Volume 52, Number 9
Wednesday, November 14, 2007

TechTalk
SERVING THE MIT COMMUNITY

PHOTO / **DONNA COVENEY**

Richard Eckaus

Study sees potential for acceleration in U.S. emissions

Sarah H. Wright
News Office

U.S. greenhouse gas emissions could grow more quickly in the next 50 years than in the previous half-century, even with technological advances and current energy-saving efforts, according to a new study by Richard Eckaus, the Ford International Professor of Economics, emeritus, and his co-author, Ian Sue Wing (Ph.D. 2001).

What's more, technology itself may be more the stuff that dreams are made on than the most available tool for reducing CO_2 emissions or solving the global energy crisis, cautions Eckaus.

"There is no a priori reason to think technology has the potential for reducing energy use while meeting the tests of economics. It's politically unappetizing in the U.S., but in Europe, gas costs six dollars a gallon. Make energy more expensive: People will use less of it," Eckaus says.

In their paper, "The Implications of the Historical Decline in U.S. Energy Intensity for Long-Run CO_2 Emission Projections," published in the November issue of Energy Policy, Eckaus and Wing portray the changing interplay among technology, energy use and CO_2 emissions, based on a simulation of the U.S. economy.

"We found that, in spite of increasing energy prices, technological change has not been responsible for much reduction in energy use, and that it may have had the reverse effect," Eckaus says of their results.

The researchers studied the periods 1958 to 1996 and 1980 to 1996 and projected from 2000 to 2050. Based on their findings from the past 50 years and adjusted for a more realistic expectation for technological changes, they found that the rates of growth for energy use and emissions may accelerate from the historical rates of 2.2 percent and 1.6 percent, respectively.

"The rates of growth could be higher by a half percent or more, which becomes significant when compounded over 50 years," Eckaus says.

He acknowledges it has become counterintuitive to question technology's poten-

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Reporting now from the future

Sarah H. Wright
News Office

A producer of the megahit computer game, "The Sims," an MIT-alumnus-turned-social-media-guru at Yahoo! and a folklorist who specializes in Harry Potter fan-fiction will join industry and academic leaders in a two-day conference, Futures of Entertainment 2, to be held Nov. 16-17 at the MIT Media Lab's Bartos Theater.

Jesse Alexander

Tina Wells

Futures of Entertainment 2 (FoE2) will "get right to the nuts and bolts of developments in the media space," said Joshua Green, research manager of the Convergence Culture Consortium (C3), organizer and host of the event.

Henry Jenkins, director of the Comparative Media Studies Program and the Peter de Florez Professor of Humanities, will open FoE2 with an overview of media convergence. Jenkins' books on media and popular culture include "From Barbie to Mortal Kombat: Gender and Computer Games" and "Fans, Bloggers and Gamers: Exploring Participatory Culture."

Jonathan Gray, author of "Watching the Simpsons," C. Lee Harrington, co-author of "Soap Fans," and Jason Mittell, author of "Genre and Television," will open the Nov. 17 session.

FoE2 will offer five in-depth panels during the two-day event. The panel on Cult Media includes Danny Bilson, co-producer of "The Sims" for Electronic Arts, and Jesse Alexander, of "Heroes" (NBC), who will discuss how to stay true to the few while building properties attractive to the many and the role of fans in mainstreaming cult media.

Advertising and Convergence Culture is a discussion of the implications of breaking down the distinction between content and advertising. Tina Wells, CEO

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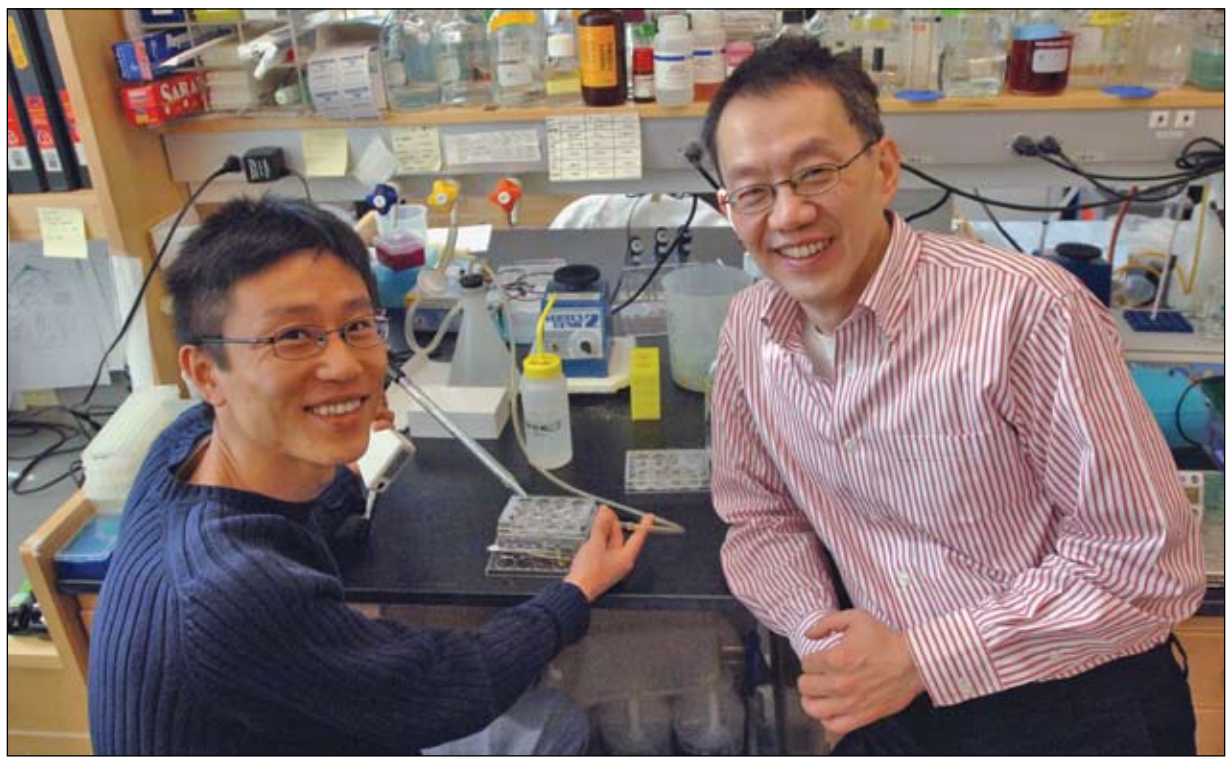

PHOTO / **DONNA COVENEY**

Building bridges in the brain

From left, Picower Center professor Morgan Sheng, Menicon Professor of Neuroscience, joins research scientist Myung Jong Kim in the lab. They have shown how manipulating a brain scaffolding protein called PSD-95 could boost cognitive function. See story on page 7.

Team analyzes genomes of 12 fly species

Approach could unlock secrets of human genome

Leah Eisenstadt
Broad Institute

In work that reveals important clues in the evolution of genes, an international consortium of MIT scientists and colleagues has analyzed the genomes of twelve species of the fruit fly Drosophila in one of the first large-scale comparisons of multiple animal genomes.

The researchers' approach may also help unlock the secrets of other genomes, including our own.

The work appears in the Nov. 8 issue of Nature and in more than 40 accompanying papers in Genome Research and other journals.

"Having the sequences of many closely related species allows us to study the evolutionary forces that have shaped the fruit fly's family tree, and to discover the working parts of the fly genome in a systematic way," said Manolis Kellis, associate member of the Broad Institute of MIT and Harvard and one of the project leaders. Kellis is also the Karl Van Tassel Career Development Assistant Professor of Electrical Engineering and Computer Science at MIT, and is affiliated with the Insti-

PHOTO COURTESY / **SCOTT BAUER, USDA**

The Mediterranean fruit fly, a species of Drosophila.

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Civil engineering students build a pedal-powered laptop.
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NEW HOPE WITH YEAST
Susan Lindquist speaks on yeast's role in neurobiology.
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MIT will host first Great American Smokeout

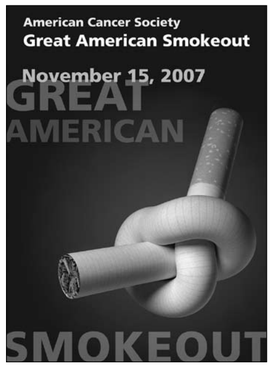
Thirty percent of all cancer deaths are attributable to smoking, so helping friends and family to stop will be the focus of the first ever cross-campus Great American Smokeout event at MIT on Nov. 15. In conjunction with the American Cancer Society's annual event, MIT's Community Health Working Group will provide information and "quit kits" in three campus locations.

The Smokeout aims to inform the MIT community about the many resources available to smokers through the Center for Health Promotion and Wellness at MIT Medical. "In conjunction with the Smokeout, we're launching brand-new tobacco treatment services," says health educator Lauren Mayhew.

Any member of the MIT community can make an appointment for a quit-smoking consultation with an MIT Medical health educator trained in tobacco treatment. The health educator can support in creating a quit plan and help to develop strategies for coping with triggers and cravings. Also, matters such as sleep, fitness, nutrition and stress management can be addressed during this consultation.

"On average, it takes several attempts for someone to quit smoking," adds Mayhew. "It's important that people prepare to quit—it really is something that requires planning and preparation."

Setting a quit date, preferably at least



a week in advance, and stopping completely on that date, is one effective tool for quitting tobacco. Evidence shows that the chance of successfully quitting is also much higher with the use of behavioral counseling and FDA-approved stop-smoking medications, including nicotine patches, gum and nasal spray than by quitting cold turkey.

Information on these methods, along with quit kits, will be available across campus on Nov. 15. Look for tables in Lobby 10, the E25 Atrium and the Wolk Lobby in Sloan. There will also be a cold turkey sandwich giveaway, courtesy of Subway. Other resources include a seven-week quit-smoking class that the Center for Health Promotion offers. The next class, which meets weekly, begins Jan. 9.

Tobacco use is the first challenge that the Community Health Working Group has tackled. According to facilitator Maryanne Kirkbride, the new group is charged with selecting "high-priority, cross-cutting health issues for systematic campuswide improvement." The group includes staff from the Center for Health Promotion and Wellness at MIT Medical, the Z Center, DAPER, Environmental Health and Safety, Facilities and Human Resources. Group membership is open; if interested, e-mail kirk@med.mit.edu.

Visit these links for more information: web.mit.edu/medical/quitsmoking, American Cancer Society: www.cancer.org, Mass. Dept. of Public Health: www.trytostop.org, MGH Quit Smoking Service: www.massgeneral.org/tts/.

FUTURE

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of Buzz Marketing group and winner of AOL's Black Female Entrepreneur's Award, Mike Rubenstein, art director at the Barbarian Group, and Faris Yakob, senior strategist and digital ninja at Naked Communications, among others, will lead.

What kinds of revenue sharing should or could exist when companies turn a profit based on the unpaid labor of their consumers? Fan Labor panelists discussing the future of compensation for invisible labor include Mark Deuze, author of "Media Work" (2007); Catherine Tosenberger, specialist in Harry Potter online fanfiction and contributor to NPR's "Recess!" and Raph Koster, president of Areae and author of "A Theory of Fun for Game Design."

Beyond the launch of shiny new devices, the mobile market has been dominated by data services and reformatted content, and mobile's "killer app" has yet to materialize. Mobile Media panelists on the future of mobile services will include Marc Davis (Ph.D. 1995), Social Media Guru at Yahoo! Inc., and Alice Kim, Senior Vice President of Digital Distribution and Partner Relations for MTV Networks.

Media companies are developing new ways to measure audiences. The panel on Metrics and Measurement will discuss how these new models account for the impact of DVRs, video-on-demand and online video.

For more information on FoE2, go to www.convergenceculture.org/futures ofentertainment/2007/.

FLY

Continued from Page 1

tute's Computer Science and Artificial Intelligence Laboratory.

On the one hand, the researchers studied the differences across species to help elucidate how evolution has shaped fly biology over millions of years. Their analysis revealed that while many attributes of Drosophila genomes are in fact conserved across multiple species, each species has novel features not seen in any other. For example, the genes involved in interactions with the environment and in reproduction showed signs of adaptive evolution, meaning that they likely provided some survival advantage to the organism.

On the other hand, the researchers studied the similarities of the different species to help define the functional parts of the fly genome. The parts of a genome that are unchanged (conserved) are those that have been kept by evolution and are thus likely to play crucial roles. Thus, genome comparison can reveal which regions of the genome are functional, based on the degree to which evolution has conserved them.

"Focusing on the conserved part of the genome is a great way to discover what has been maintained by evolution," said Kellis. "Moreover, by looking more closely at the subtle patterns of mutation within conserved regions, we can predict the functional roles they play."

Indeed, at the level of DNA, several combinations of letters, or nucleotides, may encode the same function, in the way that a storyteller can use different combinations of words to tell the same tale. For example, four different nucleotide combinations—GTT, GTC, GTA and GTG—encode the same protein building block, or amino acid. Thus, a change in the third letter would leave the amino acid unchanged, one example of how DNA changes can be tolerated while preserving the function of the corresponding protein.

Through these kinds of random mutations, evolution explores the possible nucleotide combinations that preserve function. This exploration produces unique patterns of genomic change, described by the researchers as "evolutionary signatures" that are specific to the function of that region of DNA.

Kellis and colleagues identified evolutionary signatures associated with a variety of roles in the genome such as protein-coding genes. The researchers then used these evolutionary signatures to systematically identify the functional elements encoded in the fly genome, leading to hundreds of novel functional elements and many new insights on animal biology.

The team's analysis is the first time that such a diverse range of evolutionary signatures has been applied to identify the functional elements of a genome in a comprehensive way. "By comparing many closely related genomes, we were able to discover things we never thought were possible using one genome sequence alone," said Kellis.

One intriguing possibility is that evolutionary signatures may even identify novel, yet-unknown classes of functions. For example, although the fruit fly has been intensely studied for more than a century, microRNAs were only discovered in the last decade and are now known to play a central role in development. Many other classes of yet-unknown functional elements may be hidden in the fly genome, and recognition of their common evolutionary properties may help lead to their discovery.

The study of the 12 flies has immediate implications for the discovery of functional elements in the human genome. "We are now using similar methods to analyze 32 mammalian genomes, in order to help understand the human genome," Kellis explained. "We should be able to apply the methodology of evolutionary signatures to any group of closely related species."

The Broad Institute of MIT and Harvard was one of several sequencing centers to participate in the work, in addition to Agencourt Bioscience Corporation, the Washington University Genome Sequencing Center and the J. Craig Venter Institute.

DIGITALK: Where IT's at

Forum on MIT VoIP

On Monday, Nov. 26, Information Services and Technology (IS&T) will host a community forum on the new MIT Voice over IP (VoIP) telephone service. It will be held from 11 a.m. to 12:30 p.m. in W20-306 (Twenty Chimneys). MIT VoIP provides telephone and voice-mail services over MITnet rather than over traditional telephone wires. Key advantages include the ability to set rules for handling calls and to receive voice-mail messages via e-mail as audio file attachments.

The forum will consist of a presentation on MIT VoIP today, a brief demo and a Q&A session with representatives from IS&T's VoIP Core Team. To learn more, visit web.mit.edu/ist/topics/voip.

Don't leap to Leopard

IS&T strongly recommends that Macintosh users wait to upgrade to Apple's newest operating system, Mac OS X 10.5 (Leopard).

With any new operating system, there are going to be incompatibilities and bugs. Some applications that are important to productive and safe computing at MIT do not work with Leopard, including TSM and SAPgui. IS&T expects that vendors will release updates to address these incompatibilities.

IS&T's Computing Help Desk offers limited support on basic configuration issues for new machines arriving with Leopard installed. As critical application issues are resolved, IS&T will offer more in-depth support.

For details, see the Mac OS X 10.5 Release Notebook at web.mit.edu/swrt/releases/macosx. Send your questions about Leopard to the Mac OS X Release Team at macosx-release@mit.edu.

Order goods online with eCAT^3

eCAT^3 (pronounced "eCAT cubed") provides MIT with an easy-to-use, web-based solution for ordering goods from several suppliers, including Office Depot. To get started, you need an MIT certificate, SAP authorizations and permissions, and a few minutes to set up your eCAT^3 profile. When creating your profile, set up at least one "Ship to" and "Bill to" location, complete with building, room and e-mail address. You can then search for products, place orders and create "favorites" lists.

When you submit an order, eCAT^3 brings you to the SAP requisition page where you provide your GL account, cost object and material group information. Completing the requisition starts the SAP workflow. Purchase orders are sent electronically to eCAT^3 for disbursement to the vendor. The vendor will ship your order and send an electronic invoice to SAP.

For links to eCAT^3 suppliers and training resources, visit web.mit.edu/ecat/ecat3.

Support for Windows Mobile devices

IS&T now offers support for Windows Mobile 5 Pocket PC/smartphone and Windows Mobile 6 Professional/Standard devices. This includes support for the Windows Mobile operating system, e-mail on these devices, the SyncML application for wireless synchronization with MIT's TechTime calendar and Wi-Fi connection to MITnet.

In addition, IS&T continues to test Apple's iPhone and Research In Motion's BlackBerry 8830 World Edition smartphone. IS&T plans to provide limited support for these devices within a few months.

For details on IS&T's support for mobile devices, visit itinfo.mit.edu/article.php?id=8663.

Digitalk is compiled by Information Services and Technology.

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Office of the Arts
web.mit.edu/arts

Printed on recycled paper

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Tech Talk is published by the News Office on Wednesdays during term time except for most Monday holiday weeks. See Production Schedule at web.mit.edu/newsoffice/techtalk-info.html. The News Office is in Room 11-400, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA 02139-4307.

Postmaster: Send address changes to Mail Services, Building WW15, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA 02139-4307.

Subscribers may call 617-252-1550 or send e-mail to mailsvc@mit.edu.

Tech Talk is distributed free to faculty and staff offices and residence halls. It is also available free in the News Office and the Information Center.

Domestic mail subscriptions are $25 per year, nonrefundable. Checks should be made payable to MIT and mailed to Business Manager, Room 11-400, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307.

Periodical postage paid at Boston, MA.

Sloan students ready for leading roles

Stephanie Schorow
News Office Correspondent

The head surgeon (played by Vic Malla) hands a scalpel to a first-year medical student with a startling command: Start cutting on the patient. The student (played by Jean Ng) decides this isn't a good idea and snaps out a response to deflect the direct order: "You want me to operate on *George Clooney*?" The surgeon, just as quickly, replies: "George Clooney would *want* you to operate."

As the MBA students dissolved into laughter while watching the improvised scene—an exercise in the Sloan Innovation Period workshop "Improvisation and Influence: An Experiential Leadership Lab"—a valuable lesson is highlighted. Quick thinking, a grasp of details and subtle manipulation of status can be invaluable tools in the business world.

"Virtually every discipline has within it improvisation," actress and consultant Daena Giardella told the SIP class. "Great leaders are master improvisers; they respond to the situation."

Meanwhile, across campus, other Sloan students are wielding swords and calling on "We few, we happy few, we band of brothers" for the SIP class, "Leadership as Acting," in which Sloan senior lecturer Christine Kelly leads students through a shortened version of Shakespeare's "Henry V."

These two SIP classes, held during the October 2007 session, may seem more suited for Broadway than the boardroom but both underscore the message that leadership requires multiple skills—skills that can be taught and practiced.

In Kelly's class, for example, participants improved their speaking and presentation styles while considering the management techniques of the boy king of England. In the play, Henry V uses threats, guile, charm and inspiration to get what he wants—whether victory on the battlefield or the heart of a French princess. A number of students played his role, giving each a taste of being the king. Putting on the play is not just a chance to be on stage, it's "more what you learn about yourselves as leaders," Kelly said.

In one scene, for example, Henry threatens a French mayor with hideous mayhem if he doesn't capitulate. "It's an example of a leader using fierce words to get what he wants," Kelly noted. In another scene, Henry is reflective, somber and worried; in another he is flirtatious, using his rough and plain style to his wooing advantage.

Indeed, influence has become a key skill in the global marketplace, where top-down, my-way-or-the-highway relationships are in flux and leaders need to subtly shift language, tone and body stance with subordinates or partners, noted Deborah Slobodnik, a co-founder of Options for Change and a co-teacher in the improvisation class. She and Giardella challenged their students through skits and exercises to examine their own style of influence—their "default" setting—and adopt new styles: "You need to be able to pivot," Giardella said.

Some of the exercises seemed silly at first: Emi Fong had to sing a ditty about her shirt, while Alex Prieux had to play an alien journalist describing a human house. But the humor, quick response and actions helped students "straddle the moment."

Other exercises forced students to improvise on what others said or did: Prieux and Trip Bellard argued heatedly about imaginary owed money; David Gold played a calming therapist to a distraught Prieux; Kabir Goyal convinced a skeptical Catherine Ma to climb into a sewer.

"We are so caught into what we want the other person to think or feel, we plow over the clues" offered by the other person, Giardella said.

In an intense exercise, students were asked to describe their "inner critic" and pretend to kick it around. After first holding back, Alejandra Santamaria smashed her inner naysayer with improvised karate moves. We never really lose that internal critic, Giardella said, but we can use the inner demon to our advantage. "You can master its energy and use it for your own purposes," she said.

"Leadership is an emotional expression," said Taariq Lewis, who enthusiastically dove into the nuances of playing the young commander in "Henry V." "In this class, we remember how to be open and honest and emotional. I'm trying to be a better leader by learning how to be emotionally charged but still corporate."

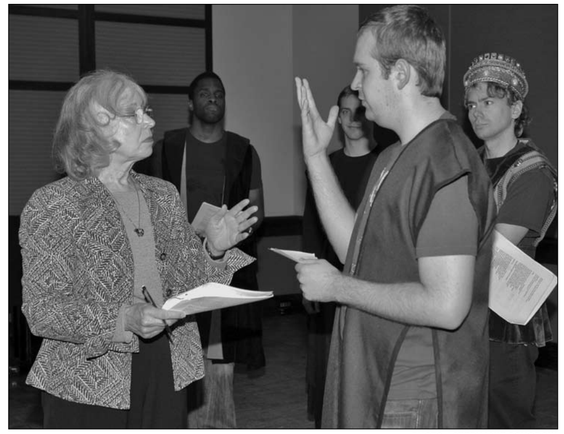


PHOTO / **STEPHANIE SCHOROW**

Sloan senior lecturer Christine Kelly, left, explains the finer points of Shakespeare to Vadim Skaletsky as fellow students Taariq Lewis, John Angelos and Gregor Hanuschak look on.

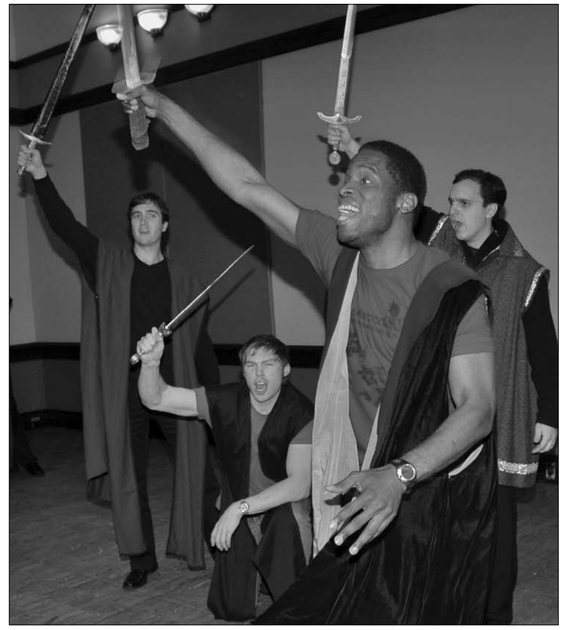


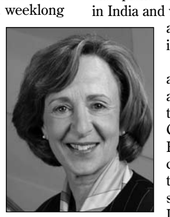
PHOTO / **STEPHANIE SCHOROW**

Taariq Lewis, in front, gives enthusiastic voice to Shakespeare's "Henry V" along with, from left, Robin Lamb, Ben Frenkel and Ignacio Diaz. All are MIT Sloan students.

Hockfield to lead MIT India trip; will focus on fostering collaboration

Anne Trafton
News Office

On Nov. 16, MIT President Susan Hockfield will lead a delegation on a weeklong trip to India that will highlight MIT's history with India and the potential for future collaborations.



Susan Hockfield

During the past few years, faculty and student interest in India has grown significantly, and there are currently a dozen formal collaborations between MIT and India. There are now 229 Indian students at the Institute, and more than 40 faculty members have collaborations with colleagues in India.

Hockfield, who is the first sitting MIT president to go to India, will visit New Delhi, Mumbai and Bangalore. In New Delhi, she will lead the symposium, "India and MIT: A Conversation About the Future," at which several MIT faculty members will speak. She will also deliver a public lecture on "Universities and the Global Knowledge Economy" to the Confederation of Indian Industries in Mumbai.

While in Bangalore, Hockfield will visit the leaders of John F. Welch Technology Centre, Infosys, Wipro and Biocon. She also plans to meet with groups of alumni in India and with dignitaries from the Indian government, academia and industry.

MIT faculty who will accompany Hockfield to India are Subra Suresh, dean of the School of Engineering; Charles Cooney, the Robert T. Haslam Professor of Chemical Engineering; Esther Duflo, the Abdul Latif Jameel Professor of Poverty Alleviation and Development; Arvind, the Johnson Professor of Computer Science and Engineering; Steven Lerman, dean for graduate students; Ram Sasisekharan, professor of biological engineering and health sciences and technology; Martha Gray, co-director of the Harvard-MIT Division of Health Sciences and Technology; Philip Khoury, associate provost; O'Neil Outar, director of institutional initiatives; and Tuli Banerjee, director of the MIT-India Program.

AWARDS AND HONORS

Former students honor Stephen Ross, mentor and teacher, with $100K prize

Linked by the "transforming influence" he has had on their lives and careers, more than 50 former students recently surprised MIT Sloan School of Management Professor of Financial Economics Stephen A. Ross by unveiling a major new prize in his name to honor outstanding papers in his field.

Stephen Ross

In more than 35 years of research and teaching, Ross has had a major impact on the field of finance. Among other things, he is the inventor of the Arbitrage Pricing Theory and a pioneer in the area of financial derivatives and interest rate models. He is the co-author of "Corporate Finance," now in its eighth edition.

After a fundraising drive among former Ross students that far exceeded the organizers' goals, the first Stephen A. Ross Prize in Financial Economics will be awarded by the end of 2008 by the newly created nonprofit Foundation for Advancement of Research in Financial Economics. In only about a year of fundraising, 50 former Ross students, who now teach at such institutions as MIT, Yale, the University of Chicago, Stanford and the University of Pennsylvania, together donated more than $617,000 toward endowing the prize. After a second phase of fundraising within the academic and investment communities, the foundation expects to be able to award a prize of at least $100,000 every two years. In keeping with the foundational nature of Ross' research, the prize-winning publication will either develop or rigorously test a theory pertaining to financial economics.

In addition to the Ross prize, McGraw-Hill/Irwin, the publisher of Ross' hugely popular textbook, is honoring Ross with the publication of "Stephen A. Ross, Mentor: Influence through Generations," a collection of papers by Ross' students. The volume is edited by Mark Grinblatt, another former Ross student.

MIT Corporation grants tenure, makes tenured appointments to faculty

The Corporation's Executive Committee has approved 50 faculty for tenure, effective July 1, 2007. Unless otherwise noted, all promotions are from associate professor without tenure to associate professor with tenure.

George-Marios Angeletos
Economics
Education: B.A. 1996, M.S. 1997 (both from Athens University), M.A. 2000, Ph.D. 2001 (both from Harvard University)
Joined MIT faculty: 2001

Angeletos is an economic theorist whose most recent research has examined economic environments in which agents have limited and dispersed information about aggregate economic conditions.

Martin Z. Bazant
Mathematics
Education: B.S. 1992, M.S. 1993 (both from University of Arizona), Ph.D. 1997 (Harvard University)
Joined MIT faculty: 2000

Bazant is an expert in physical applied mathematics. His current research focuses on microfluidics, electrochemical systems and granular flow.

Adam Berinsky
Political Science
Education: B.A. 1992 (Wesleyan University), Ph.D. 2000 (University of Michigan)
Joined MIT faculty: 2003

Berinsky is a scholar of American politics who specializes in public opinion. His research focuses on how politically relevant groups are represented in the American political process.

Vladimir Bulovic
Electrical Engineering and Computer Science
Education: B.S.E. 1991, M.A. 1995, Ph.D. 1998 (all from Princeton University), M.S. 1993 (Columbia University)
Joined MIT faculty: 2000

Bulovic is a leading researcher in the field of molecular, nanostructured and organic semiconductor electronics.

Erik Demaine
Electrical Engineering and Computer Science
Education: B.Sc. 1995 (Dalhousie University), M.Math. 1996, Ph.D. 2001 (both from University of Waterloo)
Joined MIT faculty: 2001

A pioneer in the field of computational origami, Demaine has made many contributions to computational geometry and geometric folding.

Michael Ernst
Electrical Engineering and Computer Science
Education: S.B. 1989, S.M. 1992 (both from MIT), M.S. 1997, Ph.D. 2000 (both from University of Washington)
Joined MIT faculty: 2000

Ernst works in the field of software engineering and has made major contributions to program analysis, programming language design, and software testing.

David Kaiser
Science, Technology and Society (STS)
Education: A.B. 1993 (Dartmouth College), Ph.D. 2000 (Harvard University)
Joined MIT faculty: 2000

As a historian of science with an active research career in physics, Kaiser is leading a move to better integrate the history of physics with physics itself and with mainstream American history of the Cold War.

J. Troy Littleton
Biology
Education: B.S. 1989 (Louisiana State University), Ph.D. 1994, M.D. 1997 (both from Baylor College of Medicine)
Joined MIT faculty: 2000

Littleton, a specialist in molecular neurobiology, focuses on understanding how neuronal synapses form and function, and has recently developed models to study neurodegenerative disease.

Nicola Marzari
Materials Science and Engineering
Education: Laurea 1992 (Università di Trieste, Italy), Ph.D. 1996 (University of Cambridge)
Joined MIT faculty: 2001

Marzari's research is dedicated to understanding, predicting and designing the properties of complex materials and devices using first-principles simulations.

Joseph Paradiso
Media Arts and Sciences
Education: B.S. 1977 (Tufts University), Ph.D. 1981 (MIT)
Joined MIT faculty: 1994

Paradiso, a pioneer in the field of sensor networks, is responsible for such conceptual and technical innovations as power harvesting, parasitic mobility and body sensor networks. His research has impacted applications in art, sports, medicine and human-computer interaction.

David Perreault
Electrical Engineering and Computer Science
Education: B.S.E.E. 1989 (Boston University), S.M. 1991, Ph.D. 1997 (both from MIT)
Joined MIT faculty: 2001

A specialist in power electronics, Perreault is leading the way to power conversion solutions for the next generation of engineering systems.

Gunther Roland
Physics
Education: Diploma 1989 (Frankfurt University), Ph.D. 1993 (Institute for Theoretical Physics, Frankfurt University)
Joined MIT faculty: 2000

Roland's research studies the fundamental interactions of nature at very high energies. He is particularly interested in the strong interaction and nature of matter under extreme conditions of density and temperature.

Senthil Todadri
(from assistant professor)
Physics
Education: M.Sc. 1992 (Indian Institute of Technology), Ph.D. 1997 (Yale University)
Joined MIT faculty: 2001

Senthil's research interests are in understanding theoretically materials whose electronic properties do not seem to fit with conventional theories of the physics of solids, such as high-temperature superconductors.

Kai von Fintel
Linguistics and Philosophy
Education: B.A. 1983 (University of Münster), B.A. 1986 (University of Köln), M.A. 1992, Ph.D. 1994 (both from University of Massachusetts at Amherst)
Joined MIT faculty: 1994

Von Fintel's research interests are in semantics, pragmatics and philosophy of language, and the intersections among them.

Vladan Vuletic
Physics
Education: Diploma 1992, Ph.D. 1997 (both from Ludwig-Maximilians-Universität Munich)
Joined MIT faculty: 2003

Vuletic's research focuses on the coherent and controlled interaction of ultracold atoms with light.

Joseph Weber
Economics, Finance and Accounting
Education: B.S. 1990 (Bucknell University), Ph.D. 2000 (Pennsylvania State University)
Joined MIT faculty: 2000

Weber, an accounting researcher, has three streams of research—accounting choice, audit quality and disclosure—and is best known for his work on how accounting choices impact debt contracts and capital markets.

Ivan Werning
(from assistant professor)
Economics
Education: B.A. 1996 (Universidad de San Andres), M.A. 1997 (Universidad Torcuato di Tella), Ph.D. 2002 (University of Chicago)
Joined MIT faculty: 2002

A leader in the field of macroeconomics, Werning has made important contributions to several subfields, including the design of optimal unemployment insurance, work on optimal taxation and the design of fiscal policies.

Moe Z. Win
Aeronautics and Astronautics
Education: B.S.E.E. 1987 (Texas A&M University), M.S.E.E. 1989, M.S. 1998, Ph.D. 1998 (all from University of Southern California)
Joined MIT faculty: 2002

A world leader in ultrawide bandwidth (UWB) communications and networks, Win has made important contributions to multiple-antenna systems, diversity techniques and satellite communications.

John Fernandez
Architecture
Education: S.B. 1985 (MIT), M.Arch. 1989 (Princeton University)
Joined MIT faculty: 1998

A leader in the field of sustainable and resource-efficient buildings, Fernandez is a practicing architect and published author whose research focuses on the intersection of architectural design and materials technology.

Amy Finkelstein
(from assistant professor)
Economics
Education: A.B. 1995 (Harvard University), M.Phil. 1997 (University of Oxford), Ph.D. 2001 (MIT)
Joined MIT faculty: 2005

An applied economist working in the fields of public economies and health economics, Finkelstein has studied the role of government insurance programs in affecting the rate of medical progress and the health of the target population

Piotr Indyk
Electrical Engineering and Computer Science
Education: Magister 1995 (Warsaw University), Ph.D. 2001 (Stanford University)
Joined MIT faculty: 2000

A pioneer in the area of high-dimensional computational geometry and in the development of algorithms for massive data sets, Indyk works broadly in the area of algorithms.

Deb Kumar Roy
Media Arts and Sciences
Education: B.A.S. 1992 (University of Waterloo), M.S. 1995, Ph.D. 1999 (both from MIT)
Joined MIT faculty: 2000

Roy studies language acquisition and use by machines and children. He has built the most advanced embodied language-learning machines to date and has put forth a compelling theoretical framework for the foundations of symbolic communication.

Christopher A. Schuh
Materials Science and Engineering
Education: B.S. 1997 (University of Illinois at Urbana-Champaign), Ph.D. 2001 (Northwestern University)
Joined MIT faculty: 2002

Schuh has contributed significantly to materials research in three main areas: understanding of grain boundary interface networks, design of nanocrystalline alloys and mechanisms of deformation at the nanoscale.

Joshua B. Tenenbaum
(from assistant professor)
Brain and Cognitive Sciences
Education: B.S. 1993 (Yale University), Ph.D. 1999 (MIT)
Joined MIT faculty: 2002

Tenenbaum is a cognitive scientist who studies learning and inference in humans and machines. He builds computational models with the twin aims of reverse-engineering core human cognitive capacities, such as concept learning, causal reasoning or language acquisition, and engineering more-human-like artificial systems with these same capacities.

Muhamet Yildiz
Economics
Education: B.S. 1992, M.S. 1994 (both from Bogazici University), Ph.D. 2000 (Stanford University)
Joined MIT faculty: 2000

An economic theorist, Yildiz is a leader in bargaining theory, particularly the study of the role of excessive optimism in delaying efficient agreements, and in research on higher-order beliefs in games.

Not pictured

Alexander Postnikov
Mathematics
Education: M.S. 1993 (Moscow State University), Ph.D. 1997 (MIT)
Joined MIT faculty: 2001

Postnikov is a leader in enumerative and algebraic combinatorics whose research introduces new methods to solve combinatorial problems that apply to algebra, geometry, representation theory, theoretical physics and other fields.

Faculty named full professors
Page 6

Faculty appointments with tenure

Dennis Frenchman
Full professor
Urban Studies and Planning
Education: B.Arch. 1972 (University of Cincinnati), M.Arch.A.S, M.C.P. 1976 (both from MIT)
Joined MIT faculty: 1983

Frenchman, an urban designer and educator, is an international leader in the redevelopment of historic cities and sites, the transformation of downtown districts, and the integration of new-media technology with city design.

Ju-Lee Kim
Associate professor
Mathematics
Education: B.S. 1991 (Korean Advanced Institute of Science & Technology), Ph.D. 1997 (Yale University)
Joined MIT faculty: 2007

Kim is a leading representation theorist working on the natural symmetry groups that arise in number theory.

Rahul Mehrotra
Associate professor
Architecture
Education: Diploma 1985 (School of Architecture at Ahmedabad, India), M.Arch. 1987 (Harvard University)
Joined MIT faculty: 2007

Mehrotra has developed an interwoven approach to design practice and research that reflects the specifics of local conditions in Asia as well as critical global issues such as rapid urbanization.

Dianne K. Newman
Full professor
Biology
Education: B.A. 1993 (Stanford University), Ph.D. 1997 (MIT)
Joined MIT faculty: 2007

Newman is a world leader in geobiology, a field that seeks to understand the co-evolution of life and Earth.

Jonas C. Peters
Full professor
Chemistry
Education: B.S. 1993 (University of Chicago), Ph.D. 1998 (MIT)
Joined MIT faculty: 2006

Peters' research group is involved in the design of new inorganic and organometallic transformations and the synthesis of novel ligands and transition metal complexes.

Sara Seager
Associate professor
Earth, Atmosphere and Planetary Sciences
Education: B.Sc. 1994 (University of Toronto), Ph.D. 1999 (Harvard University)
Joined MIT faculty: 2007

Seager's research goals include determining the bulk composition and atmospheric characteristics of exoplanets of all masses and ages and understanding the potential for and signatures of habitability and life on exoplanets.

Paul A. Seidel
Full professor
Mathematics
Education: Diploma 1994 (Heidelberg University), Ph.D. 1998 (University of Oxford)
Joined MIT faculty: 2006

Seidel is a leading figure in symplectic geometry, an increasingly central field in mathematics with links to theoretical physics, analysis and low-dimensional topology.

Nader Tehrani
Associate professor
Architecture
Education: B.F.A. 1985, B.Arch. 1986 (both from Rhode Island School of Design), M.A.U.D. 1991 (Harvard University)
Joined MIT faculty: 2007

Tehrani, founder and principal of the award-winning firm Office dA, focuses his research on materials, computer-aided manufacturing and sustainability.

Roger White
Associate professor
Linguistics and Philosophy
Education: B.A. 1993 (University of New South Wales), Ph.D. 2000 (MIT)
Joined MIT faculty: 2006

A specialist in the theory of knowledge and the philosophy of science, White has written widely on epistemology and significantly on the apparent fact that the universe is "fine-tuned" to make possible the emergence of life.

16 faculty are named full professors with tenure

Angelika Amon
Biology
Education: B.A. 1989, Ph.D. 1993 (both from University of Vienna at Austria).
Joined MIT faculty: 1999

A leader in the field of mitotic cell cycle regulation, Amon has discovered regulatory networks that govern and ensure the fidelity of chromosome segregation during mitosis and meiosis.

Thomas F. DeFrantz
Music and Theater Arts
Education: B.A. 1988 (Yale University), M.A. 1989 (City College of New York), Ph.D. 1997 (New York University)
Joined MIT faculty: 1997

DeFrantz, a choreographer, director and dancer, is a historian of dance and an expert on African-American dance. He has directed or performed in dozens of productions at MIT and internationally.

Daniel Fox
Linguistics and Philosophy
Education: M.A. 1993 (Tel Aviv University), Ph.D. 1998 (MIT)
Joined MIT faculty: 2001

Fox's main research specialty is the interface between syntax, semantics and pragmatics, including the modular organization of the linguistic system and the limits imposed on the information flow relevant for the application of optimization principles.

William H. Green Jr.
Chemical Engineering
Education: B.A. 1983 (Swarthmore College), Ph.D. 1988 (University of California at Berkeley)
Joined MIT faculty: 1997

A leader in the computer simulation of reactive chemical processes, Green applies chemistry, quantum mechanics and numerical methods to engineering.

Jonathan P. How
Aeronautics and Astronautics
Education: B.A.Sc. 1987 (University of Toronto), S.M. 1989, Ph.D. 1993 (both from MIT)
Joined MIT faculty: 2000

An internationally recognized scholar and engineer, How has contributed to theoretical and practical advances in navigation and control of complex aerospace-relevant systems.

Hiroshi Ishii
Media Arts and Sciences
Education: B.E. 1978, M.E. 1980, Ph.D. 1992 (all from Hokkaido University)
Joined MIT faculty: 1995

Ishii is head of the Tangible Media Group and co-director of the Things That Think consortium at the MIT Media Lab. His research focuses upon the design of seamless interfaces between humans, digital information and the physical environment.

Caroline A. Jones
Architecture
Education: A.B. 1977 (Harvard-Radcliffe College), M.A. 1988, Ph.D. 1992 (both from Stanford University)
Joined MIT faculty: 2002

Jones studies modern and contemporary art, with a particular focus on its technological modes of production, distribution and reception.

John J. Leonard
Mechanical Engineering
Education: B.S.E.E. 1987 (University of Pennsylvania), D.Phil. 1994 (University of Oxford)
Joined MIT faculty: 1994

Leonard and his students have made substantial contributions to autonomous mobile robotics, in particular the development of robust methods for Simultaneous Localization and Mapping.

Thomas Levenson
Writing and Humanistic Studies
Education: B.A. 1980 (Harvard University)
Joined MIT faculty: 2004

Levenson, a professor of science writing, is the author of three books and producer/director/writer of nine nationally broadcast science documentaries, and has written articles on science for national and international publications.

Nasser O. Rabbat
Architecture and Planning
Education: B.Arch 1979 (Damascus University), M.Arch II, 1984 (UCLA), Ph.D. 1991 (MIT)
Joined MIT faculty: 1991

Rabbat is an architectural historian who focuses on the history and historiography of Islamic art and architecture, urban history and postcolonial criticism.

Not pictured

John G. Brisson II
Mechanical Engineering
Education: B.E. 1981 (Stevens School of Technology), M.S. 1983, Ph.D. 1990 (both from Harvard University)
Joined MIT faculty: 1993

Brisson has focused his recent research on energy engineering, with projects focusing on carbon sequestration, a compact cryocooler for use in space and new methods of making ice and ice cream.

Not pictured

Rajeev J. Ram
Electrical Engineering and Computer Science
Education: B.S. 1991 (California Institute of Technology), Ph.D. 1997 (University of California at Santa Barbara)
Joined MIT faculty: 1997

Director of the Center for Integrated Photonics and Associate Director of the Research Lab for Electronics, Ram has contributed to photonic systems ranging from fiber-to-the-home to alternative energy.

Seth Teller
Electrical Engineering and Computer Science
Education: B.A. 1985 (Wesleyan University), M.S. 1990, Ph.D. 1992 (both from University of California at Berkeley)
Joined MIT faculty: 1994

Teller's research focuses on machine vision, sensor networks and fine-grained localization and situational awareness for mobile robotics and assistive devices.

Andrei Tokmakoff
Chemistry
Education: B.Sc. 1988 (California State University at Sacramento), M.Sc. 1991, Ph.D. 1995 (both from Stanford University)
Joined MIT faculty: 1998

Tokmakoff's research group studies the time-evolution of molecular structure in chemical reactions and biophysical processes.

Brian C. Williams
Aeronautics and Astronautics
Education: S.B. 1981, S.M. 1984, Ph.D. 1989 (MIT)
Joined MIT faculty: 1999

Williams is a leading international scholar, researcher and educator in the design, development and deployment of complex aerospace autonomous systems. These reason intelligently and act responsibly thanks to model-based programming.

ECKAUS

Continued from Page 1

tial to solve the energy problem. But U.S. steelmaking illustrates how fossil fuel consumption can increase along with technological change: Steelmakers' furnaces are now electrical, reducing coal use at the plant. But coal generates some of the electricity that powers the factory furnace, resulting in more CO_2 emissions.

"The net savings in this case comes from the use of scrap steel instead of iron ore, not from new furnace technology," Eckaus says.

A former consultant to the World Bank, Eckaus has been an advisor on economic policy to Egypt, India, Mexico and Portugal, among other countries; he advocates policies to control both energy use and CO_2 emissions.

"Technological change will not necessarily reduce dependence on fossil fuels. Energy taxes or a system of caps on energy use and trade in emissions permits are necessary," he says.

In a new paper on a related topic, "Unemployment Effects of Climate Policy," Eckaus and co-author Mustafa H. Babiker of Aramco model the negative effects on labor employment of policies to limit greenhouse gas emissions. They then propose economic policies to counteract these effects.

"Climate change is a social and economic problem. If society wants to do something about it, it will have to bear the cost. It won't be free. It's an unprecedented social problem that requires a social response," Eckaus says.

According to Eckaus and Babiker, emissions restrictions policies generate the social problem of unemployment by reducing the demand in some industries for workers. The lowered output, in turn, would lead to reductions in the GNP by as much as 4 percent in the coming decades—a depressing effect on the U.S.

"If there were two policies, instead of just one—a counteracting labor market policy, as well as the emissions restrictions—the negative direct economic effects could be completely eliminated," they write.

In conversation, Eckaus suggests a labor market policy—a wage subsidy such as reduced labor taxes—to aid workers displaced from such industries as petroleum refining, automobile-making, metal fabricating and some chemical industries.

"Most studies assume labor and wages will adjust; some assume these will adjust quickly. But our study shows unemployment will go up, and adjustments won't necessarily follow quickly. We need an economic policy to address that," he says.

"We might expand and subsidize public transportation systems. We could launch a transportation-stamp program, to operate like food stamps: 'Get a stamp and get on a bus!'" he says.

Eckaus, Babiker and Wing are affiliated with the MIT Joint Program on the Science and Policy of Climate Change.

Student engineers go for the burn with pedal-powered laptop

Nancy Stauffer
MIT Energy Initiative

MIT students have come up with a way to recharge your laptop without plugging it in. Rather than consuming electricity, you'll be burning calories—your own.

The students designed and built an exercise bicycle that uses "pedaling power" to charge a laptop computer. As the bike's instructions note, if you have trouble "squeezing in that daily exercise," you can now "multitask with no problem—[you can] bike while you work!"

The pedal-powered laptop began as a class assignment for Course 1.102, Introduction to Civil and Environmental Engineering (CEE) Design (Spring 2007), when students were instructed to design and build a device that converts mechanical power into electrical power.

Class members Piotr Fidkowski, Sebastian Figari, Sara John, Kendra Johnson, Julia Kiberd, Tina Lai and Devon McCorkle teamed up to work on connecting an exercise bike to one of the computers in a dorm's Athena cluster (grouped workstations for student use). Encouraged by their instructors—CEE senior research associate John Germaine, lecturer Jessica Banks, technical instructor Stephen Rudolph and teaching assistant Matthew DeJong—team leader Johnson contacted Oliver Thomas and Laxmi Rao of Information Services and Technology (IS&T), the MIT office that oversees the Athena computers.

"We were very excited when the students came to us for guidance," said Rao, who is MIT's first IT energy coordinator and a member of the MIT Energy Initiative's (MITEI) Campus Energy Task Force. "It's the kind of collaboration that the task force would like to encourage, where MIT service providers partner with creative students to take innovative energy-saving projects built in the lab and try them out on the MIT campus."

After many hours in the lab, the students coupled a laptop donated by Dell to a much-altered exercise bike. In their design, the motion of the wheel is conveyed through a flywheel, belt and gears to a generator in the back, which charges a conventional 12-volt battery like that in a car. A charge controller regulates the electricity coming to the battery to prevent overcharging. With the aid of a 12-volt cigarette-lighter adaptor, the battery supplies electricity to the laptop, which rests on a tray atop a swiveling arm in place of the handlebars.

The bike seat is adjustable and the laptop easily moved, so a person of any height can produce an arrangement that's comfortable and ergonomic for both pedaling and computing. A cover over the wheel ensures that the rider's clothing won't get caught, and a clear plastic box encloses the electrical components but leaves them visible to curious observers.

In preliminary calculations, the students predicted that a bicyclist should be able to produce up to 75 watts continuously—far more than the 30 watts needed to power the laptop. Indeed, in an initial test drive, team member Figari easily generated 50 watts while checking his e-mail.

The pedal-powered laptop was on display last summer in N42, the building that houses IS&T. While the students originally intended to place it in an Athena cluster, they are now hoping to install it in the fitness center at the Stata Center. In moving their project from the lab to the campus, they will encounter some of the real-world challenges of taking a product to the public, from ensuring its safety and reliability to negotiating with facilities that may use it—a valuable extension of their classroom education.

For more information on the pedal-powered laptop project, go to web.mit.edu/ist/services/it-energy/projects.html.

This project is part of the IT Energy@MIT Initiative. Begun in March 2007 under the direction of Rao, this initiative aims to support the campus energy-saving goals of MITEI by reducing energy use for information technology across campus. Among the planned projects: an energy audit of Building N42 by a team of faculty members, graduate and undergraduate students, and personnel from MIT Facilities.

PHOTO / **LAXMI RAO**

Julia Kiberd '08 pedals the specially adapted exercise bike, generating power for the laptop she's using to check her e-mail. At the Student Center display of the bike are, from left, technical instructor Stephen Rudolph, Kendra Johnson '09, IT energy coordinator Laxmi Rao and civil and environmental engineering senior research associate John Germaine.

AgeLab co-develops course for caretakers

Patti Richards
News Office

An estimated five million Americans suffering from Alzheimer's disease or other forms of dementia are driving an average of nine months longer than their caregivers think is safe, according to a two-year study by the MIT AgeLab, The Hartford Financial Services Group and the Boston University Alzheimer's Disease Center.

To address the problem, researchers from those organizations have developed a first-of-its-kind guide, "At the Crossroads: The Support Group Kit on Alzheimer's Disease, Dementia and Driving," to help caregivers decide when and how individuals with dementia should limit or stop driving.

The researchers released materials this month at a major conference at MIT in conjunction with the start of National Alzheimer's Awareness Month.

"Decisions about driving are intensely personal, yet they have profound public implications," said Joseph F. Coughlin, founder and director of the MIT AgeLab. "Our goal is to help families and caregivers manage the transition from driver to passenger."

Key organizations, including the Alzheimer's Association and the American Occupational Therapy Association, will make the tool available to their caregiver support groups, and it can also be ordered online free of charge at www.thehartford.com/alzheimers.

"Our goal is to help caregivers develop a plan to gradually move the person from driver to passenger and identify alternative transportation," said Jodi Olshevski, corporate gerontologist for The Hartford. "We help them find ways to get their loved one to stop driving, but not stop living."

The guide is one of several research and public education products produced by the nearly 10-year partnership between the MIT AgeLab and The Hartford, addressing critical issues facing older people including transportation, care-giving, retirement and catastrophe planning.

MIT IDs enzymes key to brainpower

Bolstering disintegrating neural connections may help boost brainpower in Alzheimer's disease patients, according to MIT neuroscientists and their colleagues in work reported in the Nov. 8 issue of Neuron.

The researchers zeroed in on the enzymes that manipulate a key scaffolding protein for synapses, the connections through which brain cells communicate. Synapses are weakened and lost in neurodegenerative diseases such as Alzheimer's and Parkinson's disease.

"We identified a major underlying mechanism through which synapses are strengthened and maintained," said Morgan H. Sheng, Menicon Professor of Neuroscience at MIT's Picower Institute for Learning and Memory. "The enzymes involved could be good targets for potential drug treatments."

A protein called postsynaptic density-95 (PSD-95) is a key building block of synapses. Like the steel girders in a building, it acts as a scaffold around which other components are assembled. "The more PSD-95 molecules, the bigger and stronger the synapse," said co-author Myung Jong Kim, a Picower research scientist.

Previous research had shown that mice genetically altered to have less PSD-95 experienced learning and memory problems.

In the current study, the researchers identified for the first time the enzymes that work behind the scenes on PSD-95, adding a phosphate group to a specific amino acid in the PSD-95 protein. This process—called phosphorylation—is critical for PSD-95 to do its job in supporting synapses.

"Adding a phosphate group to a single amino acid allows PSD-95 to promote synapse size and strength," said Sheng, who also holds an appointment in MIT's Department of Brain and Cognitive Sciences and is a Howard Hughes Medical Institute investigator. "Therefore, promoting this process could help improve cognitive function."

Sheng believes manipulating PSD-95 through phosphorylation could lead to bigger and more robust synapses, which would boost brainpower in both normal and diseased brains. "It's possible that promoting PSD-95 phosphorylation could also help neuropsychiatric illnesses in which synapse function goes awry, such as schizophrenia, depression and autism," Sheng said.

In addition to Sheng and Kim, authors include Picower research scientist Kensuke Futai; Yasunori Hayashi, MIT assistant professor of neurobiology and RIKEN-MIT investigator; and Jihoon Yu and Kwangwook Cho of the University of Bristol in England.

This research is supported by the National Institutes of Health.

–Deborah Halber

Lindquist researches new role for yeast

Yeast has gone from being a workhorse of the brewing and baking industries to a discovery platform for neurobiology, professor of biology Susan Lindquist told an MIT audience in an Oct. 24 lecture sponsored by the Molecular Frontiers Foundation.

Lindquist, a former Whitehead Institute director, said that her lab has turned to yeast in its search for ways to prevent Parkinson's disease in humans.

"Yeast is by far the best understood organism on the planet, and they just do things in a lot of the ways that [humans] do," Lindquist said."

Specifically, she showed that yeast cells are vulnerable to the aggregation of alpha-synuclein, a process that causes Parkinson's disease in humans. Using yeast as a model organism, Lindquist's lab found 60 genes that influence the lethal, neurodegenerative disease.

Furthermore, assays on yeast allowed her and her researchers to screen 150,000 chemicals for their ability to prevent the aggregation of alpha-synuclein. Seven compounds proved promising and might some day help to fight Parkinson's disease, she said.

The Molecular Frontiers Foundation promotes the understanding and appreciation of molecular science in society. Launched in 2006, the foundation's scientific advisory board consists of 26 leading scientists, including eight Nobel laureates.

Time magazine honors MIT for inventions, inventors

Six MIT inventions and two MIT inventors were celebrated as the best of 2007 in Time magazine's annual survey of the world's most promising—and sometimes startling—visions of the future, as seen by scientists, engineers, educators and designers.

The two inventors chosen by Time are Tim Berners-Lee and Vannevar Bush.

Berners-Lee, senior researcher and holder of the 3Com Founders Chair at MIT's Computer Science and Artificial Intelligence Laboratory, is known as the father of the web. He proposed it in 1989, launched it on the Internet in 1991 and continues to guide its evolution in his role as founder and director of the World Wide Web Consortium (W3C), an international forum.

MIT's first dean of engineering, Bush developed a modern analog computer to solve complex equations during the 1930s. Bush envisioned what he called a "mechanized private file and library of exceeding speed and flexibility," opening the door to breakthroughs in computer and Internet technology.

Time singled out MIT inventions that may improve life for people living in cities, in space, in remote or disadvantaged areas, or with disabilities.

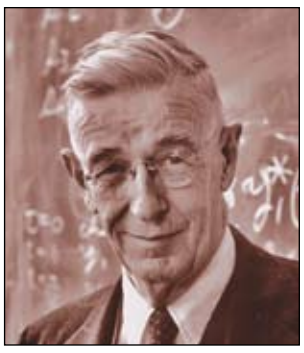
PHOTO / **WEBB CHAPPELL**

MIT Media Lab Professor Hugh Herr and his team of researchers have developed the world's first robotic ankle, an important advance for lower-limb amputees.

PHOTO / **DONNA COVENEY**

Domo, a robot designed by Aaron Edsinger and Jeff Weber, shows promise as an assistant for the elderly or wheelchair-bound.

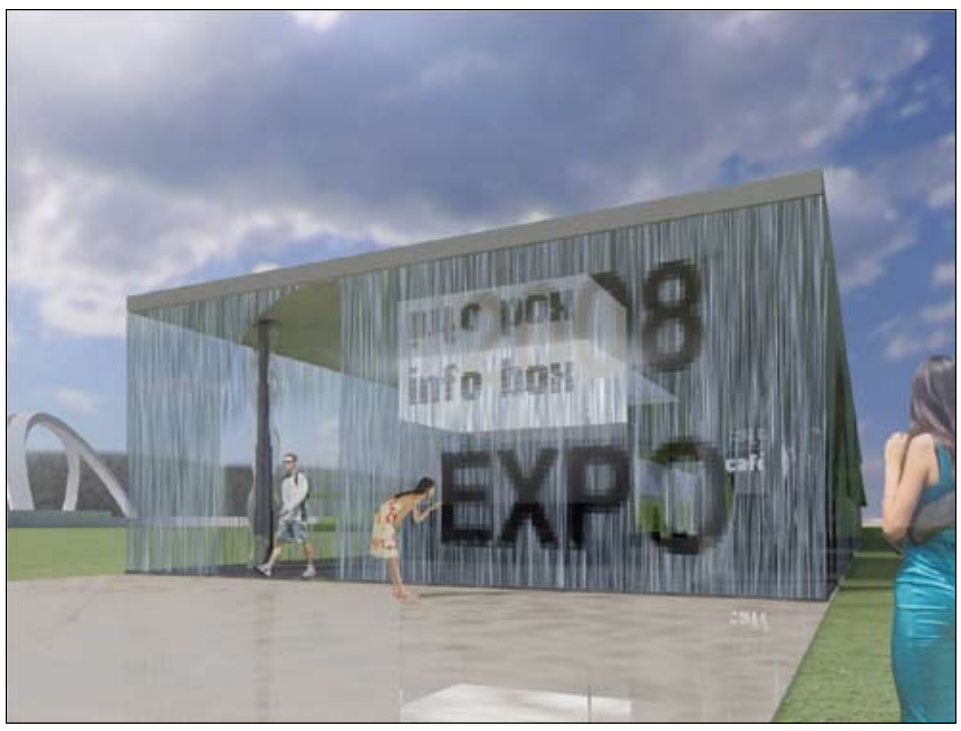
Tim Berners-Lee



Vannevar Bush

IMAGE COURTESY / **FUSE-PROJECT**

The MIT Media Lab developed the low-cost XO Laptop to provide the world's poorest children with a means for learning, self-expression and exploration.



GRAPHIC COURTESY / **CARLORATTIASSOCIATI—WALTER NICOLINO, CARLO RATTI, CLAUDIO BONICCO AND MATTEO LAI**

Above, the SENSEable City Laboratory's fluid building imagines programmable water walls that sense a visitor and automatically part, like curtains.

PHOTO / **FRANCO VAIRANI/SMART CITIES GROUP**

The Smart Cities group at the MIT Media Lab is working on the foldable, electric City Car, which it hopes will revolutionize mass transit and help alleviate pollution.

PHOTO / **DONNA COVENEY**

Dava Newman's prototype BioSuit is designed to allow superior mobility when humans eventually reach Mars or return to the moon.