Technology, has been awarded the PICMET Medal for Leadership in Technology Management. The award will be presented at the PICMET (Portland International Center for Management of Engineering and Technology) annual symposium in Istanbul this summer.

Wesley L. Harris, head of the Department of Aeronautics and Astronautics, was presented with an honorary Ph.D. from the University of Pretoria in South Africa on April 26. Harris was honored for "his contributions as a leader of the civil rights movement and for his scholarship at the highest level."

Patricia Tang, associate professor in the music and theater arts section, has been selected as an American Association of University Women Postdoctoral Fellow for the 2006-2007 academic year. This fellowship will give Tang time to devote to writing and researching her next book, "Marketing African Music: Africa Fete and the Globalization of Afro-pop."

PHOTO / **MARIE-NOELLE CRUYSMANS**

Princess Mathilde of Belgium presents the Interbrew-Baillet Latour Health Prize to MIT Professor Hidde Ploegh on Saturday, May 6.

Ploegh wins Belgian health prize

Princess Mathilde of Belgium presented Hidde Ploegh, MIT biology professor and member of the Whitehead Institute, with the 2006 Interbrew-Baillet Latour Health Prize on Saturday, May 6.

The prize, worth 150,000 euros (about $192,000), is the largest scientific prize awarded in Belgium. Sponsored by the InBev-Baillet Latour Fund, the award is given annually to one or two scientists "to recognize the merits of a person whose work has contributed prominently to the improvement of human health."

According to a statement released by the foundation, Ploegh "has made fundamental discoveries on how abnormal proteins are broken down in cells and how viruses manipulate these processes to gain advantage. His work has changed our understanding of how normal cells eliminate newly made proteins that are incorrectly folded, and of how viruses evade immune responses."

One of the world's leading researchers in immune system behavior, Ploegh studies the various tactics that viruses employ to evade our immune responses, and the ways in which our immune system distinguishes friend from foe. His findings have implications for vaccine and drug development.

NEWS YOU CAN USE

Avakian reception

A reception will be held to honor Laura Avakian, retiring vice president for human resources, on Tuesday, May 23, in the R&D Commons in the Stata Center.

Avakian, who announced her retirement in February, has been at MIT since 1999. For more information, visit web.mit.edu/newsoffice/2006/avakian.html.

The MIT community is invited to attend the reception, which will be held from 4 to 6 p.m.

ADDICTION–

Continued from Page 1

tor of the Picower Institute, it is particularly apt for the Picower Institute to partner with health insurance giant CIGNA on an exploration of addiction because addiction is "an extreme form of learning and memory."

Panelists also included Dr. Craig Coenson of CIGNA Behavioral Health; Steve Pasierb of Partnership for a Drug-Free America; and Dr. Shelly Greenfield of Harvard Medical School and McLean Hospital. The conference, which brought together diverse stakeholders to explore how insights gained from advanced study of learning and memory could be applied to addiction, was moderated by Ira Flatow, host of National Public Radio's "Science Friday."

Moyers urged recovered addicts and addiction researchers to speak out to end the stigma that is stalling potential treatments for addiction as a disease.

"It starts with people in recovery, but it doesn't end there," Moyers said. "If you are a person in recovery or a family member, go back and share that with someone in your community. If you are a researcher, explain to someone why you are committed to what you are doing. It is science that informs public policy; science has the awesome responsibility to smash the stigma."

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Nocera links basic science to solar power

Deborah Halber
News Office Correspondent

Only the sun, which pours more energy onto the Earth's surface in an hour than the entire planet uses in a year, has the capacity to meet future global energy needs — but people will have to act fast to make use of it, according to MIT Professor Daniel G. Nocera.

The basic science that will help produce an alternative, clean energy source with the help of sunlight needs to be realized within the next 10 years to make a difference, said Nocera, who is the W.M. Keck Professor of Energy and professor of chemistry at MIT.

Nocera spoke Thursday, May 11, on "Powering the Planet: The Challenge for Chemistry in the 21st Century" as part of the MIT Energy Club Lecture Series.

Nocera's laboratory is seeking a future alternative fuel source by studying the principles that govern the conversion of photon energy into chemical potential during photosynthesis. The trick is to design a system in which the energy needed to break the chemical bonds between the hydrogen and oxygen in water is compensated by the absorption of a photon. The payoff: an alternative, clean fuel source — hydrogen — produced with the help of sunlight.

Daniel Nocera

"Solar plus water has the capacity to meet future energy needs, but it is the furthest one away" from being realized, he said. "The basic science has to be solved in the next 10 years so that policy and infrastructure can then be addressed."

Nocera targeted 2050 as the year that solar energy will provide a significant portion of the world's energy needs.

He said that basic science has to provide the answers because an engineering approach alone has not worked. "Inroads are possible when renewable energy is tackled as a basic science project. Even photovoltaics has to be viewed as a basic science problem," he said.

In 2004, according to a world energy assessment report done by Caltech, global energy needs were 13.5 terawatts (TW, or trillion watts). Most came from oil, gas and coal. Nocera calculates that world energy consumption will be 28 TW in 2050, maybe closer to 35.

The growing energy needs of China, India and Africa will account for much of that increase, Nocera said. Currently, the half of the world population living in these developing nations uses the least amount of energy. "If you want to be rich, you use energy," Nocera said. "The rest of the world is trying to reach" the high energy consumption level of the U.S. "We have to hope that India and China won't make the same mistakes as us along the way."

Although dwindling supplies of oil and considerable supplies of methane and coal still exist, environmental concerns, rising prices and security issues have finally converged, creating "consensus that we need new energy sources because of these three factors," Nocera said.

Nocera is certain that using solar energy to harvest hydrogen from water will work, although splitting water into its components is extremely difficult because stable bonds hold the molecules firmly together. Nocera's laboratory is working on a system that produces hydrogen, and it has "a foot in the door" on the even more difficult problem of getting oxygen out.

Algorithms put to use in oil hunt

Nancy Stauffer
Laboratory for Energy and Environment

Mathematical procedures developed at MIT may soon help energy companies locate new sources of oil many kilometers underground.

Working closely with teams at Shell International Exploration and Production, the MIT researchers have demonstrated the power of one of their procedures by mapping out an underground oil-trapping geological formation based on limited seismic data.

To keep up with the world's growing demand for oil, energy companies must drill deeper and look harder in increasingly complex geological structures. But locating such structures many kilometers beneath the Earth's surface is difficult, and getting it right is important. Companies can spend as much as $100 million drilling a single well — a costly mistake if it comes up dry.

To find promising underground sites, companies collect seismic data by using air guns or explosives to send shock waves deep into the ground. How the waves are reflected by underground layers provides information that sophisticated signal-processing techniques can turn into 3-D images of the subsurface. But identifying promising geological structures within those images is difficult.

The Stochastic Systems Group (SSG) at MIT's Laboratory for Information and Decision Systems specializes in designing mathematical procedures, or algorithms, that can quickly analyze complex images. Could some of their algorithms be useful in the oil exploration business? Professor Alan S. Willsky, director of the SSG, and Shell researchers started a project to find out.

Obvious candidates were procedures for defining a continuous surface from a limited set of data points. As a first target, the researchers selected the task of mapping out "top salt," that is, the surface along the tops of contiguous salt domes. Salt domes form deep underground when heavy layers of sediment deposit on salt beds from ancient oceans. The salt extrudes upward like globules in a lava lamp, in the process tilting and blocking off sedimentary layers and creating traps where oil can accumulate.

To generate a map, industrial experts pick points in the onscreen images that they think may be the top salt, and the computer fills in the gaps. By changing their "picks," the experts produce multiple maps for consideration, each one covering several kilometers in length, width and relief. Generating those maps quickly is critical.

The MIT algorithms are well suited to the task. The key is how the different

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PHOTO / **DONNA COVENEY**

Getting energized

President Susan Hockfield and U.S. Secretary of Energy Samuel W. Bodman leave the president's office together on Tuesday, May 9. Bodman delivered a talk on campus later that day.

Experts discuss 'tomorrow's crisis'

Deborah Halber
News Office Correspondent

For every promising energy solution, there are pitfalls that may deflate wind's sails, take the shine off solar, nuke nuclear. The MIT Energy Conference brought together technology, policy, industry and finance leaders for a day to figure out how to ensure that energy technologies evolve to their fullest potential to halt global warming, stabilize energy-related political unrest and bring down prices at the pump.

"Solving Tomorrow's Energy Crisis: Entrepreneurship, Innovation & Policy," drew hundreds of participants from a variety of fields to the Tang Center on Saturday, May 13.

Keynote talks were given by Joseph Romm, executive director of the Center for Energy and Climate Solutions and author of "The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate"; Vinod Khosla, founding CEO of Sun Microsystems, venture capital executive and "social entrepreneur" using microfinance as a poverty alleviation tool; W. Bob Lockwood of Cambridge Energy Research Associates, an advisor to international energy companies, governments, financial institutions and technology providers; and Don Paul, vice president and chief technology officer of Chevron Corp.

Panels of technologists, financiers, politicians and entrepreneurs described the fact and fiction behind biofuels, clean carbon, solar, nuclear, buildings and transportation.

Alternative fuels are key, said William Moomaw, director of the Center for International Environment and Resource Policy at Tufts University. "If we burned all the oil that remains to be recovered, we would be putting 200 gigatons of carbon into the atmosphere," an amount equaling two-thirds of what has already been emitted, Moomaw said.

In biofuels, the news is largely good: "Biofuels, combined with increased vehicle efficiency and smart growth, could eliminate the need for gasoline by 2050," said Yerina Mugica of the Natural Resources Defense Council. The U.S. Energy Bill-mandated goal of 7.5 billion gallons of ethanol a year will likely be met by 2009, well before the 2012 deadline. The challenge will be changing the petroleum-based infrastructure to make ethanol-burning cars and ethanol pumps more widely available.

Solar power's future is more cloudy. In Germany and Japan, the success of the solar industry was directly proportional to the level of government subsidies. In the United States, the industry is determined to go from $10 billion to $100 billion in revenues with the help of government incentives and market-driven manufacturing improvements. Many believe that once solar achieves "grid parity" — cost-competitiveness with conventional grid-supplied electricity — people will choose solar over other sources.

MIT researchers described their state-of-the-art work in metabolic engineering; electrochemical storage; nanotechnology for thermoelectric conversion; organic semiconductors for lighting and solar energy conversion; and chemical breakthroughs in harvesting hydrogen from solar and water.

The conference also provided a forum for entrepreneurs to network with energy venture capitalists, technologists and academics. Students showcased their work in a poster session on Friday, May 12.

The event was sponsored by the Venture Capital and Private Equity Club, the MIT Energy Club and the MIT Sloan Energy and Environment Club.

Team plugs into fuel-efficiency

MIT researchers are trying to unleash the promise of an old idea by converting light into electricity more efficiently than ever before.

The research is applying new materials, new technologies and new ideas to radically improve an old concept — thermophotovoltaic (TPV) conversion of light into electricity. Rather than using the engine to turn a generator or alternator in a car, for example, the new TPV system would burn a little fuel to create super bright light. Efficient photo diodes (which are similar to solar cells) would then harvest the energy and send the electricity off to run the various lighting, electrical and electronic systems in the car.

Such a light-based system would not replace the car's engine. Instead it would supply enough electricity to run subsystems, consuming far less fuel than is needed to keep a heavy, multicylinder engine running, even at low speed. Also, the TPV system would have no moving parts — no cams, no bearings, no spinning shafts — so no energy would be spent just to keep an engine turning over, even at idle.

"What's new here is the opportunity for a much more effective energy system to be created using new semiconductor materials and the science of photonics," said Professor John Kassakian, director of the Laboratory for Electromagnetic and Electronic Systems (LEES), where the work was conducted. The idea is to create intense light, let it shine on new types of photo diodes to make electricity, and bounce any excess light back to the light source to help keep it glowing hot. In theory, Kassakian said, efficiency could be as high as 40 percent or 50 percent.

Kassakian is a professor in the Department of Electrical Engineering and Computer Science (EECS). His research colleagues are EECS Professor David Perreault and LEES principal research engineer Thomas Keim, plus EECS graduate students Ivan Čelanović and Natalija Jovanović.

At the heart of their energy system would be a cylindrical element, such as tungsten, etched with tiny pits — nanoholes — so it emits intense light at selected wavelengths when heated to a high temperature, perhaps 2,200 degrees Fahrenheit (1,500 Kelvin). Special light-sensing cells, made of a new material such as gallium antimonide, would surround the glowing element, picking up the radiated light. A highly specialized filter, set between the two, would let the most useful light wavelengths pass through to hit the photo diodes, while reflecting light of less useful wavelengths back to the heating element, pumping up the temperature.

The relatively high efficiency, compared to photovoltaic systems in use today, is expected to come from scientists' new ability to fine-tune all three main parts of this system. This includes the light emitter, the cells that respond well to that tuned light, and a way to scavenge light at wavelengths that might otherwise be wasted.

"This new technology is what makes it a very attractive system," Kassakian said. "There are the new materials that let us build more appropriate photo diodes" that convert light into electricity. "There's our new understanding of photonics that lets us build the selective emitters" to glow brightly at specific wavelengths. "And there's the photonic band-gap filter, made of thin silicon and silicon-dioxide

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PHOTO / **DONNA COVENEY**

Professor John Kassakian examines a thermophotovoltaic device late last month with, from left, Professor David Perreault and doctoral students Ivan Čelanović and Natalija Jovanović.

Warbling whales speak a language all their own

The songs of the humpback whale are among the most complex in the animal kingdom. Researchers led by an MIT graduate student have now mathematically confirmed that whales have their own syntax that uses sound units to build phrases that can be combined to form songs that last for hours.

Until now, the ability to use such a hierarchical structure of communication has been seen only in humans.

The research, published online in the March 2006 issue of the Journal of the Acoustical Society of America, offers a new approach to studying animal communication, although the authors do not claim that humpback whale songs meet the linguistic rigor necessary for a true language.

"Humpback songs are not like human language, but elements of language are seen in their songs," said Ryuji Suzuki, a graduate student in the Harvard-MIT Division of Health Sciences and Technology. Suzuki, who is also a Howard Hughes Medical Institute predoctoral fellow in neuroscience at MIT, is first author of the paper.

With limited sight and sense of smell in water, marine mammals are more dependent on sound — which travels four times faster in water than air — to communicate. For six months each year, all male humpback whales in a population sing the same song during mating season. Thought to attract females, the song evolves over time.

Suzuki and co-authors John Buck and Peter Tyack applied the tools of information theory — a mathematical study of data encoding and transmission — to analyze the complex patterns of moans, cries and chirps in the whales' songs for clues to the information being conveyed. Buck (S.B. 1989, M.S. 1991, Ph.D. 1996) is an electrical engineer at the University of Massachusetts at Dartmouth, and Tyack is a biologist at Woods Hole Oceanographic Institution in Massachusetts.

Suzuki, who began the project as an electrical engineering undergraduate at UMass-Dartmouth, worked with Buck and Tyack to develop a computer program to break down the elements of the whale's song and assign an abstract symbol to each of those elements. Suzuki wanted to see if he could design a computer program that enabled scientists to classify the structure of the whales' songs.

He used the program to analyze struc-

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Media Lab project explores language acquisition

Sarah H. Wright
News Office

Many people preserve their babies' priceless first smiles, words or steps on video, but Associate Professor Deb Roy, head of the MIT Media Lab's Cognitive Machines research group, is taking parental attentiveness to a whole new level.

Roy is recording nearly all of his new son's waking hours in an ambitious attempt to use these data to unravel the mystery of how humans naturally acquire language within the context of their primary social setting. He will pay particular attention to the role of physical and social context in how his son, 9 months old, learns early words and early grammatical constructions.

Roy's vast recording and analysis effort, known as the Human Speechome Project (speech + home), will yield some 400,000 hours of audio and video data over three years. Roy will present a paper on the Speechome Project at the 28th Annual Cognitive Science Conference in July.

"Just as the Human Genome Project illuminates the innate genetic code that shapes us, the Speechome project is an important first step toward creating a map of how the environment shapes human development and learning," said Frank Moss, director of the Media Lab.

To conduct the Human Speechome Project, Roy has installed 11 overhead, omnidirectional fisheye video cameras and 14 ceiling-mounted microphones that can record all activity in his home. A 5-terabyte disk cache in the basement stores data temporarily until it is physically carted back to the Media Lab for analysis.

Deb Roy

Roy and his wife have already gathered more than 300 gigabytes per day of compressed data by recording an average of 12-14 hours a day. To retain control over privacy, every room is equipped with video-off and audio-off buttons, and an "oops" button to erase previously recorded data.

Once at the Media Lab, the data is stored in a massive petabyte (1 million gigabyte) disk storage system donated by several companies: Bell Microproducts, Seagate Technology, Marvell and Zetera. To test hypotheses of how children learn, Roy's team will develop machine learning systems that "step into the shoes" of his son by processing the sights and sounds of three years of life at home. The effort constitutes one of the most extensive scientific analyses of long-term infant learning patterns ever undertaken.

"It is not enough to simply capture and store all these data using conventional means," Roy noted. "Instead we need to keep all the information online so that we can do rapid exploration of patterns hidden within the data."

Given the voluminous outpouring of data, new visualization techniques have emerged from the project in an effort to expose basic movement patterns within the home (e.g., a person moving from room to room), as well as more complex behaviors (e.g., changing a diaper or putting away dishes). In addition, a variety of speech and video processing algorithms are under development to start making sense of behavioral and communication patterns embedded in the data.

In supporting Roy's project, Moss noted the potential applications that technology developed for Speechome might have.

"Equally exciting are the spinoff opportunities that could result from this research. The innovative tools that are being developed for storing and mining thousands of terabytes of speech and video data offer enormous potential for breaking open new business opportunities for a broad range of industries — from security to Internet commerce," Moss said.

The project has received seed funding from the National Science Foundation (NSF). Christopher Kello, director of the Perception, Action and Cognition program of the NSF, said, "This project will constitute an unprecedented record of the interactions and environmental cues that contribute to the acquisition of language, as well as other social, cognitive and motor skills."

Any downside? "After we had installed all the equipment for data collection and in-house storage, our home electricity bill quadrupled," Roy said.

Mini skyscraper 'Muscles' way onto campus

Sarah H. Wright
News Office

"Muscles," a 35-foot-high skyscraper designed to change posture thanks to a jointed spine and pneumatic muscles, was constructed in front of the Stratton Student Center at MIT on Friday, May 12.

Winner of MIT's first mini-skyscraper design competition, "Muscles" is the brainchild of four graduate students known collectively as the WhoWhatWhenAir skyscraper team. The team was awarded $7,000 to build its tower, which will be on view at MIT through May 21.

The Muscles designers — Philippe Block, Ph.D. candidate in building technology; Axel Kilian, postdoctoral associate in architecture; Peter Schmitt, master's candidate in media arts and sciences; and John Snavely, master's candidate in architecture — responded as a team to questions about their innovative and victorious structure.

Q. *Your team members have previously worked on projects using artificial muscles, including retractable roof structures, athletic cars and kinetic sculptures. What was your vision for Muscles?*

A. Our goal was to design a structure that responds to the people interacting with it. The design attempts to make tall buildings smarter — that is, to integrate active control in structures.

Q. *How exactly does Muscles interact?*

A. Our tower is an articulated jointed spine controlled by a series of pneumatic "muscles". Activating the pumps allows the structure to bend in different directions by introducing a twist in the jointed core. By stacking and activating several muscle units, the mini skyscraper can gently curve in space away from its upright equilibrium position. The pneumatic movement is graceful and precise. If no muscles are active, the core keeps the structure upright.

Q. *Say Muscles was scaled up from 35 feet to 1,400 feet. What value would a moving skyscraper have?*

A. In the mini skyscraper, actuation is used for expressive movement. In a full-scale tower, such active structural components would be used to cancel out movement and stabilize a tall structure against changing forces from wind or earthquakes.

Q. *What were some of the toughest design challenges?*

A. Toughest? Scaling up an exciting idea from a drawing to a functioning prototype and then to a full outdoor structure that has to resist wind loads, pass security, be accepted by the city of Cambridge and fit within our fabrication capabilities and budget constraints.

Q. *Who or what inspired you to build a tower that resembles a body more than a building?*

A. Structural engineer Guy Nordenson formulated the idea of responsive structures for buildings. He said, "If architects designed a building like a body, it would have a system of bones and muscles and tendons and a brain that knows how to respond. If a building could change its posture, tighten its muscles and brace itself against the wind, its structural mass could literally be cut in half."

The mini-skyscraper competition offered an opportunity to try out these ideas at a reasonable scale.

Q. *What are your building materials for Muscles?*

A. The original muscles in the prototype were built from cable sleeving mesh and bike tubing with metal fittings to integrate valves and attachment points.

The final core structure consists of sculpted arms built from a lightweight fiberglass composite. The pneumatic actuators (the "muscles") and control system were shipped from Germany, sponsored by the manufacturer Festo.

Q. *Anything else MIT readers should know?*

A. We are excited to see the structure slowly come together and hope it will be received well by the MIT community. We depend a lot on the support from MIT — from student volunteers, the Department of Architecture and Professor Yung Ho Chang, head of the architecture department, who initiated the competition, as well as from the tremendous support of professors, facilities and administration in making this project become a reality.

The MIT Mini-Skyscraper Competition was organized by the Department of Architecture.

For more information on the contest, visit architecture.mit.edu/mini_skyscraper/.

To see Muscles in motion, visit destech.mit.edu/akilian/newscreens/muscletower/applet/index.html.

To read a blogography of Muscles, visit www.musclesfrombrussels.blogspot.com.

PHOTO / **PHILIPPE BLOCK**

Achitecture postdoctoral associate Axel Kilian, left, works with graduate student John Snavely on an early prototype for the 'Muscles' mini skyscraper.

PHOTO / **PHILIPPE BLOCK**

Media arts and sciences graduate student Peter Schmitt works on the 'Muscles' mini skyscraper mold in the MIT Paint Shop. He is cutting off excess fiberglass/epoxy cloth, the material that forms the core of the structure. The negative mold is made of plywood and cardboard.

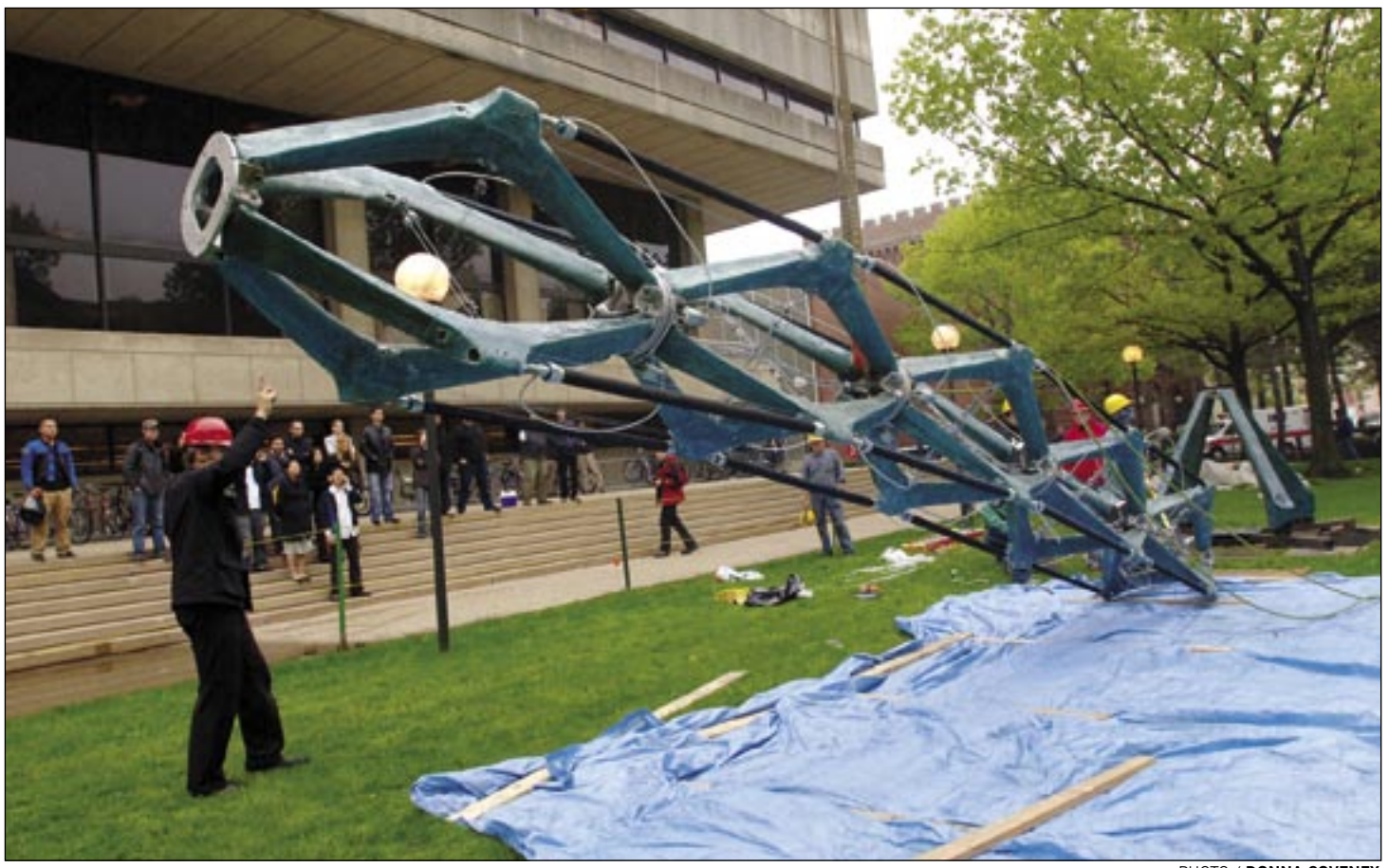


PHOTO / **DONNA COVENEY**

The winning mini skyscraper 'Muscles' is hoisted into position in front of the Stratton Student Center on Friday, May 12.

Technology conference focuses on Lebanon

The International Conference on Lebanese Technology Development (TECHLEB 06) will be held at MIT on Saturday, May 20, and Sunday, May 21.

The mission of the conference, which is being organized by the Lebanese Club at MIT, is to define strategies essential to making Lebanon a vibrant and sustainable technology hub in the Middle East and Africa region.

The conference is being held under the auspices of the Lebanese prime minister, Fouad Siniora. Lebanese minister of finance Jihad Azour, minister of telecommunications Marwan Hamade, minister of culture Tarek Mitri, and Raymond Khoury, director of the technical cooperation unit at the Office of the Minister of State for Administrative Reform, will represent the Lebanese government.

At the conference, the MIT Enterprise Forum will introduce its plans to bring MIT's $50K business plan competition to Lebanon and the Arab world.

Major sponsors of the conference include the American University of Beirut, Booz Allen Hamilton, Berytech, Byblos Bank, Cyberia, Dubai Silicon Oasis, IncoNet Data Management, Investcom, Kafalat, Kommsult, the Lebanese American University, Mobius Logic, TagLogic and the University of Balamand.

For more information, visit www.techlebconference.com.

Nobelist offers views on flu pandemic

Anne Trafton
News Office

If an influenza pandemic sweeps across the globe, as many public health officials fear, it will take a combination of scientific work and political planning to handle it effectively, said Nobel laureate Peter Doherty at a lecture at MIT on Thursday, May 11.

Even if scientists can create a vaccine against the deadly disease, producing enough for everyone who needs it and distributing it efficiently present enormous challenges, Doherty said.

"These are not simply scientific problems," he said. "It's really a matter of policy and logistics."

Doherty offered the 2002-2003 SARS (severe acute respiratory syndrome) outbreak as an example of a fairly successful handling of a new infectious disease. In that case, scientists were able to figure out quickly what was causing the disease and take measures to contain it.

Doherty, who has spent his entire professional life studying infectious diseases, won the Nobel Prize in Physiology/Medicine with Rolf Zinkernagel in 1996 for discovering how T cells recognize their targets. He now has laboratories at the University of Melbourne in Australia and St. Jude Children's Research Hospital in Memphis, Tenn.

In his May 11 lecture, titled "Plagues, Pestilences and Influenza," Doherty, a native of Australia, offered some historical background to the current avian flu scare.

A strain of avian flu known as H1N1 is believed to be responsible for the 1918-1919 influenza pandemic that killed 40 million people around the world. Public health officials fear the avian flu strain (H5N1) that is now infecting birds in Asia and Europe could mutate to a form that spreads easily from person to person, leading to another deadly pandemic.

"If it did, we're worried it could be very severe and very dangerous," Doherty said.

Unlike the typical flu, which kills about 36,000 people in the United States each year, mostly the elderly and very young children, the strain that caused the 1918 outbreak was most deadly in young adults. That's because it provoked a very rapid immune response called "cytokine storm," which leads to blood leakage and shock, according to Doherty. "People essentially drowned in their own body fluids," he said.

That quick death actually causes influenza pandemics to eventually burn out, as carriers die before passing on the virus. "Generally it's not beneficial for pathogens to kill their hosts," Doherty said.

Smaller flu outbreaks in 1957 and 1968 also followed genetic mutations in the influenza virus.

Human history has often been shaped by periodic outbreaks of infectious disease, according to Doherty. "Infectious disease has always been a major force in human evolution, particularly after we started to develop villages and cities," he said.

The worst infectious disease outbreak in recorded history, the bubonic plague that struck Europe during the mid-14th century, killed one-third of the continent's population.

Even that long ago, people had a concept of contagion, but they didn't know anything about the existence of micro–organisms and how they carry disease, Doherty said. Lacking any knowledge of infectious agents, people came up with their own theories of how diseases spread. Jews were persecuted because they were suspected of poisoning drinking wells, and women believed to be witches were burned.

Ignorance about diseases like rabies probably also gave rise to myths about monsters, Doherty said. "It's almost certain that the Dracula legend arose from rabies," which causes an aversion to light and voracious sexual appetite, he said.

It wasn't until scientists developed the germ theory of disease in the late 19th century that people realized diseases were carried by micro–organisms, including bacteria and viruses.

For fuller text, visit web.mit.edu/newsoffice/2006/plagues.html.

OIL

Continued from Page 3

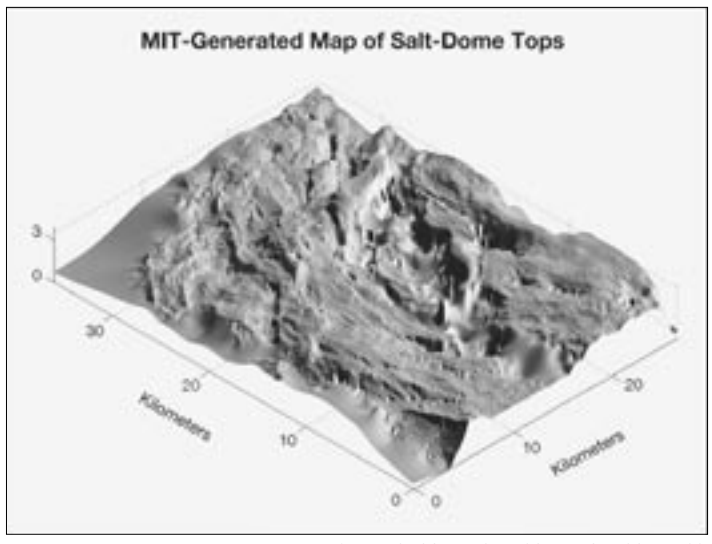
picks relate to one another. "There are statistical relationships between things that happen at different points in space," said Willsky, the Edwin Sibley Webster Professor of Electrical Engineering. "You don't expect properties of the rock at one point to be completely independent of the properties a meter away."

Given a set of picks, the MIT algorithms automatically define statistical relationships from one pick to the next and fill in the missing points based on those relationships. Moreover, they calculate the uncertainty associated with each generated point.

But identifying the top salt is only the beginning. The company also needs to see the shapes of geologic formations to guide their drilling. With a salt dome, for example, the company needs to drill into the adjacent sedimentary layers but not into the salt itself because it will contain no oil.

Again, the MIT researchers have algorithms that can help — algorithms that they have been using to help medical researchers interpret data from MRIs and CT scans.

Key to the success of this research is constant interaction between the MIT and Shell researchers. "We don't just develop tools and throw them over the transom to Shell," said Willsky. "We're constantly looking over each other's shoulders" to find areas of mutual interest and potential benefit. Teaching each other about their separate areas of expertise is also critical. For Shell, the challenge is to understand MIT's "modern mathematical tools" well enough to build them into the company's existing analytical methods.



GRAPHIC /COURTESY JASON K. JOHNSON, EECS

MIT algorithms were used to create this map, which shows a geological structure that traps oil many kilometers below the earth's surface.

This research was funded by Shell International Exploration and Production through MIT's Computer Science and Artificial Intelligence Laboratory.

TPV

Continued from Page 4

layers that act as selective mirrors, letting the desired wavelengths through and reflecting back the rest."

Of course, numerous engineering problems remain to be solved. Kassakian said the light-collecting cells will have to be cooled: "We'll want to run as hot as we can, but not melt everything." Also, different materials are being tested to see which work best in terms of light emissions, light harvesting and light reflection.

"This whole concept is simple and not new," he added. Back in the late 1960s and early 1970s, much research was done on TPV and light-harvesting technology, first to create solar energy systems for spacecraft, and then in response to energy shortages that spurred an intense burst of research into various alternative energy technologies, he said.

The first focus of this MIT research "is for an automotive system that will take excess heat from the TPV system and use it to drive the car's heating and air conditioning systems," Kassakian said. "And what this would do is replace the present alternator and air conditioner, both of which are now run by the engine."

In addition, new TPV systems might mesh nicely with hybrid automobile technology, in which fuel is saved by shutting down the engine when the car is stopped, say at traffic signals.

Recent papers on this work have appeared in Physical Review B and the Journal of Applied Physics. Initial funding for the research was from the MIT/Industry Consortium on Advanced Automotive Electrical/Electronic Components and Systems.

The work is presently funded in part by Toyota, but Toyota has made no decision to develop this technology for automobiles.

DIGITALK: WHERE IT'S AT

Certificate renewal

June is quickly approaching, and that means renewal time for MIT personal certificates. These certificates provide access to MIT's secure web applications, including benefits, SAPweb and WebSIS. It's also time to renew the MIT Certifying Authority (MIT CA). The MIT CA authenticates MIT's secure web servers to your computer.

Renewal of certificates is not automatic, and personal certificates obtained in the past year are set to expire on July 30. MIT community members can get their new MIT CA and personal certificates starting June 5. Go to web.mit.edu/ist/help/cert.

Note that if you use certificates on multiple machines, you will need to get a new certificate for each machine. For assistance, contact computing-help@mit.edu or x3-1101.

Math tools

IS&T recently launched Mathematical Tools at MIT, a web topic page that gives the community access to comprehensive information on math software and related topics. It's located at web.mit.edu/ist/topics/math.

This resource features an overview of commonly used computational and numerical software packages (MATLAB, Mathematica, Maple). It also has links to software licensed on Athena or for private machines at discounted rates; tools for web publishing (e.g., mathML); and tutorials and FAQs. Students can download MATLAB at no charge for academic use on their personal computers.

Technotrash recycling

The MIT Department of Facilities has started a Technotrash recycling program on campus. A range of items can be placed in the specially marked bins for recycling: cellphones and PDAs; diskettes, CDs, DVDs and tapes; and rechargers and rechargeable batteries. It's fine to toss in the jewel cases and packaging too.

So far, Technotrash bins have been placed in three locations: Building 9, 4th floor; the Stata Center, Dreyfoos Lobby; and the Stratton Student Center, main lobby.

To learn more, go to web.mit.edu/facilities/environmental/reuse.html.

Connections for guests

Campus guests can register their computers for one to five consecutive days of network service, up to 14 days per year. To connect laptops to MITnet, visitors need a wireless network card that supports the 802.11 a/b/g standard. The laptop also needs to be configured for DHCP, which obtains an IP address automatically. Many network cards are configured for DHCP by default. Firewall software, if running, needs to be disabled until the registration process is complete.

To register, visitors should start up a web browser and select "visitor registration" from the onscreen menu. A web page will display the MITnet rules of use, followed by a screen requesting the visitor's contact information, number of days of connectivity, and event for which they are on campus. The connection takes about 10 minutes to activate. For more information, see web.mit.edu/ist/topics/network/netguests.html.

Digitalk is compiled by Information Services and Technology.

In a college first, MIT is named HeartSafe Community

Sasha Brown
News Office

MIT became the first college in the country to be officially honored with a HeartSafe Community designation on Wednesday, May 10, in the Student Center.

The HeartSafe Community Program is an initiative by the Massachusetts Office of Emergency Medical Services (OEMS) and the Emergency Medical Care Advisory Board to recognize efforts to provide survival technology for residents and visitors. These include automatic defibrillators — electrical devices that can restore a normal heartbeat during a heart attack — as well as the training needed to use them.

MIT's first public automatic defibrillator has been in place in the Student Center for a couple of months. On May 10, John Guidara, executive director of the Metro Boston Emergency Medical Services Council, presented MIT with road signs to be installed on Massachusetts Avenue indicating the HeartSafe designation.

Junior Rachel Williams, chief of MIT's Emergency Medical Services (EMS) and sophomore Jonathan Liu, of the American Red Cross Team and Network of MIT (ARCTAN), officially received the signs.

"Receiving designation as a HeartSafe community is a great honor to the dedication of everyone who worked for it. The effort was tremendous, and MIT-EMS is proud to represent the MIT community as we strive for a safer campus," Williams said.

Dale Cotton (S.B. 2005), a member of MIT-EMS, was one of the driving forces behind installing the defibrillators, said Maryanne Kirkbride, clinical director for campus life. "It is the story of how the vision of a hard-working engineering student, then alum, ignited fellow students, alumni, faculty and staff around the goal of ready access to life-saving care on campus," Kirkbride said.

Many campus offices and groups besides MIT-EMS and ARCTAN were involved in bringing the defibrillators to campus, including the Department of Facilities, MIT Medical, MIT Police, Information Services and Technology, Environmental Health and Safety, the Department of Student Life, the Campus Activities Complex, Human Resources, the Information Center, Sodexho, the Alumni Association, DAPER and others, Kirkbride said.

Orchestra leader bids farewell tonight

Lynn Heinemann
Office of the Arts

Dante Anzolini, music director of the MIT Symphony Orchestra (MITSO) since 1998, will conduct his farewell concert tonight, leading the symphony in a performance of Mahler's Symphony No. 7.

The 8 p.m. concert in Kresge Auditorium will be followed by a post-concert reception in the lobby of Kresge. Admission is $5 at the door.

Anzolini, who is also music director of the Teatro Argentina Orchestra, is renowned in the United States and Europe, where he has toured extensively. During his years here, he has maintained an active conducting schedule outside of MIT, to critical acclaim.

Institute Professor John Harbison praised Anzolini, noting, "It has been a privilege for us in music and theater arts to acquaint our students with Dante's high level of musicianship." Harbison also said that MIT students could not have played for a "more articulate, perfectly prepared and musically acute conductor" than Anzolini.

Anzolini's students sang their own songs of praise for their teacher and conductor, citing both his remarkable musical abilities and his high standards on their behalf.

Daryush Mehta, a doctoral candidate in health sciences and technology and MITSO clarinetist for three years, recalled Anzolini's astuteness and candor as a conductor: At the end of a long rehearsal, Anzolini observed that Mehta had played a single incorrect note earlier in the evening.

"From that moment on, I knew Dante was special. He could hear a pin drop in the middle of a snowstorm from a mile away — and then he would tell you if it were flat or sharp," said Mehta.

Violist Andrew McPherson (S.B. 2004, music and electrical engineering; M.Eng. 2005), also remembers being impressed, if not intimidated, by Anzolini's musical ear. "Dante once remarked to his conducting class that if someone throws a cat on the piano keyboard, we should be able to transcribe the notes it plays. I'm convinced he could do this."

McPherson credits the MIT music section and, most importantly, Anzolini himself in shaping his decision to continue in the Ph.D. program in music composition at the University of Pennsylvania. Anzolini "treated us as professionals ... and constantly challenged us with difficult and complex repertoire," McPherson said.

That repertoire included large orchestral works by Bartok, Stravinsky, Copland and Ives, compositions by MIT faculty and student composers, and pieces more familiar to American audiences such as Georges Bizet's "Carmen Suite" and symphonic dances from Leonard Bernstein's "West Side Story."

Pieces by Mahler are prominent on the list of works Anzolini has conducted at MIT, including Symphonies No. 1, No. 6 and No. 9. MITSO recorded Mahler's Fifth Symphony on its first European tour in May 2000 and the Adagietto movement was played in Killian Court on Sept. 12, 2001, during the community response to the attacks on the World Trade Center and Pentagon.

Mehta said, "My mouth watered almost each time our repertoire list would come out. Dante knows how to choose a wide range of energetic and level-raising repertoire. He has the ear, the heart and the soul of a great orchestra conductor."

Anzolini's next performance outside MIT will take place on Sunday, May 21, when he will lead the Choral Arts Society of Washington, D.C., in a performance at the Kennedy Center for the Performing Arts in celebration of its 40th anniversary.

An interim conductor will lead MITSO next year while a search is launched for a new director.

PHOTO / **THOMAS MAXISCH**

Dante Anzolini, the longtime music director of the MIT Symphony Orchestra, will conduct his farewell concert at Kresge Auditorium this evening at 8.

PHOTO / **DONNA COVENEY**

Once there was sun

On a sunny day earlier this spring, light made a play of shadows in the nearly empty corridor on the first floor of the Whitaker Building.

Infotech program aids African students

Sasha Brown
News Office

Senior Bryant Harrison first heard about the MIT Africa Internet Technology Initiative (AITI) during high school when the relatively new program was highlighted in a Boston Globe article.

"It sounded like an impressive program," said Harrison, who is now president of the initiative. Harrison taught a course in information technology in Kenya through the program during the summer of 2004.

Each summer for the past six years, AITI has sent MIT students, both graduate and undergraduate, to several countries in Africa. Working in teams of four, the students teach six-week courses in computer programming.

Paul Njoroge, a Kenyan graduate student in electrical engineering and computer science, started AITI in 2000 to combat the disparity he saw between the information technology knowledge base in the developing world and the United States.

AITI was officially recognized as part of the MIT Association of Student Activities last summer. But in recent months, AITI officers have struggled to find the funding they had in the first years of the program.

"Once we were past the first few years of funding, we were kind of on our own," Harrison said. "It is an expensive program to maintain." AITI released a recent budget that shows the Kenyan portion alone costs more than $25,000.

"Ideally we would like to have huge grants, but those take a lot of time and experience," he said. "We need to take steps to be more sustainable."

AITI was founded on the notion that information technology is empowering, Harrison explained. Students in the developing world do not have the kinds of information technology programs "we take for granted here," he said. Many of the roughly 75 university students who take AITI courses have Internet experience but lack programming experience, he said.

In Nairobi, Kenya, MIT students teach courses at a local high school and at Strathmore College. Students then return and train the next AITI teachers. "Each generation of AITI leaders rigorously trains the next," said President Emeritus Paul Gray, who helped Njoroge start AITI.

Over the years, Gray said he has received glowing thank-you notes from principals and teachers in Africa whose students went through the program. "The program has been very successful, not only in its objective, but also in bringing MIT there and having our name known for this kind of work," Gray said. "It is well on its way to becoming a permanent part of the Institute."

Usually, roughly 16 MIT students are chosen each year from a pool of between 60 to 75 applicants. This year, the group was only able to send 10 MIT students, who all went to Kenya, because of the lack of funding, Harrison said.

AITI looks less for extensive Java programming experience than for the kind of people who will give back to the program, he said. "We are looking for enthusiasm and the kind of person who can handle all the different things you will encounter," Harrison said.

Gray has confidence in the "student-created and continued program," he said. "We continue to seek gifts that will sustain AITI." To make a donation to AITI, contact Gray at pogo@mit.edu or x3-4665.

WHALES

Continued from Page 4

tural characteristics of the humpback songs recorded in Hawaii. To measure a song's complexity, Suzuki analyzed the average amount of information conveyed per symbol. He then asked human observers who had no previous knowledge of the structure of the whale songs to classify them in terms of complexity, redundancy and predictability. The computer-generated model and the human observers agreed that the songs are hierarchical, confirming a theory first proposed by biologists Roger Payne and Scott McVay in 1971.

Suzuki said that information theory also enabled the researchers to determine how much information can be conveyed in a whale song. Despite the "human-like" use of hierarchical syntax to communicate, Suzuki and his colleagues found that whale songs convey less than one bit of information per second. By comparison, humans speaking English generate 10 bits of information for each word spoken. "Although whale song is nothing like human language, I wouldn't be surprised if some marine mammals have the ability to communicate in a complex way," said Suzuki. "Given that the underwater environment is very different from our world, it is not surprising that they would communicate in rather a different way from land mammals."

The structure of the humpback whale song is repetitive and rigid. The whales repeat unique phrases made up of short and long segments to craft a song. There are multiple layers, or scales, of repetition, denoted as periodicities. One scale is made up of six units, while a longer one consists of 180-400 units. The combined periodicities give the song its hierarchical structure.

Suzuki compared his new technique for animal communication research with more traditional models, such as the first-order Markov model that is used to analyze bird songs, which are often shorter and simpler in structure than humpback whale songs. The Markov model proved inadequate for the whale song's complex structure.

Information theory, in contrast, proved perfect for analyzing humpback whale songs because it provided a quantitative analysis of the complexity and structure of the songs. "Information theory was the right choice because it allows one to study the structure of humpback songs without knowing what they mean," said Suzuki.

"I hope that knowing the hierarchical structure in humpback songs will inform research in other fields, such as evolutionary biology," said Suzuki. The technique he developed is already being used by a postdoctoral fellow in Buck's laboratory to analyze recently recorded songs of humpback whales from Australia.

Faculty meeting slated

A regular meeting of the faculty will be held Wednesday, May 17, at 3:30 p.m. in Room 32-141. The agenda includes:

- Election of the members of standing committees and officers of the faculty
- Progress in implementing recommendations in the CUP/CSL Report on Advising and Mentoring of Undergraduates
- Update on underrepresented minority faculty and graduate student recruitment and retention
- Report from the Energy Research Council
- Election of the members of the faculty ex officiis
- Recognition of faculty members moving to the rank of professor emeritus
- Report from the Killian Award Selection Committee
- Topics arising and questions for the provost and the chancellor

MIT EVENT HIGHLIGHTS MAY 17-21

Science/ Technology · Performance · Architecture/ Planning · Humanities
Music · Exhibit · Reading · Special Interest
Business/ Money · Film · Sports · Featured Event

PHOTO / **JUDITH DANIELS**

Up on the roof

This photo, taken from the top of the Albany Street Garage, is part of 'Up on the Roof: Photographs by Judith Daniels,' an exhibit of photos taken from the rooftops of buildings at MIT. Daniels is an administrative assistant in the School of Architecture and Planning. The exhibit is on view at the Rotch Library Gallery (Room 7-238) through May 30.

WEDNESDAY May 17

"Composing a Life" Annual exhibition of student art projects from the Experimental Study Group-sponsored seminar, "Composing a Life: An Exploration of Self through Photography, Art, and Writing." Open 24 hours. Wiesner Student Art Gallery. 253-7019.

"Prophet Sharing: Strategic Interaction Between Muslim Clerics and Middle Eastern Regimes" Talk by Julie Taylor of Harvard University. Noon. Room E38-615. 253-7529.

Artist Behind the Desk Performance Flamenco dance by Sheba Bergman, postdoctoral fellow in the Department of Chemistry. Noon. Killian Hall.

MIT Symphony Orchestra Mahler's Symphony No.7. $5. 8 p.m. Kresge Auditorium. 452-2394.

THURSDAY May 18

Senior Awards Banquet 6:30–9:30 p.m. MIT Museum. 253-7271.

Vesak Day Celebration Celebration of Buddha's birthday with Japanese Shakuhachi concert and prayers. 7–9 p.m. MIT Chapel. 324-6030.

MIT Muses Spring Concert MIT's all-female a cappella ensemble sings, performs skits and says goodbye to its graduating seniors. 9 p.m. Room 10-250.

FRIDAY May 19

Original Architectural Drawings and Prints by Richard Fleischner List Visual Arts Center. 9 a.m.–5 p.m. 253-4400.

MIT Gardeners Group: Basic Urban Composting Talk by Randi Mail, director of recycling for the Cambridge Department of Public Works. Noon. Room 10-105. 253-1900.

Mellon Grantees Presentation Five research presentations by recipients of grants from the Mellon-MIT Inter-University Program. 1–5 p.m. Room E38-615.

MIT Chamber Music Society Student Recital Ravel's "Le Tombeau de Couperin"; Ligeti's "Six Bagatelles for Wind Quintet"; Charles Shadle's "A Romance (for Miss Jewett)"; David Maslanka's "Quintet for Winds No. 3." 5 p.m. Killian Hall. 253-2826.

SATURDAY May 20

Academic Institutes of Pakistan Dinner Dinner and discussion. 7–10 p.m. Room W20-307.

MIT Chinese Choral Society MIT Chinese Choral Society presents its biannual concert: Spring Harmony. 7:30–9 p.m. Building W16. 253-9833.

Logarhythms Spring Concert Annual spring all-male a cappella concert with guest group the Harvard Callbacks. 8 p.m. Room 10-250.

SUNDAY May 21

Chantey Sing Sing sea music and chanteys with a room full of maritime enthusiasts, professional and amateur singers. 1–4 p.m. MIT's Wood Sailing Pavilion. 253-5852.

Gallery Talk Talk by List Visual Arts Center staff, presented in conjunction with "9 Evenings." 2 p.m. List Visual Arts Center. 253-4400.

MIT Chamber Music Society Junior Catherine McCurry on the violin; graduate student Darius Torchinsky on the cello; graduate student Vincent Chi-Kwan Cheung on the piano. Coached by David Deveau. 5 p.m. Killian Hall. 253-2826.

Go Online! For complete events listings, see the MIT Events Calendar at: http://events.mit.edu.
Go Online! Office of the Arts web site at: http://web.mit.edu/arts/office.

EDITOR'S CHOICE

MIT COMMUNITY PLAYERS — *May 18*
Production of "Laundry & Bourbon" and "Lone Star" by James McLure. May 18-20. $10; $8 MIT community; $6 MIT students.
Kresge Little Theater
8 p.m.

RESONANCE CONCERT — *May 19*
MIT co-ed a cappella group Resonance performs its spring concert.
Room 10-250
7:30 p.m.

SWAPFEST — *May 21*
MIT's monthly high-tech, ham radio, computer and electronics flea market. $5.
Albany Street Garage
9 a.m.–2 p.m.

Media Lab researcher gets into Monkey Business

Sarah H. Wright
News Office

Rachel Kern's office in the MIT Media Lab is quiet — a bit too quiet — when visitors drop by to hear about Monkey Business, her master's thesis and the latest research phase in the lab's Speech Interface Group.

Then Kern sits down and begins to talk, and soon two plush monkeys hanging by their tails from little stands also begin to talk.

A lot.

The chatter starts with a naturalistic "Squee!" from the monkey on Kern's desk, followed at once by a slightly different, equally natural little shriek from the monkey on a second desk. Little monkey faces go up and down. Invisible sensors sense. Tiny motors whir. Fuzzy arms reach out. Their animatronic cuteness knows no bounds.

"They're reacting to each other," Kern explains, as the electronic duet escalates, then ebbs. "My goal is to facilitate informal communication among distributed group members — people who work together, but in different locations. The monkeys alert people in one office of activity or gathering in another place," she said.

The monkeys in Kern's office, known as Bruce and George, are not only responsive to Kern and to each other, but also to monkeys in other offices, notably that of principal research scientist Chris Schmandt, Kern's thesis advisor, and the offices of other members of the Speech Interface Group. Motion and proximity sensors and individualized "speech" programming identify the office where the fun is under way.

Thus Kern knows there's activity in Schmandt's office — Bruce begins to twitch and look up and make little squeaks. His squeaks are different from George's and signal "which office has the activity," Kern said. (Their signals are actual snippets of recorded chimpanzee vocalizations, Kern said.)

PHOTO / **DONNA COVENEY**

Animatronic monkeys keep graduate student Rachel Kern company in her office at the Media Lab on Friday, May 12. Colleague Matt Adcock, background, has another monkey with him. The monkeys are designed to aid communication between colleagues.

With activity next door, and three people chatting and moving about in Kern's office, the noise of the two monkeys' sensors and squeakers and servo motors becomes distracting sometimes, Kern admitted.

"The spirit of the project is fun. They're designed to promote spontaneous communication," she said. "They can also be turned off."

A native of Newton, Mass., Kern has long been interested in affective computing — using computer technologies to communicate, express, reflect or facilitate human emotional experience without relying on keyboards and monitors.

Formerly a keyboard and flute player for a Washington, D.C., rock band, LavaJet, Kern received the B.A. degree in cognitive science from Northwestern University in 1999. She worked as a software quality engineer until coming to the Media Lab in 2004.

One predecessor to Monkey Business was Kern's EMotoPhone, a cellphone that allows users to send personalized "emoticons" — photo images of the sender's face displaying emotions such as affection or frustration — on its screen. Another was Galvaphone, a cellphone equipped with a "galvactivator," a glove that can detect the wearer's galvanic skin response.

Her switch to working with animatronic agents — electronic animals — was inspired by the Cellular Squirrel, former Media Lab colleague Stefan Marti's cute stuffed squirrel whose wiry "guts" serve as a mobile communication device.

Formally known as an autonomous interactive intermediary, Marti's Cellular Squirrel neither rings nor vibrates. Instead, it uses little gestures to alert the user — its "companion" — that an instant voice message has arrived.

"Stefan tried out several electronic animals — he built a parrot, then a bunny, which morphed into a squirrel. It was very popular, more like a phone. It has a light, informal quality," she said.

The two monkeys in Kern's office do have the lighthearted, informal quality Kern enjoyed in the Cellular Squirrel. Eventually, she said, the monkeys in Monkey Business could be customized, so each one could be used to sense remote activity in particular locations, to move in particular ways as well as communicate with others. They could also be used to broadcast audio activity to keep people connected.

Thanks to their playfulness and their programming, the monkeys may have applications in health care. But for now, Bruce and George and their friends just want to have fun, Kern said.