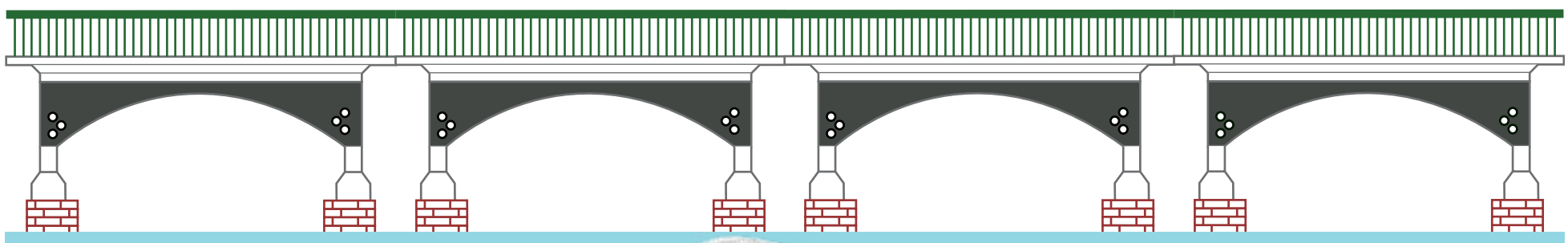
Volume 53, Number 3
Wednesday, September 24, 2008

TechTalk
SERVING THE MIT COMMUNITY

# RULER of the Mass. Ave. Bridge




## Smoot reflects on his measurement feat as 50th anniversary nears

**Patrick Gillooly**
News Office

As his fraternity brothers laid his 5-foot, 7-inch frame end-to-end to measure the Massachusetts Avenue bridge one night in October 1958, there was one distinct thought running through Oliver Smoot's mind.

"It was pretty cold," he said.

Smoot '62 evoked memories recently about the night his name became a unit of measurement as MIT prepares to celebrate the 50th anniversary of the quirky hack. A series of events has been planned for the weekend of Oct. 4.

See web.mit.edu/smoot for more information on the Oct. 4 festivities

"Looking at the pictures, I think I had one sweater and I did have on gloves … but basically we all had on windbreakers and you get out in the middle of a bridge and it's windy," he said. "Even if the temperature isn't that low, it's cold out there."

In 1958, as a freshman at MIT and Lambda Chi Alpha pledge, the fraternity pledgemaster hatched the idea to use the shortest — and most scientifically named pledge — to measure the bridge from Boston to Cambridge. Little did they know, however, that their activity would make its way into MIT, Boston and even Google lore.

They also underestimated how difficult getting up and down 364.4 times (plus or minus an ear) would be.

▶Please see SMOOT, **PAGE 7**


PHOTO / **NANCY DUVERGNE SMITH, ALUMNI ASSOC.**
Oliver Smoot

## SMOOT ANNIVERSARY EVENTS: Oct. 4

### Charles River clean up 11:30 a.m.-4 p.m.

Volunteers from the MIT community and beyond gather at the Kresge Oval for a barbecue lunch before cleaning the shoreline of the Charles River. MIT President Susan Hockfield, Oliver Smoot and other guests will speak at 12:30 p.m. Visit web.mit.edu/smoot/schedule.htm to register.

### Herb Reed and the Platters Concert 5-6:30 p.m.

Famed '50s music group Herb Reed and the Platters play the MIT Kresge Auditorium at 5 p.m. Pre-show tickets available for $25 online at web.mit.edu/smoot/platters.htm; tickets at the door (if available) $35.

### MIT Big '50s Party 6:30-11 p.m.

The MIT Club of Boston, the Class of 1962 and Lambda Chi Alpha fraternity sponsor a classic 1950s party at the MIT Museum. Includes dedication of the "Smoot Stick," alumni from Logarhythms, MIT's all male acapella group and music and food from the '50s

Ticket prices: General public $50; MIT Club of Boston member/guest $45; Lambda Chi Alpha fraternity alumnus $45; MIT Class of '62 member/guest $45.

PHOTO COURTESY OF THE MIT MUSEUM

# 2 faculty, 2 alumni awarded MacArthur 'genius' grants

## Winners each get $500,000 in unrestricted funds

**Anne Trafton**
News Office

Two MIT faculty members — a physicist and a structural engineer who studies architectural history — have won 2008 MacArthur Fellowships, commonly known as "genius" grants.

Marin Soljacic '96, assistant professor of physics, and John Ochsendorf, associate professor of architecture, will each receive $500,000 in "no strings attached" support over five years from the John D. and Catherine T. MacArthur Foundation.

The foundation named 25 new fellows on Sept. 23 for "their creativity, originality and potential to make important contributions in the future."

Ochsendorf, 34, said he has been "walking on air" since getting the news last week. "It was like a lightening bolt out of the sky," he said. "I kept saying, 'It's not possible, it's just not possible.'"

Ochsendorf, who has been at MIT since 2002, studies building technology, evaluating the soundness of historical structures with an eye toward identifying ancient technologies for use in modern buildings.

His early studies investigated the construction of hand-woven, fiber-suspension bridges that spanned deep ravines in the Inca Empire. More recently, he has turned his attention to the causes of vault and buttress failures in French and Spanish Romanesque churches.

He and a group of students recently designed England's Pines Calyx dome, an energy-efficient structure built from local resources using a tile vaulting system patented in the 19th century by Spanish architect Rafael Guastavino.

"In the 21st century, as we're faced with climate change and diminishing natural

▶Please see MACARTHUR, **PAGE 5**

## PEOPLE

### Three faculty win NIH awards

Oudenaarden, Ting and Regev have won Pioneer Awards from the National Institutes of Health.

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## RESEARCH

### Tap into the trees

MIT undergraduate and his colleagues find out how a tree could be used to power fire-prevention sensors.

**PAGE 4**

## CALENDAR

### State of the Institute

MIT administrators, including President Susan Hockfield, will address the community at 11 a.m. on Monday.

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## Events at MIT

### Today

**• Iraq Reconstruction: Lessons Learned**. Christopher Kirchhoff, Lead Writer, SIGIR (Special Inspector General for Iraq Reconstruction), will speak from 12-1:30 p.m. in E38-615.

**• MIT Energy Club Discussion Series: Solar to Chemical Energy Conversions**. Yogesh Surendranath will speak from 6-7 p.m. in NW35, Thirsty Ear Pub (in the New Ashdown House, 235 Albany St. Speech will focus on "Solar-To-Fuels: The Importance of Making Oxygen." The vast majority of energy used by mankind is provided in the source of chemical, carbon-based fuels. All of this fuel originated from biological solar-to-fuels conversion: photosynthesis. Solar energy is the only source of sufficient scale to meet future energy demand.

### Thursday, Sept. 25

**• MIT/WHOI 40th Anniversary Symposium**. 12:30-5 p.m. in E51. Symposium to celebrate the 40th anniversary of the establishment of the doctoral program between MIT and the Woods Hole Oceanographic Institution.

**• The Campaign and the Media**. John Carroll, Boston University; Ellen Goodman, Boston Globe; and Tom Rosenstiel, director, Project for Excellence in Journalism, will speak from 5-7 p.m. in E15-070. How have American news media responded to this historic presidential campaign? Is it true, as many have suggested, that the influence of newspapers and television has declined in the digital era? Have the media become more partisan and polarized? Are they more preoccupied with polls and campaign strategy than with substantive issues? Has the coverage by traditional media been qualitatively different from that by online news sources? In this first of two forums on the campaign and the media, our speakers will offer report cards on the current state of American political journalism.

### Friday, Sept. 26

**• Threatening Changes: Experimental Evidence on Americans' Responses to Immigrants**. Dan Hopkins, MIT, will speak. 12-1:30 p.m. in E53-482 as part of the MIT Political Science Work in Progress Colloquia (WIP).
*URL: web.mit.edu/polisci/research/wip.html*

**• The Great Glass Pumpkin Patch@ MIT**: Opening Reception. 5-8 p.m., W16, Kresge Oval. 1,000 hand-blown glass pumpkins, created by artists from the MIT Glass Lab. Proceeds benefit the MIT Glass Lab, where the MIT community can learn and practice the art of glassblowing. Pumpkin sales only on Saturday, Sept. 27 (rain date: Sept. 28); no sales at reception.
*URL: web.mit.edu/glasslab/sales_pumpkin.html*

# Kagame underscores tech ties in Compton speech

**Stephanie Schorow**
News Office correspondent

PHOTO / **L. BARRY HETHERINGTON**

Rwandan President Paul Kagame delivers his Compton lecture on Sept. 18 in Kresge Auditorium.

Connections between the technology-hungry countries of Africa and the tech-savvy MIT community were underscored Thursday, Sept. 18, by the first democratically elected president of the Republic of Rwanda and the first African leader to give MIT's prestigious Compton lecture.

Paul Kagame, a former guerrilla leader whose forces helped halt the Rwanda genocide of 1994, told a packed crowd in the Kresge Auditorium that for Africa to use its abundant natural resources to overcome poverty, "We must invest heavily in new levels of education and especially knowledge institutions. This is where we in Africa and Rwanda remain particularly vulnerable."

Kagame, a man described by MIT President Susan Hockfield as "one of Africa's most promising young leaders" and someone unafraid of building a country on the basis of ideas, drew four standing ovations — two during the introductions before he even spoke a word.

Kagame, a soft-spoken man with a bespectacled, scholarly demeanor, talked slowly and deliberately about how science and technology — particularly mobile technology — was accelerating economic growth in Africa.

He described how the mobile phone was "leapfrogging" development. Africa is "the world's fastest-growing mobile telephone market" and mobile-phone companies will invest $50 billion in the continent in the next five years, he said.

Mobile phones have transformed ways of doing business, stimulated the economy by spinning off smaller retail enterprises and "reduced the barriers" among farmers, traders and consumers, he said.

"Africans are using mobile phones to retrieve savings, transfer funds, make payments and access student exam results." Even AIDS treatment has been affected: "The remotest areas of the country, without electricity, are linked to the (medical) system by solar-powered mobile phones," he said.

"This illustrates the almost limitless ways these technologies can be used to sidestep our development challenges."

Still, he added, "this is not enough." The continent needs to train and retain knowledge specialists — the "single most challenging task facing Africa," he said.

Kagame said Africans look to places such as Boston as models because of the productive interaction here among "knowledge centers," business and government. Boston, he noted, "transformed itself from a maritime trading port to the knowledge economy center that we see today."

Africa seeks transformation as well. The current political stability and growth of democracy in Rwanda "is in sharp contrast to a decade ago" when it was uncertain if the country was even "a viable state," he said. Now, the continent is becoming increasingly "relevant" on the world stage: "Significant foreign investment is coming into Africa from Asia, especially China, India, as well as the Gulf states."

Kagame made a direct appeal for more links between MIT and Rwanda. "I invite you, MIT community, to be part of overcoming our challenges and turning them into opportunities," he said.

During a lengthy Q&A, Kagame fielded questions on topics such as what other mobile technology might be helpful to Africa (he wasn't sure) and how to encourage competent leadership and "good governance" throughout the region.

Sloan MBA student Erica Carlisle asked how Rwanda would deal with its high birthrate (the country is the densest populated in Africa). Kagame said education would help to encourage families, which have an average of six children, to reduce that to half.

# MITEI awards second round of seed grants

**David Chandler**
News Office

The MIT Energy Initiative's second round of seed grants for energy research, announced last week, will go toward a wide array of research topics ranging from microhydropower and solar-thermal power projects for developing countries to the development of novel materials for insulation or power generation, to computer software that can help to optimize energy use in cities or in a whole nation.

Seventeen projects received grants in this second round, with total funding exceeding $1.7 million. A previous set of grants received funding in January of this year, and MITEI will continue to award new grants twice each year.

Among the new projects are two aimed at developing new solar-thermal systems to bring electric power as well as heating to rural villages in the developing world. One of these, headed by Rajeev Ram, professor of electrical engineering and associate director of the Research Laboratory for Electronics, could capture leftover heat from existing solar cookers, or even from conventional wood-burning stoves, that are in use in many villages in Asia. The solid-state thermoelectric devices would produce about 20 watts of power to provide reading lights that are 150 times more energy-efficient, as well as cleaner, than the kerosene lamps now in use.

Three other groups receiving the grants are also working on thermoelectric systems — solid-state devices that generate electricity from temperature differences, without the need for any moving parts. One is seeking to find new, novel materials that may be more efficient than existing thermoelectric compounds; another is developing thermoelectric systems that can be scaled up to large power-producing plants; and the final group is examining the potential of photonic crystals to capture energy from waste heat.

Another solar thermal project, led by Leonhard Professor of Civil and Environmental Engineering Harold Hemond and Ronald C. Crane (1972) Professor of Mechanical Engineering Ahmed Ghoniem, aims to develop larger installations that could provide power to a village school or clinic. The solar concentrating system, using mirrored troughs to focus sunlight on liquid-filled tubes and photovoltaic cells, could provide heat and power all from the same unit.

Another project will try to develop control systems for "self-powered" devices, such as biomedical sensors or therapeutic devices that generate their own electricity from the user's movements or body heat so that they never require battery replacement. And another will seek to develop new materials that will work better as either insulators or heat-conducting material for radiators or cooling systems.

A project headed by Pappalardo Professor of Mechanical Engineering Alexander Slocum will work on designs for far-offshore windmills with a built-in energy storage system to provide on-demand power. The system would use water pumped inside a huge concrete base as storage for energy produced by the wind turbine, and the platform could also be connected to wave or current generating systems.

For a full list of all the grant recipients and their projects, please go to web.mit.edu/mitei/news/spotlights/recipients-09-08.html.

Funding for the new grants comes from MITEI's founding and sustaining members, supplemented by funding from the Singapore-MIT Alliance, the Chesonis Family Foundation, David desJardins, and other private donors.

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# 3 faculty win '08 NIH Pioneer Awards

**Elizabeth Thomson**
News Office

Three MIT faculty are among 16 scientists nationwide to receive 2008 Pioneer Awards from the National Institutes of Health for their "pioneering — and possibly transforming — approaches to major challenges in biomedical and behavioral research."

Professors Alexander van Oudenaarden, Aviv Regev and Alice Y. Ting will each receive $2.5 million over five years.

Now in its fifth year, the Pioneer Award program is designed to support individual scientists of exceptional creativity at any career level.

"These highly creative researchers are tackling important scientific challenges with bold ideas and inventive technologies that promise to break through barriers and radically shift our understanding," said Dr. Elias A. Zerhouni, director of the NIH.

Van Oudenaarden, the W.M. Keck Career Development Professor in Biomedical Engineering and a professor of physics, "will explore the role of random variables in gene expression during cellular development and specialization."

Regev, an assistant professor of biology also affiliated with the Broad Institute, "will examine how the regulatory networks that control cell function change over time in development, disease and evolution," according to the NIH.

Ting, the Pfizer-Laubach Career Development Associate Professor of Chemistry, "will develop new technologies to image and study proteins in living cells."

Previous Pioneer winners from MIT include Emery Brown of the Harvard-MIT Division of Health Sciences and Technology and the Department of Brain and Cognitive Sciences (2007) and Arup K. Chakraborty, the Robert T. Haslam Professor of Chemical Engineering, Chemistry and Biological Engineering (2006).

Alex van Oudenaarden

Alice Ting

Aviv Regev

# CMSE wins six-year, $19.2M NSF grant

Amid an increasingly challenging federal funding environment, MIT's Center for Materials Science and Engineering (CMSE) has won a six-year, $19.2 million National Science Foundation grant that will support research, K-12 educational outreach programs and vital shared experimental facilities.

"CMSE is privileged to be able to bring some of the Institute's finest researchers together to perform interdisciplinary materials research that can impact the current and future needs of society," said CMSE Director Michael Rubner, the TDK Professor of Materials Science and Engineering. "We're excited about moving forward with a new research program that represents the culmination of a two-year internal and external review process."

Through the new program, research will be conducted in three interdisciplinary research groups. One, the Design of Nanomaterials for Electrochemical Energy Storage and Conversion, seeks to accurately model, predict and determine how thermodynamics, phase behavior and kinetics are modified at the nanoscale.

The second, Mechanomutable Heteronanomaterials, will develop new dynamically tunable multicomponent heterogeneous nanostructured systems with an emphasis on mechanical behavior.

The final group, Multimaterial Multifunctional Nano-Structured Fibers, will explore the design, fabrication, characterization and physical phenomena of a new class of multicomponent nanoscale fiber materials.

The NSF grant will also support two smaller projects: Engineering Living Cells via Nanomaterials, and New States of Frustrated and Correlated Materials. CMSE also plans to provide seed funding for research that has the potential to redefine the direction of an existing interdisciplinary research group (IRG), or lead to a completely new IRG. A seed competition will begin this fall.

The new grant, awarded through NSF's Materials Research Science and Engineering Centers (MRSEC) program, will also allow CMSE to continue two other key programs: shared experimental facilities and K-12 outreach.

Every year some 700 to 800 individual researchers use CMSE facilities for materials analysis, crystal growth and preparation, electron microscopy, and X-ray diffraction. "Our facilities are critically important to the MRSEC program as well as to the broader MIT community and beyond," Rubner said. "We are gratified that we will be able to continue support of these facilities and expand them in coming years."

The center also has a strong education program directed toward graduate students, undergraduates, middle- and high-school students, and K-12 teachers.

# MIT named to AARP top employer list

MIT has once again been named to AARP's list of the 50 Best Employers for Workers Over 50, a distinction the Institute has won three other times in the past five years.

AARP's annual rankings, announced this week by AARP CEO Bill Novelli, recognize employers across the country that excel at recruiting, retraining and retaining mature workers.

The Institute ranked 14th on the list and was the second-highest ranking college or university, behind Cornell University, which was ranked first overall. MIT was also named to AARP's list in 2006, 2005 and 2003.

AARP 2008 Best Employers FOR WORKERS OVER 50

Thirty-seven percent of MIT employees are age 50 and older, and their average tenure is 16.7 years.

Some practices MIT has in place to support its workforce over age 50 include:

- A seminar series from MIT's Center for Work, Family and Personal Life on the aging workforce and eldercare;
- Recruiting through attending job fairs and workshops in connection with Operation A.B.L.E. of Greater Boston, which provides training and employment services for mature workers.

More details can be found online at www.aarpthemagazine.org.

PHOTO / **SUSAN COHEN**

## Stratton medal awarded to Margaret McDermott

Margaret McDermott HM '90, a major benefactor of the arts at MIT whose generosity also supports students scholarships and faculty chairs, received the Catherine N. Stratton Medal in the Arts during a reception at her home in Dallas. The award features a stylized portrait of Stratton and is given to individuals who have made significant contributions to the Council for the Arts at MIT or the arts at MIT.

The award was designed by Suzana Lisanti, senior communications strategist, and created in the MIT glass lab by instructor Peter Houk. In attendance at the reception were Margaret McDermott, Mary McDermott Cook, Irwin Grossman '52, Bill '60 and Jean Booziotis, Tom '57 and Effie McCullough, Margaret Anne Cullum and Susan Cohen, director of the Council for the Arts. Letters of tribute to McDermott from MIT President Susan Hockfield, Associate Provost Philip Khoury and Brit d'Arbeloff SM '61 were read and a champagne toast was given, followed by lunch.

## Events at MIT

### Sunday, Sept. 28

• **Energy Regatta at MIT**. 9 a.m.-12 p.m. at 51, MIT Sailing Pavilion. The MIT Francophone Club and the world-class oil company Total invite you to a sailing event open to all MIT students. The event will be followed by a reception at the Sailing Pavilion on Saturday evening. This event is a unique opportunity to meet fellow MIT students and Total representatives in a fun atmosphere! All sailing levels welcome. Non-sailors welcome as spectators. Interest in oil engineering, energy and operation research is a plus. This event is limited to 50 people and open to MIT only.
*URL: total-sailing.mit.edu*

### Monday, Sept. 29

• **The State of the Institute**. Speakers include: President Susan Hockfield, Provost L. Rafael Reif, Chancellor Phillip L. Clay, Executive Vice President and Treasurer Theresa M. Stone. 11 a.m. in W16, Kresge Auditorium. A lunch reception will follow the forum.

### Wednesday, Oct. 1

• Come celebrate MIT women's history and learn about MIT's extraordinary first alumna, **Ellen H. Swallow** (Richards, chemistry, Class of 1873) at this one-woman show presenting Ellen in her own words. From 7-9 p.m. in Room 4-370. Ellen Swallow Richards (ESR) applied her brilliant mind, chemistry training and organizing finesse to concerns that all people care about — clean water, air, pure food. Joyce Beery Miles will first portray Ellen as a young student before Vassar and during her Vassar days. The second scene covers her initial days at MIT and in the Women's Chemistry lab, and finally, the show will depict ESR's last 10-15 years of professional activity, including the 1893 Columbia World Exposition in Chicago, her work with the New England Kitchen, and the Lake Placid Conference.
*URL: http://alumweb.mit.edu/groups/amita/*

**Submit your events!**

Log on to events.mit.edu to add your events to MIT's online calendar. Select events will be selected from the online calendar to be published in Tech Talk each Wednesday.

## AWARDS &HONORS

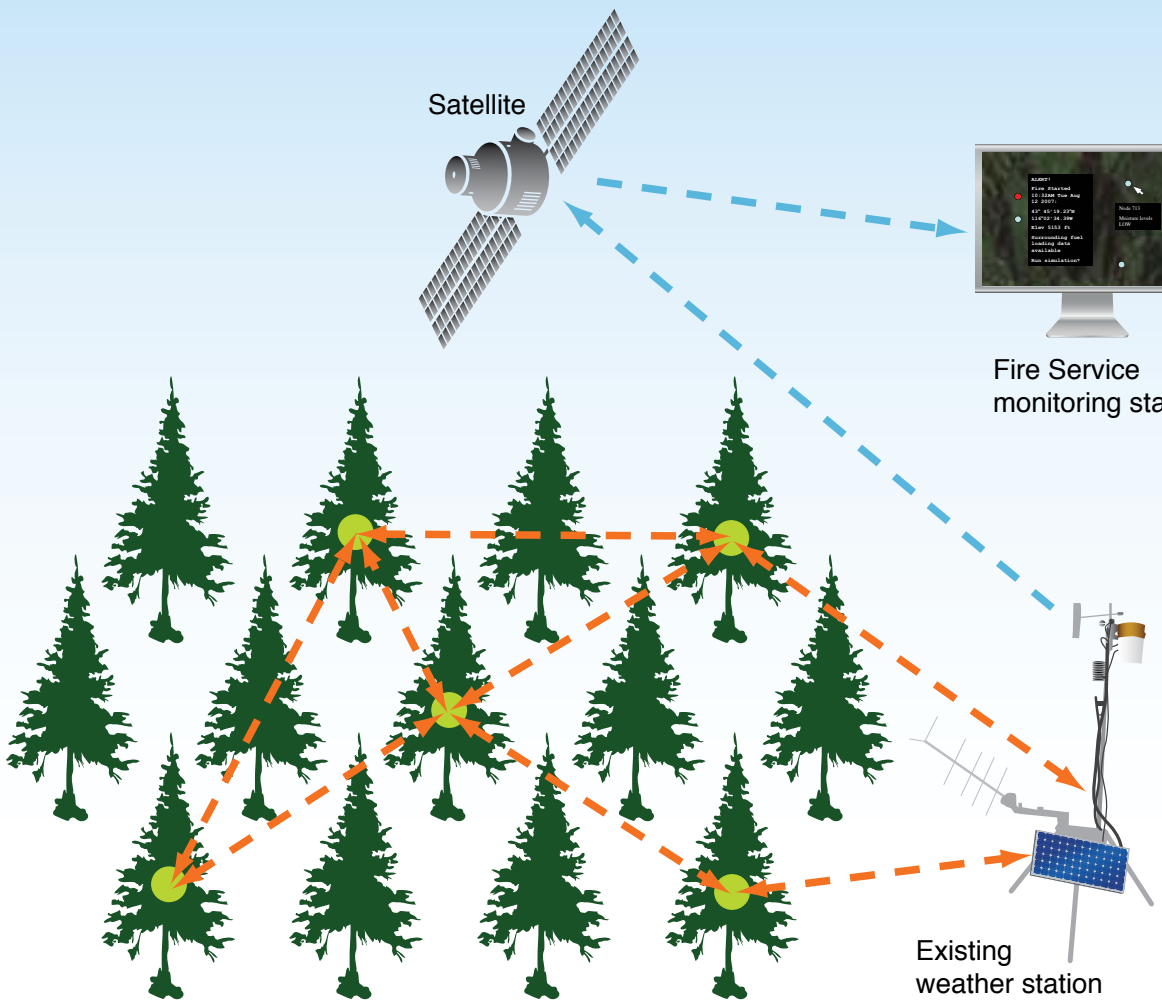
### Marine Technology Society honors MIT student work

The Marine Technology Society's Student Section at MIT (13Seas) was honored with the Outstanding Student Section Award at the MTS's annual Awards Luncheon on Sept. 16. This is the third year in a row the MIT section has won the award.

### DeRon Brown wins Boston Globe football award

MIT junior DeRon Brown earned the New England region's top weekly honor in football last week after being selected as the Boston Globe Gold Helmet award winner following the Engineers' impressive victory against Mass. Maritime. Brown delivered the second-highest single-game rushing total in school history while MIT opened the fall slate with two straight wins for the first time since 2004.

# Preventing forest fires with tree power




GRAPHICS / **REBECCA MACRI**

## Sensor system runs on electricity generated by trees

**Elizabeth Thomson**
News Office

MIT researchers and colleagues are working to find out whether energy from trees can power a network of sensors to prevent spreading forest fires.

What they learn could also raise the possibility of using trees as silent sentinels along the nation's borders to detect potential threats such as smuggled radioactive materials.

The U.S. Forest Service currently predicts and tracks fires with a variety of tools, including remote automated weather stations. But these stations are expensive and sparsely distributed. Additional sensors could save trees by providing better local climate data to be used in fire prediction models and earlier alerts. However, manually recharging or replacing batteries, often at very hard-to-reach locations, makes this impractical and costly.

The new sensor system seeks to avoid this problem by tapping into trees as a self-sustaining power supply. Each sensor is equipped with an off-the-shelf battery that can be slowly recharged using electricity generated by the tree. A single tree doesn't generate a lot of power, but over time the "trickle charge" adds up, "just like a dripping faucet can fill a bucket over time," said Shuguang Zhang, one of the researchers on the project and the associate director of MIT's Center for Biomedical Engineering (CBE).

The system produces enough electricity to allow the temperature and humidity sensors to wirelessly transmit signals four times a day, or immediately if there's a fire. Each signal hops from one sensor to another, until it reaches an existing weather station that beams the data by satellite to a forestry command center in Boise, Idaho.

Scientists have long known that trees can produce extremely small amounts of electricity. But no one knew exactly how the energy was produced or how to take advantage of the power.

In a recent issue of the Public Library of Science ONE, Zhang and MIT colleagues report the answer. "It's really a fairly simple phenomenon: an imbalance in pH between a tree and the soil it grows in," said Andreas Mershin, a postdoctoral associate at the CBE. The first author of the paper is Christopher J. Love, an MIT senior in chemistry who has been working on the project since his freshman year.

To solve the puzzle of where the voltage comes from, the team had to test a number of theories — many of them exotic. That meant a slew of experiments that showed, among other things, that the electricity was not due to a simple electrochemical redox reaction (the type that powers the "potato batteries" common in high school science labs). The team also ruled out the source as due to coupling to underground power lines, radio waves or other electromagnetic interference.

Testing of the wireless sensor network, which is being developed by Voltree Power (http://voltreepower.com), is slated to begin in the spring on a 10-acre plot of land provided by the Forest Service.

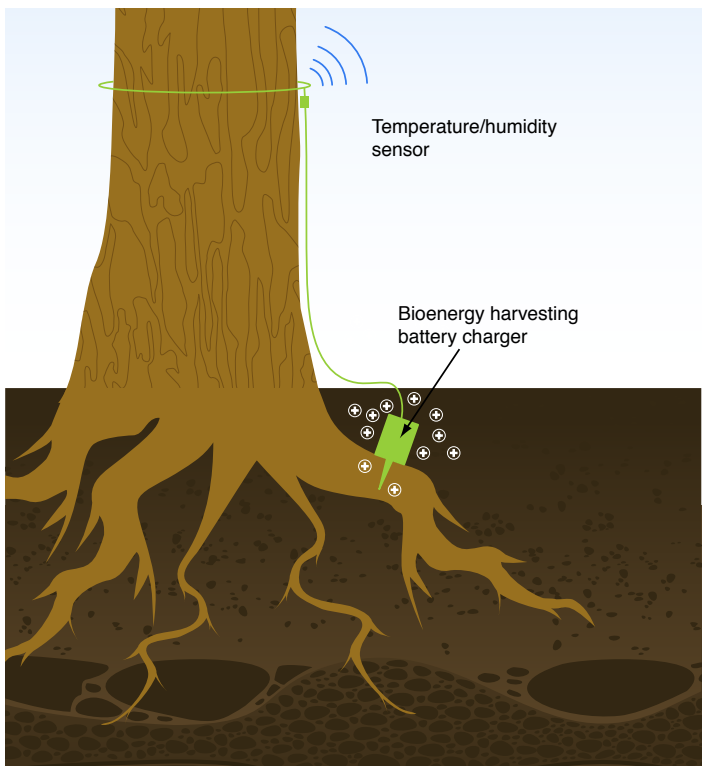
According to Love, who with Mershin has a financial interest in Voltree, the bioenergy harvester battery charger module and sensors are ready. "We expect that we'll need to instrument four trees per acre," he said, noting that the system is designed for easy installation by unskilled workers.

"Right now we're finalizing exactly how the wireless sensor network will be configured to use the minimum amount of power," he concluded.

The original experiments were funded by MagCap Engineering, LLC, through MIT's Undergraduate Research Opportunities Program.

PHOTO / **CHRISTOPHER HUANG**

MIT senior Christopher Love and colleagues are working to find out whether energy from trees can be used to prevent forest fires.




MIT on the ELECTION

## CALLING ALL FACULTY

The News Office wants to hear your thoughts on election issues. A new series, scheduled to debut next week and run until Election Day, aims to give MIT faculty members a chance to weigh in on major campaign issues. This week's question: What should be the next president's top priority in the areas of science and technology? Answers should be limited to 100 words, and can be e-mailed to Stephanie Schorow at sschorow@mit.edu.

# Why chemotherapy works for some people and not others

## MIT cell findings could predict individuals' responses

**Anne Trafton**
News Office

MIT researchers have shown that cells from different people don't all react the same way when exposed to the same DNA-damaging agent — a finding that could help clinicians predict how patients will respond to chemotherapy.

The research team from MIT's Center for Environmental Health Sciences (CEHS) and the Departments of Biological Engineering and Biology, identified a group of 48 genes that can predict how susceptible an individual is to the toxic compound, known as MNNG. The work appears in the Sept. 18 online edition of Genes and Development.

MNNG, a DNA-damaging compound similar to toxic chemicals found in tobacco smoke and in common chemotherapy agents, usually kills cells by inducing irreparable DNA damage. However, the researchers found a wide range of susceptibility among cells taken from healthy people.

"A cell line from one person would be killed dramatically, while that from another person was resistant to exposure," said Rebecca Fry, former MIT research scientist and lead author of the paper. "It wasn't known that cell lines from different people could have such dramatic differences in responses."

Toxic agents such as MNNG create lesions in DNA, provoking the cell to defend itself with a variety of DNA-repair and other pathways. However, every individual expresses slight differences in the genes involved in those pathways.

"Even if everyone is exposed to exactly the same things, they would respond differently, because we're all genetically different," said Leona Samson, senior author of the paper, director of CEHS, and an American Cancer Society Research professor.

The team members found that after measuring the expression of every gene in each cell line, they could predict cell sensitivity to MNNG from the expression of just 48 specific genes, with 94 percent accuracy.

PHOTO / **DONNA COVENEY**

CEHS Director Leona Samson

Several of those 48 genes have already been linked to cancer, said Samson, but it was not known that their expression is already altered before exposure to the DNA damaging agent.

This study is specific to MNNG, but similar efforts are now underway in Samson's lab to predict individuals' responses to other toxic agents, including cisplatin, a common chemotherapy agent, and temozolomide, used to treat brain cancer.

Fry, the lead author of the paper, is now an assistant professor at the University of North Carolina School of Public Health. Other authors are Peter Svensson, a postdoctoral fellow in CEHS; Chandni Valiathan, a graduate student in computational and systems biology; Emma Wang and Brad Hogan, technical assistants in CEHS; Sanchita Bhattacharya, former CEHS research scientist; James Bugni, former CEHS postdoctoral fellow; and Charles Whittaker, a research scientist in the David H. Koch Institute for Integrative Cancer Research.

The research was funded by the National Institute of Environmental Health Sciences and the National Cancer Institute.

# Examining cargo at the atomic level

## Imaging technology could help detect nuclear material inside cargo without opening the doors

**Anne Trafton**
News Office

More than 11 million cargo containers enter U.S. ports annually and that number is expected to dramatically increase in the next 20 years. The U.S. Customs and Border Protection agents might benefit from technology developed by an MIT professor, which could enable screeners to examine the contents of a cargo container for the presence of radiological or nuclear material without having to open the container.

MIT Professor William Bertozzi's new technology reveals the cargo's atomic composition, which is an enhancement over current systems. The technology could also be used for cargo validation for tax revenue compliance, product safety or origin certification.

> *We're in a very different realm than what we originally thought it would be used for.*
>
> **Bob Ledoux**
> **former MIT professor**

Bertozzi and private-capital backed Passport Systems Inc., are developing the technology, known as nuclear resonance fluorescence imaging (NRFI), with additional funding from the Department of Homeland Security and Office of Naval Research.

Unlike X-rays, which only reveal the two-dimensional shape of an object, NRFI can determine the atomic composition of cargo — whether it's a harmless shipment of televisions or a load of radioactive uranium-235, which can be used to make a nuclear bomb.

Bertozzi, along with former MIT professor Bob Ledoux and Gordon Baty '61, SM '63, PhD '67, founded Passport Systems in 2002. At the time, they intended to use their detectors to find traditional explosives, but in the past few years, the company and the U.S. government have also turned its attention to detecting nuclear threats.

"We're in a very different realm than what we originally thought it would be used for," Ledoux said.

Bertozzi, a professor of physics, first came up with the idea more than 15 years ago, after Pan Am Flight 103 was blown up by terrorists. As a graduate student at MIT, Bertozzi had studied nuclear resonance fluorescence, though it wasn't his main research focus.

"All of the sudden it dawned on me that this might be a viable technique" to detect explosives, he says.

Bertozzi patented his idea and several companies were interested in developing the technology but the government's interest waned, and the project didn't get off the ground. However, everything changed after Sept. 11, 2001, and Bertozzi resurrected the idea.

"The damage to our nation's economy from the effects of an attack through the supply chain with a nuclear weapon (WMD) would be enormous and would adversely affect all segments of our population, seriously altering our nation's culture," Bertozzi said. "We are developing new technologies that will provide significant improvement over existing nonintrusive inspection technologies to help ensure that our nation is safe from such attacks."

In about a minute, the detector can determine what's inside a container, without opening it. And unlike X-rays, NRFI can detect the isotopic composition of a material even when it's shielded by lead.

NRFI technology detects the energy level of photons emitted by nuclei as they decay. Every element, and every isotope of an element, emits photons with a specific energy level. Thus NRFI can distinguish not only between different elements, but different isotopes of the same element, such as uranium-235, which is used in nuclear weapons, and uranium-238, which is not.

Such detectors could also help protect U.S. economic interests by checking to make sure a container reportedly filled with, for example, low-grade stainless steel products isn't actually carrying higher grades that would look the same to an X-ray scanner and thus avoid payment of the correct tariffs. The applications for verification in commerce are numerous.

Ledoux says the company has a good grasp on the science underlying the detection system and has identified signatures for the bomb-making materials they are trying to detect. They have recently completed a successful test of the technology for the U.S. government and are now looking to develop commercial products.

# MACARTHUR: 2 faculty win 'genius' grants

Continued from **Page 1**

resources, our buildings may look more like buildings from the past," Ochsendorf said.

Ochsendorf said that of the five universities where he has studied and taught, MIT is the only one where his current work would be possible. "I never found a university where I could do such interdisciplinary work so easily," he said. "At MIT it's not the exception but the norm."

**John Ochsendorf**

## 'Completely overwhelming'

Soljacic, who has been an assistant professor at MIT since 2005, was also shocked upon receiving word of his award. When MacArthur Foundation Fellows Program Director David Socolow called with the news, he first asked Soljacic if he was alone.

Soljacic said yes, he was in the car on the way to pick up his son from school.

"He said, 'Do you think you could pull over? I don't want anything to happen to you,'" Soljacic said. "It's just completely overwhelming because it's so unexpected. It's a great and unexpected honor."

**Marin Soljacic**

Soljacic, 34, is a theoretical physicist whose work on electromagnetic waves is important for understanding fundamental principles of optical physics and for development of devices such as switches for optical computers and wireless power transmitters.

Recently, he and his colleagues demonstrated both theoretically and experimentally that strongly coupled magnetic resonances can wirelessly transfer power over a few meters — an advance that could be used to wirelessly recharge laptop computers, cell phones and other devices.

Soljacic said the MacArthur funding will allow him to work on innovative research that might not be funded by traditional sources.

"When you have something that you believe is a really good idea, but it's pretty risky — some people might think it's too far out — it's much harder to get funding," he said.

Soljacic was a Pappalardo Fellow in MIT's Department of Physics from 2000 to 2003 and a principal research scientist in the Research Laboratory of Electronics at MIT from 2003 to 2005.

Two MIT alumni were also named MacArthur Fellows: Andrea Ghez '87 and Adam Riess '92.

Ghez, a professor of astronomy at UCLA, works on improving the spatial resolution and precision of instruments used to peer at regions of the central galaxy. Her work allows for very precise analysis of stars and black holes.

Riess, a professor of physics and astronomy at Johns Hopkins University, was a leading contributor to the finding that the universe is not only expanding, but its rate of expansion is accelerating. He is now designing experiments and devices to detect and measure dark matter.

PHOTO / **PATRICK GILLOOLY**

Ray, left, and Tom Magliozzi, right, of NPR's 'Car Talk,' listen to students at a talk on alternative-energy vehicles.

# Click and Clack glimpse cars of the future

## NPR's Magliozzi brothers in 'chock-full' tour of MIT

The star mechanics of NPR's "Car Talk" got a sneak preview at MIT last week of the kinds of innovative cars and automotive technologies that their listeners might be calling in about in years to come.

"I'm encouraged that so much is going on here, as you'd expect from MIT," said Ray Magliozzi '72, after he and his brother Tom '58 — better known on their radio program as Click and Clack — received a tour Friday of various MIT projects aimed at future alternative vehicles. They also heard presentations from five student groups working on such projects.

"It was a chock-full day — I felt like I was a student again," Ray said after hearing presentations from MIT professors Robert Armstrong, deputy director of the MIT Energy Initiative, Yang Shao-Horn of the Electrochemical Energy Laboratory, and Gerbrand Ceder of Materials Science and Engineering, as well as from student leaders of the Energy Club, the Solar Electric Vehicle Team, the Electric Vehicle Team, the Vehicle Design Summit, and Biodiesel@MIT.

"Car Talk," produced in Cambridge, has been on the air for 31 years, the Magliozzis said, and now attracts between 10,000 and 15,000 calls every week from listeners asking for advice about their car problems. While originally the focus was on the cars themselves, increasingly "the show has become about people's relationship with their cars," Ray said. Noting the importance of reducing the greenhouse gas emissions from vehicles, he said "our goal is to have people drive a lot less."

"It's pretty stupid that we're making cars that get 20 miles to the gallon," Tom said. But if today's high gas prices continue, "it won't take that long" for that to change.

Ray said that he was impressed by the work the students are doing on developing alternative cars, and told them that "the responsibility of saving the planet is in your hands." There are dire consequences from the way we currently get and use fuel for vehicles, he said. "Save us!"

# Sun-tracking device wins student prize

## Window coatings, wind generators and power unit also win

**David Chandler**
News Office

A team of three students who designed a system that could allow solar power panels to track the sun without motors or control systems won top honors last week — and a check for $10,000 — in the finals of a competition aimed at developing innovative energy technologies.

This was the second annual MADMEC — which stands for Making And Designing Materials Engineering Contest — and it offered students six categories of engineering challenges related to producing innovative solutions for energy-related problems in the developing world. The contest is co-sponsored by MIT's Department of Materials Science and Engineering (DMSE) and by corporate sponsors Dow Chemical, Saint Gobain and General Motors.

The competition began last spring, and all four of the teams that made it to the finals won prizes, ranging from the $10,000 top award to $1,000 for the fourth-place finishers.

PHOTO / **NED THOMAS**

MIT senior Ryan Bonaparte was part of a MADMEC team that worked on a way to harness energy from a waving flag.

The winning team, called Heliotrope, chose to imitate the way plants track the sun across the sky by using the difference in temperature between shaded and sunny areas to change the properties of the material supporting solar photovoltaic cells. The system, once built, is completely passive, requiring no power source or electronics to control the movement. Solar cells that track the angle of the sun can be 38 percent more efficient at generating power than those that are mounted in a fixed position, explained team member George Whitfield, a graduate student in DMSE.

The team explored several different variations of the proposed system, using various materials including polymers and bimetallic strips. The system that shows the most promise, they said, mounts solar panels at the top of a curved arch made of a pair of metals such as aluminum and steel, which should be durable enough to withstand the elements with little or no maintenance.

"We wanted to show this concept in action," Whitfield explained as he demonstrated a scale model of the arch by shining a spotlight to warm up one side and cause the arch to bend, tilting the solar panel toward the light. "Our prototypes are cheaper than existing systems" for tracking the sun, he said, and could be built from materials that are readily available in developing nations.

The second-place winner was a team that worked on a way to make inexpensive coatings for windows that would block infrared light, thus allowing daylight through while blocking the sun's heat to reduce the need for air conditioning. Third place went for simple wind generators that could be placed alongside a road to produce electricity from the movement of passing cars. And the fourth prize went to a simple attachment for a bicycle that could allow it to generate electricity to charge batteries, such as those used in the One Laptop Per Child computers.

"I was very impressed with all the entries," said Ned Thomas, DMSE head and Morris Cohen Professor of Materials Science and Engineering. The department will definitely plan on holding another MADMEC competition starting next spring, he said.

# Q&A with Neal Stephenson

Celebrated author Neal Stephenson, known primarily for his speculative fiction works, visited MIT Sunday to speak to fans and sign copies of his books, including his latest novel, "Anathem." MIT News Office correspondent Stephanie Schorow caught up with Stephenson ahead of his appearance and posed him a few questions by e-mail. Here are his responses:

**Q:** *Do you see a relationship between the inspiration for science fiction/speculative fiction and actual science?*

**A:** They play off of each other in a way that's pretty interesting. Each side provides ideas for the other.

**Q:** *In preparing your fiction, how much (if at all) do you look into actual research into media, digital technology or other sciences? How about history?*

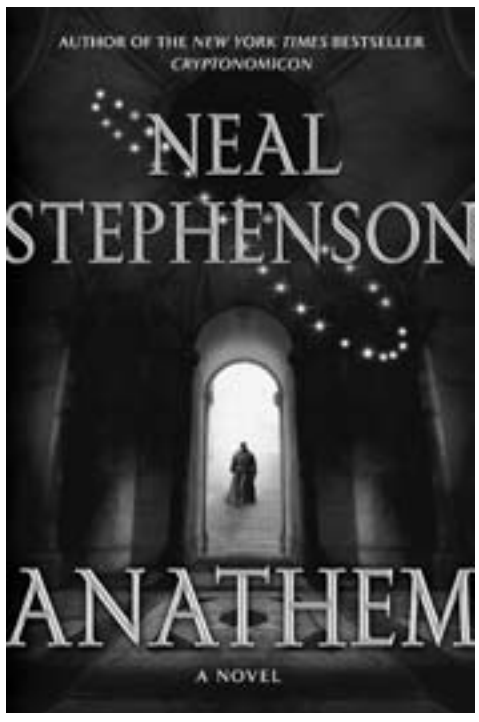
**A:** Depends on the book. I haven't written a thing about modern technology in the last eight years or so, so I haven't had to look into those topics very much. "The Baroque Cycle" and the World War II part of "Cryptonomicon" obviously required a lot of historical reading and the new novel, "Anathem," has quite a bit of philosophy and metaphysics, shading over into some fundamental physics questions such as the many worlds interpretation of quantum mechanics.

**Q:** *Why do you think that aspects of your novels (such as the "Metaverse" in "Snow Crash") seem to "come true"?*

**A:** In the case of the Metaverse, the answer is: because it's so obvious. A similar remark could be made of Google Earth.

**Q:** *Was there any one idea or concept that inspired your new novel "Anathem"? Does it in any way reflect today's culture or politics? Or do you prefer the reader to decide that?*

**A:** In general I prefer the reader to decide, but I don't want to be totally Sphinx-like and so I'll permit myself to say a little. As far as culture and politics are concerned, the important theme is long-attention-span vs. short-attention-span thinking. I'm sure that your readers




can think of any number of ways in which having a longer attention span can be useful. But I'll name one. Bankers with long attention spans don't lend money to people who can't pay it back. If we had more bankers who adopted a long-term view of their responsibilities, we might not be in the middle of a financial crisis that is blowing away 150-year-old investment banks.

**Q:** *Is there anything in your new novel (or the previous novels) that you would like MIT students to focus on as in "Hey, I could create THAT"? Or, conversely, for them to think, "Oh boy, I never realized the consequences of creating THAT."*

**A:** It'd be a big impediment to my getting any work done if I were always sitting there thinking to myself "Hmm, I'd better not write that down in case some MIT student decides to implement it." Even worse would be if I somehow got the notion in my mind that I could lead us to a brighter future by playing Pied Piper to a lot of MIT students.

Having said that, "The Diamond Age" depicts some nasty consequences of molecular nanotechnology that it would be good to avoid, and so whenever I run into a molecular nanotech person I nag them to think about what kind of immune system we are going to have to engineer in order to protect ourselves from this kind of technology.

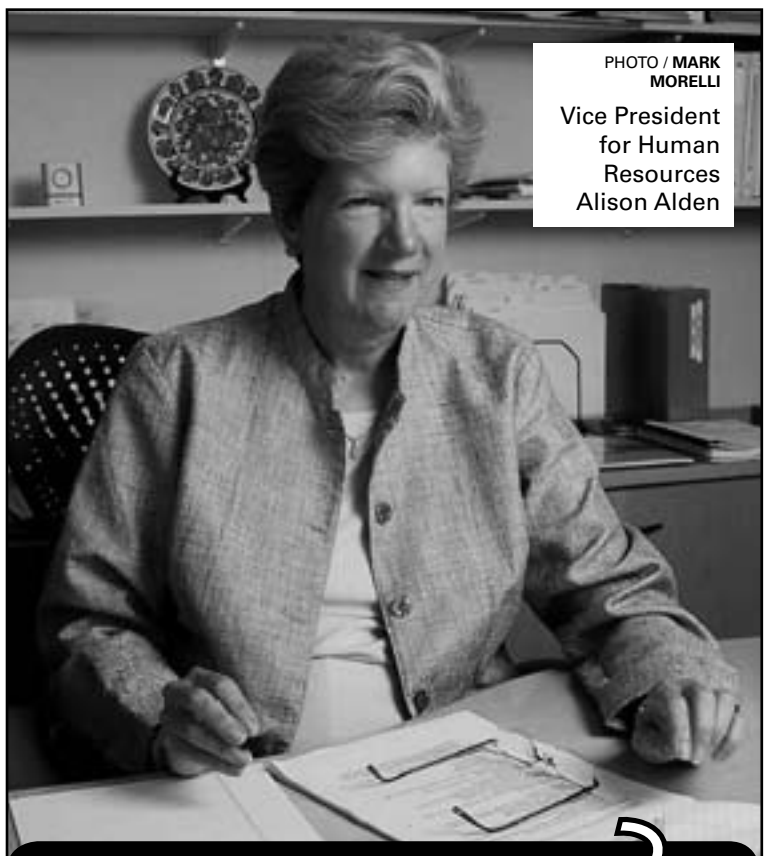


PHOTO / **MARK MORELLI**

Vice President for Human Resources Alison Alden

## Q&A with Alison Alden

*In the following interview, Human Resources Vice President Alison Alden shares her vision for MIT staff and her priorities for the coming year.*

**Q: What is your vision for staff at MIT?**

Just as MIT is known for its excellence in teaching and research, our goal is to build that same high level of energy and focus for learning and development opportunities on the staff side. I want employees to thrive in their jobs here and feel they are part of a world-class workplace. We need to actively invest in our staff just as we do with our students. We also need to build a more diverse and balanced employee population. To do our best work and solve the most complex problems, our staff should reflect the diversity of the community at large.

**Q: What do you mean by "development?"**

I think there are three things that characterize a workplace that values development. First, faculty and managers find ways in their daily interactions with their staff to provide encouragement and to create opportunities for growth. Second, the environment is such that employees feel empowered to seek feedback and view their development as a shared responsibility with their manager and with the Institute; in other words, they are active participants. Third, the workplace, in this case MIT, provides the infrastructure — the tools, programs and resources — to facilitate this occurring.

**Q: Can you talk more about what MIT is prepared to do to support this?**

We're still in the building phase but the foundation has certainly been laid. One current focus is extending our formal classroom training to help staff become stronger supervisors and managers. We will offer "Essentials of Managing" three times this year and are in the midst of a pilot for managers who already have some experience in their roles.

There will be a big push on the importance of giving feedback and developing our talent. Employees need to know how they're doing on the job, potential opportunities for growth on that job, and they should receive coaching/mentoring from their managers. The cycle of giving feedback is often referred to as performance development. We know that there are tremendous benefits to managers, employees and the Institute when time and thought are invested in performance development practices.

I'm also excited about a new peer connection program for support staff. The idea is to provide new MIT support staff with an experienced colleague who can help them navigate MIT during their first year. We want this to be very practical — so new support staff learn how to get things done at MIT.

**Q: What are some other priorities in the year ahead?**

We continue to work with the Office of the Provost to identify what is important for attracting and retaining faculty. For example, accessibility of childcare is a high priority area. We also know that it's critical for new faculty and senior leaders to get support upfront when they arrive at MIT, and as result we will pilot a customized orientation program for this population.

Look for new programs and benefits related to wellness, in partnership with our colleagues at MIT Medical. We know through the hugely successful getfit program what can happen when people work together and take responsibility for a healthier MIT.

Attention also will be focused on creating programs that help people develop skills to do their jobs better and faster. Often, staff have to learn on their own, which is typically not efficient or effective. Through the work of a cross-functional group at MIT, the Training Alignment Team, training curriculum will be developed for specific roles at the Institute. First up is curriculum for people who have responsibilities for sponsored research administration.

We invite you to look for more details about these and other priorities in upcoming issues of Tech Talk.

# **SMOOT:** Measurement feat marks 50th anniversary

Continued from **Page 1**

"I don't think any of us had the slightest idea how much work was involved with lying down, getting up," he said. "They had to help me a great way across the bridge. I started by doing a push-up, and then I couldn't even do that. It deteriorated from there."

As they neared the end of their task, a police van drove by, and made a U-turn back toward the students. Luckily, it was a false alarm — but Smoot notes that today their activity probably would garner more scrutiny.

"How would something like this be looked at today? Would the cops in the car stop and make a U-turn and check things out," he said. "Or would they see five or six male adults on the bridge with something that looked like canisters."

After the job was done, Smoot said he and his compatriots didn't give much thought to what would happen to the "Smoot marks." He graduated in 1962, started law school at Georgetown University shortly thereafter, and got married in 1964.

"There was a lot going on, so I basically didn't give it a thought," he said. "I don't recall actually thinking about it, or getting a note or having a conversation with my brothers."

That was until he gave an interview to a reporter at the now-defunct "Holiday magazine" who was investigating the strange marks on the bridge that were repainted each year by incoming Lambda Chi Alpha students. Then, he said, it seemed to take off.

And if he had to do it all over again, today? Well,

PHOTO / **PATRICK GILLOOLY**

Smoot admits he's not as strong as he used to be, but otherwise the results should be the same.

"Well as far as I can tell, and I think the meter stick we're going to give to the MIT Museum will confirm, I haven't really shrunk yet," he laughed. "I'm surprised."

And Smoot enjoys the distinction of being both a decorated professional in the standards industry (serving as a vice president Information Technology Industry Council and chairman of the American National Standards Institute's Board of Directors) and a standardized unit of measurement himself.

A Smoot is recognized enough that it's even possible to use Google's calculator function to change any measurement into Smoots.

"It's interesting to see how far apart things are," Smoot noted. "Say it's 400 miles from Washington to Boston — it's much more than that [in Smoots]."

378,268 Smoots to be exact — plus or minus an ear.

## You don't know Jack

PHOTO / **PHILIP BAILEY**

More than 1,000 hand-blown glass pumpkins, squashes and gourds in all sizes, shapes, colors and designs will transform the Kresge Oval into a colorful "Great Glass Pumpkin Patch" on Friday and Saturday, Sept. 26-27. Visitors can buy their favorite autumnal orb for prices range from $20-$200, depending on the piece's size and complexity. Many of the works feature not only vivid colors, but swirls, stripes, spots, curlicues and unusual stems.

The glass pumpkins were created by students and instructors in MIT's Glass Lab, where members of the MIT community learn and practice the art of glassblowing. Proceeds from this event benefit the lab, an art program connected with MIT's Department of Materials Science and Engineering and the Materials Processing Center. For more information, visit web.mit.edu/glasslab/sales_pumpkin.html.

## CLASSIFIED ADS

**Members of the MIT community may submit one ad each issue. Ads should be 30 words maximum; they will be edited. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.**

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Vermont vacation home for rent. Okemo mountain resort access road, newly built 3bdrm home, great location. ss kitchen, hardwood floors etc. call 617-650-7361

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1994 Mini Cooper S/JCW, Metallic Blue with Black Top and Mirrors, 24,000 miles, excellent condition, loaded, $19K. Contact Fred Mueller at 617-576-6948 (leave message). Photos and details available on craigslist.

Pottery Barn round country dinning room table with 2 leaves. 42" table expands to 72" with leaves. Asking $75. Call 617-723-3826

1996 Explorer. 4 Wheel drive automatic, 4 door, 4.0L V6 engine, 161,000 miles, good running condition, well maintained, towing package included, exterior: white, interior: grey, working heat/ac, power locks, power windows, power mirrors, power seats, keyless entry, cruise control, anti-theft system. Contact Stefanie home: (978) 887-0961, cell: (978) 790-7710

Dining Table or Conference Table, Mahogany, contemporary, pedestal base, 6'L x 3'W x 29.5" H, four cushioned chairs, dark green fabric. 1 yr. old, like NEW condition, used twice. $650. Please call Barbara at (603) 529-8208 or b.turkington@comcast.net

Classic Schwinn Unicycle, 24 inch whitewall tubular tire, adjustable seat height, lots of fun, easy to learn, $70, Peter, 617-262-2620

2000 Citation 37 ft. trailer w/2-bedrooms (never been on the road). Located at Chewonk campgrounds in Maine. Asking $14,500 or best offer. Please call Joe at 978-664-4414.

Tewksbury town house. Great location. 2 large bedrooms, 1.5 baths, new carpeting, garage, lots of storage. One pet allowed. Clubhouse/tennis courts. Low condo fee. $229,000. Call Bill at 781-249-3991.

# Finding its own way

## Robot wheelchair responds to user's spoken commands

BEDROOM

BATHROOM

**David Chandler**
News Office

MIT researchers are developing a new kind of autonomous wheelchair that can learn all about the locations in a given building, and then take its occupant to a given place in response to a verbal command.

Just by saying "take me to the cafeteria" or "go to my room," the wheelchair user would be able to avoid the need for controlling every twist and turn of the route and could simply sit back and relax as the chair moves from one place to another based on a map stored in its memory.

"It's a system that can learn and adapt to the user," says Nicholas Roy, assistant professor of aeronautics and astronautics and co-developer of the wheelchair. "People have different preferences and different ways of referring" to places and objects, he says, and the aim is to have each wheelchair personalized for its user and the user's environment.

Unlike other attempts to program wheelchairs or other mobile devices, which rely on an intensive process of manually capturing a detailed map of a building, the MIT system can learn about its environment in much the same way as a person would: By being taken around once on a guided tour, with important places identified along the way. For example, as the wheelchair is pushed around a nursing home for the first time, the patient or a caregiver would say: "this is my room" or "here we are in the foyer" or "nurse's station."

Also collaborating on the project are Bryan Reimer, a research scientist at MIT's AgeLab, and Seth Teller, professor of computer science and engineering and head of the Robotics, Vision, and Sensor Networks (RVSN) group at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL). Teller says the RVSN group is developing a variety of machines, of various sizes, that can have situational awareness to "learn these mental maps, in order to help people do what they want to do, or do it for them." Besides the wheelchair, the devices range in scale from a location-aware cell phone all the way up to an industrial forklift that can transport large loads from place to place outdoors, autonomously.

Outdoors in the open, such systems can rely on GPS receivers to figure out where they are, but inside buildings that method usually doesn't work, so other approaches are needed. Roy and Teller have been exploring the use of WiFi signals, as well as wide-field cameras and laser rangefinders, coupled to computer systems that can construct and localize within an internal map of the environment as they move around.

"I'm interested in having robots build and maintain a high-fidelity model of the world," says Teller, whose central research focus is developing machines that have situational awareness.

For now, the wheelchair prototype relies on a WiFi system to make its maps and then navigate through them, which requires setting up a network of WiFi nodes around the facility in advance. After months of preliminary tests on campus, they have begun trials in a real nursing-home environment with patients at the Boston Home in Dorchester, a facility where all of the nearly 100 patients have partial or substantial loss of muscle control and use wheelchairs.

PHOTO / **PATRICK GILLOOLY**

Nicholas Roy, assistant professor of aeronautics and astronautics; and Seth Teller, professor of computer science and electrical engineering, stand next to the robotic wheelchair they co-designed that can navigate based on verbal commands.

As the research progresses, Roy says he'd like to add a collision-avoidance system using detectors to prevent the chair from bumping into other wheelchairs, walls or other obstacles. In addition, Teller says he hopes to add mechanical arms to the chairs, to aid the patients further by picking up and manipulating objects — everything from flipping a light switch to picking up a cup and bringing it to the person's lips.

The research has been funded by Nokia and Microsoft.

DEN

KITCHEN