

Going green saves MIT green

Week of activities showcases how MIT is implementing energy-efficient practices

David Chandler
News Office

When it comes to changing the ways energy is produced and used, MIT has long been at the forefront of research. Now, in addition, students, faculty and staff are working hard to put improvements in energy efficiency into practice on campus.

Their efforts are the focus of Energy Futures Week, an annual set of events coordinated by the MIT Energy Initiative to educate, inspire and engage the MIT community in all things energy. Built around the theme of “Greening MIT,” this year’s events are aimed at raising



IMAGE COURTESY DEPARTMENT OF FACILITIES/MITI

Unveiled this week, the new ‘Greening MIT’ logo is aimed at highlighting and encouraging energy-efficient practices on campus.

awareness of, and engaging the community in, campus energy-saving efforts.

Some of those efforts are applications of well-known measures, while others are based on insight and analysis from members of the MIT community. For example, simply testing steam traps in the campus-wide heating system and replacing those that had failed has already resulted in an estimated annual savings of \$800,000 — more than the one-time cost of the replacements. Similarly, a system for continuous monitoring of building systems to identify those that need adjustment or repair has been partly implemented, in the Dreyfus Chemistry building (Building 18) and in the Zesiger Sports and Fitness Center, and could ultimately result in annual savings of \$500,000.

Replacements and improvements of lighting systems campus-wide could yield savings of \$323,000 annually,

►Please see ENERGY, PAGE 6



PHOTOS / ELIZABETH GOLDRING, (I) DONNA COVENEY

A photo of a plant taken by (inset) Elizabeth Goldring, a senior fellow at MIT’s Center for Advanced Visual Studies, who is shooting with a camera she developed that allows people who are visually impaired to take and see photos.

Beyond the mind’s eye

Visually challenged MIT poet’s ‘seeing machine’ allows photos by the sight-impaired

Elizabeth Thomson
News Office

Elizabeth Goldring smiles as she shows a visitor photos she’s taken — and can see — with her blind eye.

The demonstration comes more than 20 years after Goldring, a senior fellow at

MIT’s Center for Advanced Visual Studies, and colleagues began work on a “seeing machine” that can allow some people who are blind or visually challenged to access the Internet, view the face of a friend and much more.

The team has progressed from Goldring’s inspiration, a large diagnostic device costing \$100,000, to a \$4,000 desktop version, to the current seeing machine, which is portable and inexpensive. “We can make one for under \$500,” Goldring said.

Although the device can be connected to any visual source, such as a video camera

or desktop computer, Goldring especially enjoys using it with a photo camera. “When someone has a diminished sense, the inability to express yourself with that sense can be frustrating,” she said. By taking photos, “I feel I’m able to express myself visually with my blind eye, and there’s value in that, I think.”

Further, “it’s light enough that I really want to take it with me when I go for a walk.” (Goldring, who is visually challenged, has enough sight in one eye to permit mobility.)

►Please see GOLDRING, PAGE 6

Institute launching diversity and inclusion site

Continues the work begun at the DLC in November

Building on the momentum established at the Diversity Leadership Congress in November, MIT will launch a new web site dedicated to promoting diversity and inclusion at the Institute.

The site, “Diversity and Inclusion,” will be located at web.mit.edu/diversity and will debut on Monday, Jan. 19, Martin Luther King Jr. Day.

The site will feature proceedings from the diversity congress — including a compilation of notes from the small-group discussions; a summary of congress feedback drawn from survey data; and an overview from Provost L. Rafael Reif’s diversity report to the Corporation last month.

The site will also include a link to a webcast of the congress and slides from a presentation given at last month’s Administrative Council in which executives from General Electric presented their business case for diversity along with specific diversity and inclusion practices.

The site will also allow users to register to receive e-mails on the topics of diversity and inclusion and will encourage suggestions for additional links to expand the new campus-wide diversity site.

More than 300 academic, administrative and student leaders gathered Nov. 18 for the Diversity Leadership Congress, which offered an opportunity to accelerate MIT’s long-standing efforts at promoting diversity and inclusion by inspiring and supporting those most responsible for creating such a culture.

PEOPLE

Beginnings and endings in DUSP

Larry Vale steps down as DUSP head as Amy Glasmeier takes over the post.

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Do-it-yourself biology

Biological engineering researchers use “off-the-shelf parts” of cells to build a better microbe.

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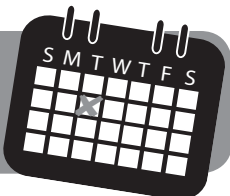
NEWS

3 named top young economists

The Economist names Duflo, Finkelstein and Werning as young researchers to keep an eye on.

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Events at MIT



Get ready to getfit@mit

Did you resolve to get into better shape in 2009? If so, visit the getfit@mit kick-off event today from noon-1:30 p.m. in Lobby 10 and learn more about the annual MIT community exercise event.

During the 12-week challenge, which kicks off Jan. 26, teams of five to eight people work together to meet steadily increasing weekly exercise goals, starting at 150 minutes in the first week. The entire MIT community is eligible. There are T-shirts for all participants as well as prize drawings and contests.

All teams must register online by Friday, Jan. 23. Details are on the program's web site at <http://getfit.mit.edu>.

Today

• **Energy Efficient Technologies at MIT.** 2-3 p.m. in E51-335. Harvey Michaels, DUSP and MITEI; Stephen Samouhos, Mechanical Engineering; Walt Henry, Department of Facilities will speak on examples of what faculty, staff and students across the Institute are doing to advance demand-side solutions to our energy challenges and discuss how they are putting this knowledge to work at MIT.

• **Sustainability in Action: Greening your Place at MIT.** Noon-2 p.m. in 68-181. Are you interested in taking action in your "place" at MIT to make a difference? Come join this interactive lunchtime workshop to learn about strategies and practices you can employ to reduce the environmental impact in your MIT "place" — office, lab, classroom or dorm.

Thursday, Jan. 15

• **Energy Careers Panel.** 3-5 p.m. in E51-335. Considering a job in the energy field? The Energy Careers Panel will feature MIT alums working in the energy sector with a wide spectrum of experience and perspectives. Learn from them about the current job market, their paths out of MIT, and what they would have done differently while at MIT had they known what they do now. There will be time for Q&A.

• **Energy, Environment, and Sustainability Student Group and Project Showcase.** 6-8 p.m. in Lobby 10. This showcase is a mix and mingle style poster session at which students who have been doing research or who belong to groups on campus that revolve around energy, environment, and sustainability will share and explain their work. This is a great opportunity to connect with fellow students active in a wide array of energy research and projects. Light refreshments will be provided. Come and learn about the great research and student group activities that your classmates have been working on!



PHOTOS / JUDITH M. DANIELS

LEFT: Former Department of Urban Studies and Planning head Larry Vale. RIGHT: New DUSP head Amy Glasmeier.

End (and beginning) of an era

Scott Campbell

School of Architecture and Planning

The legacy of Larry Vale: Seven years of building DUSP

As he steps down from what he good-naturedly calls "year seven of my four-year term as department head," Larry Vale takes satisfaction in what everyone in the Department of Urban Studies and Planning agrees has been a most productive term of office.

Since his appointment as department head in July 2002, Vale has strengthened the junior faculty through tenure and promotion cases and overseen the tripling of the department's research volume from less than \$1 million to more than \$3 million. To supplement the existing multimillion dollar financial aid programs for Master of City Planning (MCP) and PhD students — \$200,000 was given out last year — and he helped renew the growth of the undergraduate program, now admitting 10-12 majors a year.

He centralized and improved computer services and resources, built administrative staff and organized a hoopla to celebrate the program's 75th anniversary (for which he curated an exhibit and wrote a catalogue providing extensive documentation, available from department headquarters).

As part of the revamping of the MCP core curriculum, he was also responsible for the implementation, growth and development of the department's "practicum" requirement, both domestically and internationally, and oversaw increased long-term commitments to community building in Lawrence, Springfield, New Orleans, Beijing and the Pearl River Delta in China.

He also oversaw the birth and growth of the MIT-USGS Science Impact Collaborative (MUSIC) to explore new ways of incorporating science in environmental decision making; the growth and consolidation of the Scheller Teacher Education Program; the emergence and development of the China Planning Network and the SENSEable City Lab; the transformation of the Center for Reflective Community Practice into the Community Innovators Lab; and the birth of the new initiative in Landscape and Urbanism.

While handling all that, he also published two books — a new edition of "Architecture, Power and National Identity" (Routledge, 2008) and "The Resilient City: How Modern Cities Recover from Disaster" (Oxford University Press, 2005) edited with Thomas J. Campanella — and traveled widely to give presentations on disaster recovery, comparative housing redevelopment, urban design and urban security.

And during all that? The department was twice named the No. 1 planning program in North America, maintaining the ranking it had achieved in the mid-1990s, the last time such a survey was conducted.

This month, Vale begins a one-year sabbatical as a visiting scholar at Harvard's Graduate School of Design. He says he found the work of department head highly worthwhile, brokering connections and clearing away administrative roadblocks to help faculty and students achieve their goals.

"You have to take on the goals of others as your own priorities," he says. "But once you do that, it's very satisfying."

He is, however, eager to return full-time to his own work. There's a tower of papers in the corner of his office that represents a fraction of the material he's compiled in preparation for writing two new books — one on comparative public housing redevelopment and another on the history of planning ideas, which he is co-editing with Bish Sanyal, the Ford International Professor of Urban Development and Planning. Vale will return to teaching in January 2010.

Glasmeier named DUSP's 12th department head

Amy Glasmeier, who most recently was the E. Willard Miller Professor of Economic Geography at Penn State, took over this month as the new head of MIT's Department of Urban Studies and Planning, the first woman to do so since its inception in 1933.

Glasmeier replaces Larry Vale, who has headed the department for the last seven years — a period in which the department was twice named the No. 1 planning program in North America. Glasmeier will be DUSP's 12th department head.

An expert in economic geography, regional planning and spatial statistics, Glasmeier was previously on the faculty at Penn State and the University of Texas at Austin, and was the John Whisman Scholar of the Appalachian Regional Commission.

She holds a BS in Environmental Studies and Planning from Sonoma State University and an MA and PhD in City and Regional Planning from the University of California, Berkeley. She has worked and traveled all over the world, including Asia, Africa, Europe and Latin America, and is currently engaged in a retrospective examination of poverty and poverty policy in the United States, work that is leading to new perspectives on the nature and extent of persistent poverty here.

In addition to her role as professor of economic geography, Glasmeier has served as director of Penn State's environmental inquiry minor; as an editor of the journal *Economic Geography* and the *Cambridge Journal on Regions, Economy, Society*; and as director of the Center for Policy Research on Energy, Environment and Community. She has also served as head of the university's Department of Geography.

Her publications consist of more than 50 scholarly articles and several books, including "Manufacturing Time: Global Competition in the World Watch Industry, 1795-2000" (Guilford Press, 2000); and "From Combines to Computers: Rural Services and Development in the Age of Information Technology," with Marie Howland (SUNY Press, 1995).

Her most recent book — "An Atlas of Poverty in America: One Nation, Pulling Apart 1960-2003" (Routledge Press, 2005) — examines the experience of people and places in poverty since the 1960s, looks across the last four decades at poverty in America and recounts the history of poverty policy since the 1940s.

See a question and answer session with the new DUSP head on the SA+P web site at <http://sap.mit.edu/resources/portfolio/glasmeier/>.

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Nine from MIT named AAAS fellows

The American Association for the Advancement of Science (AAAS) has awarded the distinction of fellow to 486 members, including nine members of the MIT community.

Fellows are recognized for their efforts toward advancing science applications that are deemed scientifically or socially distinguished. New fellows will be presented with an official certificate and the society's gold and blue (representing science and engineering, respectively) rosette pin on Feb. 14 at the association's annual meeting in Chicago. The following MIT individuals are new AAAS fellows:

- Marcia Bartusiak, visiting professor of science writing, was cited for "exceptionally clear communication of the rich history, the intricate nature, and the modern practice of astronomy to the public at large."
- Arup Chakraborty, the Robert T. Haslam (1911) Professor of Chemical Engineering, Chemistry, and Biological Engineering, was named a fellow for "pioneering theoretical contributions to understanding of important, complex problems in polymer-metal interfaces, zeolite catalysis, random heteropolymers as recognition elements, and immunology."
- Charles W. Forsberg, a research scientist in the Department of Nuclear Science and Engineering, was named for "outstanding contributions to the development of innovative nuclear reactors and waste management systems, and to advanced low-carbon integration of nuclear, renewable, and fossil technologies."
- John D.E. Gabrieli, the Grover Hermann Professor of

Health Sciences and Technology and Cognitive Neuroscience, was cited for "penetrating analyses of the nature of human memory, its neural substrates, its development, and its problems."

- Martha L. Gray, the Edward Hood Taplin Professor of Medical and Electrical Engineering, was named a fellow for "pioneering contributions to advancing orthopedic science, and for distinguished leadership in the design and implementation of scholarly programs that integrate science, engineering, medicine and business."
- Philip S. Khoury, associate provost for the arts and the Ford International Professor of History, was named for "promoting the expansion and independent integrity of the social sciences at MIT as well as important collaborations with science and engineering."
- Mriganka Sur, the Paul E. Newton (1965) Professor of Neuroscience and head of the Department of Brain and Cognitive Sciences, was cited for "distinguished contributions to understanding the organization, development and plasticity of the cerebral cortex of the brain, and for leadership in neuroscience at MIT."
- Li-Huei Tsai, a professor in the Department of Brain and Cognitive Sciences and member of the Picower Institute for Learning and Memory, was cited for "outstanding contributions to the understanding of pathogenic mechanisms underlying Alzheimer's disease and the discovery of novel therapeutic approaches that attenuate learning and memory impairments."
- Graham C. Walker, the American Cancer Society Professor of Biology and Howard Hughes Medical Institute Professor, was named for "characterizing DNA repair mechanisms and DNA damage responses, elucidating Rhizobium functions necessary for symbiosis, and discovering a missing step in vitamin B12 biosynthesis."

Zuber urges Congress to fund science research and education

David Chandler
News Office

Funding for research and education in science and technology should be a major priority in the economic recovery package Congress will soon be talking up, said MIT geophysics professor Maria T. Zuber in testimony she gave on Jan. 7 before the Steering and Policy Committee of the U.S. House of Representatives.

"Energy and climate could be our Sputnik challenge — a new way to infuse our best talent into our science and technology system," said Zuber, who is the head of MIT's Earth, Atmospheric and Planetary Sciences department. The launching of Sputnik by the Soviet Union in 1957 spurred major U.S. investment in education in science, math and technology and led to a boom in those areas.

Zuber emphasized that while direct economic stimulus plans could lead to short-term economic benefits, it takes education and technological innovation to create lasting, long-term economic growth and job creation.

"We need to bolster existing high-growth innovation areas, and we will need to create new areas," she said. "One path ahead is clear: the country is on the cusp of a revolution in energy science and technology." With the energy sector already at \$2 trillion in the U.S. economy, "we don't have to invent a new market, we have to find new ways to grow and dominate an existing but nascent market." Such invest-

ments will not only create jobs, they will also have positive effects on the environment, and on the nation's technological leadership in the world, she said.

Toward that end, she suggested, the Department of Energy could fund many more of the 270 applications it already received for the creation of Energy Frontier Research Centers, many of which were very highly rated but were not accepted because of limited funding. In addition, major upgrades to the nation's electric grid are needed in order to enable greater efficiency and wider use of renewable energy.

Citing a recent DoE report, Zuber said that "we must develop the breakthrough energy technologies that will free us of our dependence on foreign oil, reduce our carbon emissions and create economic growth, but that will only happen with immediate, real investments."

But energy cannot be the whole story, Zuber said. It's also essential to increase the funding for research in a wide variety

of areas, including health, aerospace and basic science. Toward that end, supporting the purchase of major research instrumentation for colleges and universities could

produce a stimulus for research while helping to train the scientists and engineers of the future. In addition, support for students in the form of fellowships to sustain important research will help to prepare a new generation of technicians and scientists.

Direct investment in education by supporting the best teachers is another key area needed to bring about long-term growth in the nation's technology base, Zuber said. "Investment in highly qualified teachers who inspire, encourage and challenge students" is crucial, she said.

Zuber, who is the E.A. Griswold Professor of Geophysics, was invited to testify by House Speaker Nancy Pelosi.

Also on the panel were economists Mark M. Zandi and Martin Feldstein, former Secretary of Labor Robert Reich, and former Lockheed Martin Chairman and CEO Norman R. Augustine.



Maria Zuber

PHOTO / DONNA COVENEY

Obituaries

Douglas LaMay, EHS officer, 38

Douglas LaMay, an officer with the Office of Environment, Health & Safety, died unexpectedly on Sunday, Jan. 4. He was 38.

LaMay, of Halifax, Mass., began working at EHS in 2002, providing radiation safety support and services at the Nuclear Reactor Laboratory. In 2006, he moved to the Campus Radiation Protection group where he was responsible for radiation safety services for many Institute departments, labs and centers, as well as at the Whitehead Institute for Biomedical Research.

LaMay received a bachelor's degree in nuclear engineering from Rensselaer Polytechnic Institute and a master's from the University of Massachusetts-Lowell. He served four years in the U.S. Navy during the Persian Gulf War era and was honorably discharged at the rank of Lieutenant

Junior Grade.

Mitch Galanek, LaMay's supervisor at EHS, described him as "a caring and dedicated person who served MIT in an exemplary manner," adding that he was well respected and liked by his colleagues and was always quick to volunteer to work on any activity that would help the EHS office and the Institute. He also served on the Institute's Training Alignment Team where he was able to share his passion for learning.

He is survived by his wife, Margaret E. (O'Brien) LaMay, and a son, Kieran Liang-dong LaMay.

Members of the community who feel affected by the loss of LaMay are encouraged to contact MIT Medical's Mental Health Service. Call 3-2916 anytime and ask to speak with the clinician on call. The service also offers walk-in counseling between 2-4 p.m. every weekday on the

third floor of E23.

Family and friends are kindly invited to attend a Memorial Gathering at 1 p.m. today in the Duffy-Poule Funeral Home, 20 Peck St., Attleboro. In lieu of flowers, and for those wishing to remember LaMay in a special way, memorial contributions may be made to: MSPCA-Metro South Animal Care & Adoption Center, 1300 West Elm St. Ext., Brockton, MA 02301 and/or Nine Lives of Norton Feline Rescue Shelter, P.O. Box 548, Norton, MA 02766.

A memorial service at MIT is currently being planned, and details will be announced when they are finalized. A memorial fund has also been established at MIT and donations may be made to: The Douglas LaMay Memorial Fund, c/o MIT EHS Office, Room N52-496, 77 Massachusetts Ave., Cambridge, MA 02139, Attn: Nadia Morrison.

Events
at MIT



Friday, Jan. 16

• **BLOSSOMS video contest:** meeting for all participants. Noon-2 p.m. in 1-390. The finalists of the BLOSSOM video contest will prepare and rehearse a proto-script to be performed at this meeting. All participants are invited to attend and enjoy a reception celebration afterward.

• **Keeping Current: Using RSS Feeds to Stay Ahead in Your Research.** 4-5 p.m. in 14N-132. What's an RSS feed? How can I use it to keep up with new information in my field? We'll show you how RSS and other current awareness tools can help you stay up to date!

Tuesday, Jan. 20

• **Physics IAP Lecture Series — "Seeing the ultra-small and capturing the ultra-fast."** Speaker: Prof. Nuh Gedik. 1:30-2:30 p.m. in 6-120. In order to understand macroscopic properties of materials, understanding of the events taking place at the atomic scale is necessary. The problem, however, is that typical distances in the atomic world are too small (~a billionth of a meter) and events take place too fast (on the order of a millionth of a billionth of a second) for us to observe these things by conventional means. In this talk, we will discuss methods of capturing these ultra-fast events by using very short laser pulses to make movies with atomic scale spatial resolution and ultra-fast temporal resolution.

• **Make your own hummus at the Second Annual Hummus Experience @ MIT.** 7-8:30 p.m. in W11, the community room. More information at <http://web.mit.edu/~itai/www/hummus/>.

Wednesday, Jan. 21

• **Hummus Taste Off.** Noon-1 p.m. in W20, PDR #1&2. Contestants take part in the 2nd Annual Hummus Experience @ MIT.

• **Wind policy and the new administration.** 6-7 p.m. in the Muddy Charles Pub. MIT Energy Club Wind Sub-Community Discussion Series. Discussion series on wind energy related topics.

News in brief

Four win NSF CAREER awards

Four MIT researchers are among the latest recipients of CAREER awards, the highly selective grants that the National Science Foundation awards to junior faculty members who are likely to become academic leaders of the future.

The awardees are: Jonathan Kelner, assistant professor of applied mathematics; Jing Kong, the IIT Career Development Assistant Professor of Electrical Engineering; Levi Retsef, the Robert Noyce Engineering Career Development Assistant Professor in the MIT Sloan School of Management; and Mehmet Yanik, the Robert J. Shillman Career Development Assistant Professor of Electrical Engineering. Kelner, Kong and Yanik received their awards effective Jan. 1; Retsef's begins on Feb. 1.

No Tech Talk until Feb. 4

On Feb. 4, Tech Talk will resume its normal publication schedule. For up-to-date news and information, go to web.mit.edu/newsoffice.

MIT provides in-depth look at exploded star

Using views captured by several orbiting and ground-based telescopes, an MIT researcher and her colleagues have produced the first fully three-dimensional reconstruction of the remains of a star that exploded in a cosmic cataclysm called a supernova.

The complex supernova remnant, called Cassiopeia A (or Cas A for short), consists of a set of intertwined bubble-like shells of debris that were spewed out by a star undergoing its death throes 330 years ago.

Tracey DeLaney, a postdoctoral researcher in MIT's Kavli Institute for Astrophysics & Space Research, and her colleagues used data from the Chandra orbiting X-ray telescope, along with NASA's Spitzer Space Telescope that detects infrared light, and ground-based optical telescopes, to produce the first three-dimensional fly-through of a supernova remnant. The computer reconstruction was unveiled last week at the American Astronomical Society meeting in Long Beach, Calif.

"We have always wanted to know how the pieces we see in two dimensions fit together with each other in real life," said DeLaney. "Now we can see for ourselves with this 'hologram' of supernova debris."

This ground-breaking visualization of Cas A was made possible through a collaboration with the Astronomical Medicine project based at Harvard. The goal of the project is to bring together the best techniques from two very different fields, astronomy and medical imaging.

"Right now, we are focusing on improving three-dimensional visualization in both astronomy and medicine," said Harvard's Alyssa Goodman, who heads the Astronomical Medicine project. "This project with Cas A is exactly what we have hoped would come out of it."

While these are stunning visuals, the 3-D model from DeLaney, along with another new reconstruction of Cas A by a team at Harvard that shows how it has

changed over time, are rich resources for science. The two teams are trying to get a much more complete understanding of how this famous supernova explosion and its remnant work.

The new 3-D model of Cas A provides researchers with unique ability to study this remnant. With this new tool, DeLaney and colleagues found two components to the explosion, a spherical component from the outer layers of the star and a flattened component from the inner layers of the star.

Notable features of the model are high-velocity plumes from this internal material that are shooting out from the explosion.

Plumes, or jets, of silicon appear in the northeast and southwest, while plumes of iron are seen in the southeast and north. Astronomers had known about the plumes and jets before, but did not know that they all came out in a broad, disk-like structure.

The implication of this work is that

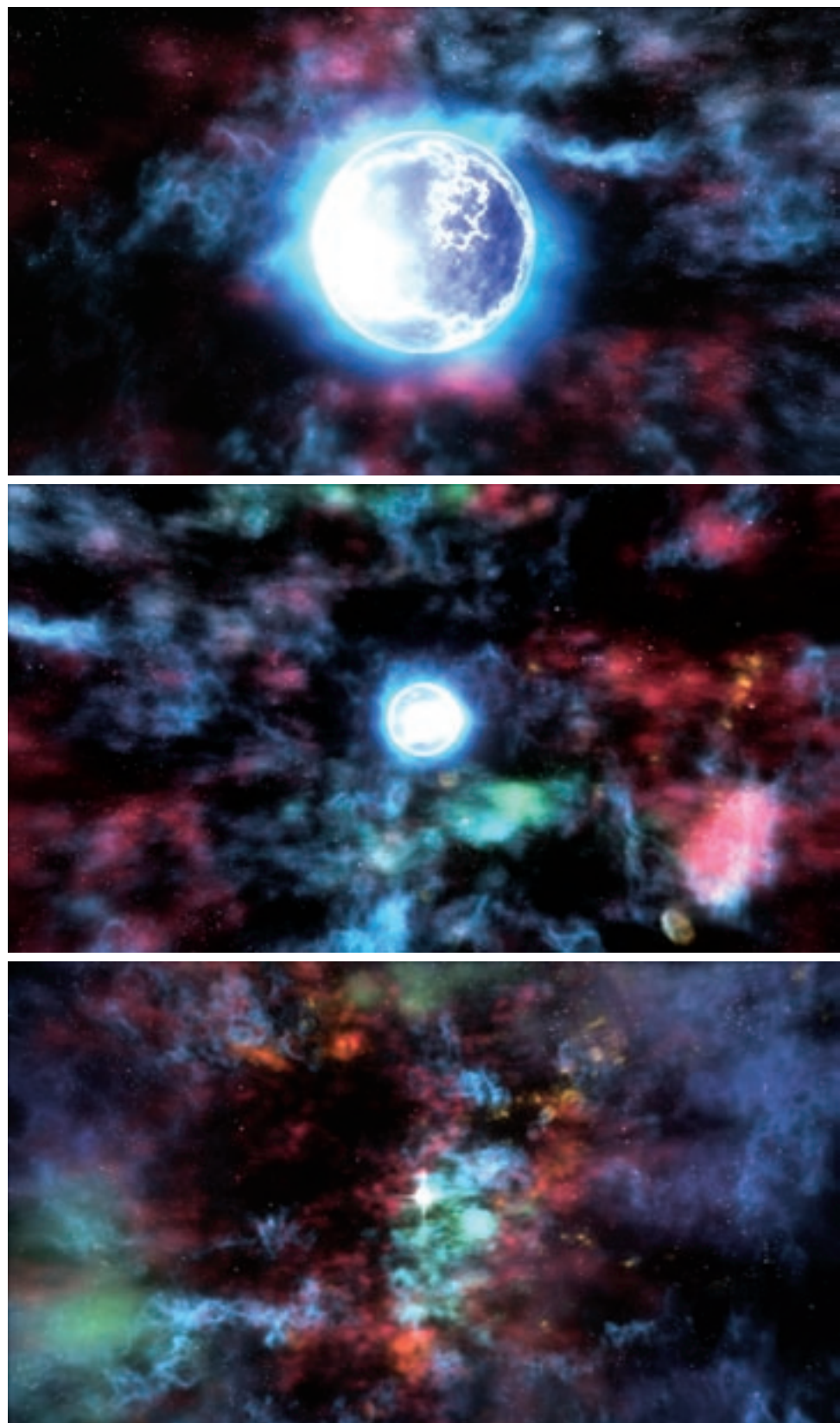
astronomers who build models of supernova explosions must now consider that the outer layers of the star come off spherically, but the inner layers come out more disk-like with high-velocity jets in multiple directions.

Cassiopeia A is the remains of a star thought to have exploded about 330 years ago, and is one of the youngest remnants in the Milky Way galaxy. The study of Cas A and remnants like it help astronomers better understand how the explosions that generate them seed interstellar gas with heavy elements, heat it with the energy of their radiation, and trigger shock waves from which new stars form.

Lawrence Rudnick of the University of Minnesota led the Spitzer part of the DeLaney study. NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory controls Chandra's science and flight operations from Cambridge, Mass.

"We have always wanted to know how the pieces we see in two dimensions fit together with each other in real life."

Tracey DeLaney
MIT postdoc



IMAGES / NASA/CXC/D.BERRY; MODEL: NASA/CXC/MIT/T.DELANEY ET AL.

This series of still illustrations depicts a fly-through of Cas A based on the 3-D representation constructed from Chandra and Spitzer data. New features unseen in traditional 2-D data sets are visible, including details of how the parent star exploded. The green region is mostly iron observed in X-rays; the yellow region is mostly argon and silicon seen in X-rays, optical and infrared; the red region is cooler debris seen in the infrared and the blue region is the outer blast wave, most prominent in X-rays.

MIT research digest



Neuroscientists ID source of cognitive decline in aging brains

As people age, memory and the ability to carry out tasks often decline. Scientists looking for ways to lessen that decline often have focused on the "gray matter" — the cortical regions where high-level functions such as memory are located.

But there are signs that the search may need to be expanded: A new study by MIT neuroscientists has found that memory and cognitive impairments were more associated with loss of brain "white matter," which forms connections within and between brain regions.

"Historically a lot of people have put their eggs in the gray matter basket. This study suggests that what might really be important are the connections and the integrity of the connections," said David Ziegler, a graduate student in the Department of Brain and Cognitive Sciences and lead author of a paper on the work that appeared in the online edition of *Neurobiology of Aging* in December.

Enhancing white matter in older people

through drug intervention or changes in diet or cardiovascular fitness could offer a new approach to countering some of the cognitive declines that are typical of advanced age, said Ziegler, who works in the laboratory of Suzanne Corkin, professor of behavioral neuroscience.

Model predicts how to build a better stent

Researchers have been puzzled in recent years by observations that drug-releasing stents (mesh-like tubes implanted to hold patients' coronary arteries open) can increase the likelihood of blood clots and heart attacks. Now, a mathematical model developed by MIT engineers can predict whether particular types of stents are likely to cause life-threatening side effects.

The model "helps explain why some stents are better than others, and could predict which stents are predisposed to cause clotting," said Elazer Edelman, the Thomas D. and Virginia W. Cabot Professor of Health Science and Technology (HST) and senior author of a paper

on the work that appeared as the cover story of the Jan. 5 issue of the *Journal of Controlled Release*.

The paper explains that stents affect the fluid dynamics of blood flowing past them and cause drugs to accumulate in certain areas. Too much drug buildup promotes clot formation.

The MIT model shows that the dynamics of blood flowing around a stent is similar to whitewater rapids, said Edelman. When water in a river flows over a boulder, some of the water strikes the base of the boulder, flies up in the air and comes back down, instead of flowing over the rock. This water continuously recirculates in the same area.

Gold particles deliver more than just glitter

Using tiny gold particles and infrared light, MIT researchers have developed a drug-delivery system that allows multiple drugs to be released in a controlled fashion. Such a system could one day be used to provide more control when battling

diseases commonly treated with more than one drug, according to the researchers.

"With a lot of diseases, especially cancer and AIDS, you get a synergistic effect with more than one drug," said Kimberly Hamad-Schifferli, assistant professor of biological and mechanical engineering and senior author of a paper on the work that recently appeared in the journal *ACS Nano*.

When gold nanoparticles are exposed to infrared light, they melt and release drug payloads attached to their surfaces. Delivery devices already exist that can release two drugs, but the timing of the release must be built into the device — it cannot be controlled from outside the body. The new system is controlled externally and theoretically could deliver up to three or four drugs.



See longer stories on these advances at web.mit.edu/newsoffice

Do-it-yourself biology:

Learning to build a better microbe

Anne Trafton
News Office

Building a cell from scratch is a lot more complicated than building a computer. But that's just what synthetic biologists, including many at MIT, are trying to figure out how to do.

Using engineering principles, researchers and students in MIT's Department of Biological Engineering are building a set of "off-the-shelf parts" for cells, cataloging and assembling bacterial DNA sequences to produce microbes tailored for a specific task. Such bacteria could have numerous applications in medicine, energy and environmental cleanup.

MIT biological engineering instructor Natalie Kuldell and recent PhD recipient Reshma Shetty will discuss the possibilities of and obstacles facing synthetic biology at a Soapbox talk, "Do-It-Yourself Biology," at 6 p.m. Wednesday at the MIT Museum.

"If you could really program a cell to

do your bidding, you could have it spit out drugs really quickly, or spit out biofuels," Kuldell said. "It would be wonderful to replace refineries with small microbial factories."

Before that can happen, biologists and biological engineers need to figure out whether engineering approaches can be practically transferred to the life sciences, which tend to be much more unpredictable, Kuldell said.

Such efforts have been underway at MIT for several years, launched by engineers Randy Rettberg and Tom Knight. An IAP course in synthetic biology they started in 2003 with Drew Endy, now at Stanford University, has grown into the iGEM (international Genetically Engineered Machine) competition, which now attracts more than 1,000 students from around the world. Each team of eight to

12 students develops its own custom-built bacteria and presents the results at MIT in November.

iGEM is built around the Registry of Standard Biological Parts, a catalog of all the "parts" (DNA sequences) that participants have developed. Students design bacteria for specific functions by assembling various parts, including protein-coding sequences (genes), promoters, ribosome-binding sites, etc.

Past prize-winning projects have included an arsenic detector for drinking water, artificial blood ("Bactoblood"), and bacteria that can digest lactose in the intestines of lactose-intolerant people.

Though some iGEM projects turn out to be impractical or would meet considerable regulatory hurdles, Rettberg is encouraged by the early successes he's seen so far.

"Many fields have huge amounts of potential but never get going. This is one where we already have 1,000 people working on it and they are making new and interesting things, and a fair amount of it is working," said Rettberg, a principal research engineer in the Department of Biological Engineering.

Kuldell also teaches several classes in synthetic biology, including one for freshmen (Course 20.020) in which students design solutions to problems they identify on their own. She tells her students they are pioneers in an emerging field, and they are eager to tackle the challenge, she said.

"Electrical engineering students should be able to program a computer and build some of the hardware, so it makes sense that biological engineering students should be able to genetically program and build a cell," Kuldell said.



GRAPHIC / PATRICK GILLOU

Robo-forklift keeps humans out of harm's way

Could allow military to handle supplies without risk to people

David Chandler
News Office

Researchers in MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) are working on a better way to handle supplies in a war zone: a semi-autonomous forklift that can be directed by people safely away from the dangers of the site.

Currently, when supplies arrive at military outposts in war zones such as Iraq, people driving forklifts unload the pallets and put them into storage, and later load them onto trucks to take the material to where it's needed. These forklift operators must often scramble for cover, slowing the work and putting them at risk.

When completed, the new robotic device will provide a safer way to handle pallet-loaded supplies of everything from truck tires to water containers and construction materials, says Matt Walter, a CSAIL postdoctoral researcher with a lead role in the project. The device is designed to operate outdoors on uneven terrain such as gravel or packed earth.

In Iraq, it has not been uncommon for workers to "have to abandon the forklift three or four times a day because they come under fire," Walter says. "A lot of the work could be automated," thus alleviating people's exposure to danger, "but it's a very difficult task."

Heavy lifting in hostile territory

The forklift is designed to operate autonomously with high-level direction from a human supervisor who could be physically nearby, or safely ensconced in a remote bunker. In an initial training phase, the forklift learns the basic layout of the storage depot facility, such as where the reception area is where incoming supply trucks arrive with a load of pallets ready to be stored, and where the storage areas are for those pallets to be deposited. The forklift can then be commanded to transport pallets from one place to another within the depot.

Determining which pallets to pick up and where they need to go requires guidance from a human supervisor, at least for now. The supervisor's tablet computer, wirelessly



PHOTO / JASON DORFMAN

linked to the forklift, displays the view from the forklift's forward-looking video camera. Using stylus gestures on the image, the supervisor indicates the truck to be unloaded, the pallet to be engaged next, and perhaps where on the pallet to insert the forklift tines.

The supervisor also speaks to the tablet, indicating the desired destination of the target pallet. As the system gets more sophisticated, the supervisor would need to do less and less, eventually simply gesturing and saying "unload

that truck," for example.

But to ensure that it can always carry out the necessary tasks, if there's ever a problem with the automated system the machine reverts to a conventional manned forklift whenever someone climbs into the operator's cabin.

Tests under way

Research began with a small test platform rigged with forklift tines and a variety of sensors and computers that was used for a series of indoor tests and is now continuing with a full-scale prototype being tested outdoors on the MIT campus.

The work is part of several projects at CSAIL focused on "the development of situational awareness for machines," explains Seth Teller, professor of computer science and engineering and project lead. Situational awareness, Teller says, involves the use of sensing, motion, inference and memory to acquire "a model of the spatial layout of the world and its contents, to allow us to plan and move purposefully in the world." Humans develop these internal maps of their surroundings without even thinking about it, but "machines can't yet do it automatically."

In developing the robotic system, the CSAIL researchers have made extensive use of computer code developed for other projects, including the autonomous vehicle MIT entered in the 2007 DARPA Grand Challenge auto race, in which unmanned cars navigated roads without human intervention, Teller says. That work has been reported in papers in the Journal of Field Robotics, and the forklift project itself is the subject of a paper being submitted for publication at an upcoming robotics conference.

Among the tasks the robot must carry out automatically is avoiding unexpected obstacles, especially people who may be walking around in the area. That turned out to be less of a challenge than expected: "It is possible to detect moving people using laser range scanners," Walter says. "Things get much harder if people are trying to trick the system by hiding or standing very still," Teller notes.

The forklift project has involved about 30 faculty, staff and students (including postdocs, PhD and MEng students, and UROPs) from MIT's CSAIL, LIDS, and Courses 2, 6 and 16, as well as from Lincoln Laboratory, Draper Laboratory and BAE Systems. It has been funded by the U.S. Army Logistics Innovation Agency.

GOLDRING: Beyond the mind's eye

Continued from Page 1

Goldring's idea for the seeing machine began with a visit to her optometrist. At the time, she was completely blind.

To determine if she had any healthy retina left, technicians peered into her eyes with a scanning laser ophthalmoscope, or SLO. With the machine they projected a simple image directly onto the retina of one eye, past the hemorrhages within the eye that contributed to her blindness.

She was indeed able to see the test image. So she asked if they could write the word "sun." "And I was amazed that I was able to read a word!" Goldring said.

She went on to use the device for other visual experiences. For example, video of her doctor was transmitted through the SLO, and for the first time she saw his face.

But although the SLO held promise for the broader blind public, it had serious drawbacks — including its prohibitive cost. Goldring determined to develop a more practical, accessible machine.

She began collaborating with people such as Rob Webb, the SLO's inventor and a senior scientist at the Schepens Eye Research Institute, Harvard University, and dozens of MIT students. Those involved in the current machine are Yifei Wu, an MIT senior who began the work as a freshman and has been instrumental in developing the seeing-machine camera; Brandon Taylor, a graduate student at the MIT Media Lab; and Quinn Smithwick, a postdoctoral associate in the same lab.

The portable device is relatively inexpensive in part because it replaces the laser of the SLO with light-emitting diodes (LEDs), another source of high-intensity light that is much cheaper.

Further, "everything in it is already mass-produced for other purposes," said Taylor. He also noted that since the seeing-machine project began, "LCDs and other components have gotten much smaller and are readily available."

The portable seeing machine is about five inches square and mounted on a flexible tripod that makes it easy to carry. A digital camera is attached to the top. The visual feed from the camera travels into the seeing machine to a Liquid Crystal Display (LCD) illuminated by LEDs. (This is the same kind of LCD common in cameras and TVs.)

The visual data is then focused into a single "point" that travels into the eye. "This is not magnification," said Smithwick. "What makes this work is focusing the data into a tiny spot of light."

What's next? Goldring aims to show the new machine to other visually challenged people and looks forward to their feedback. Plans are underway to test it at the Low Vision Clinic at the Joslin Diabetes Center's Beetham Eye Institute in Boston.

This work was supported by NASA and by MIT's School of Architecture and Planning, Center for Advanced Visual Studies, Undergraduate Research Opportunities Program, and Council for the Arts.

ENERGY: MIT Energy Futures Week showcasing how going green can also save the Institute green

Continued from Page 1

and initial implementation in just three areas is already saving \$45,000 a year. These are just some of the improvements that have been identified and implemented by a committee called the Campus Energy Task Force, established by the MIT Energy Initiative, whose goal is to help MIT "walk the talk" on energy use.

MIT Executive Vice President and Treasurer Theresa Stone, co-chair of the task force with Professor Leon Glicksman, said the group, working in collaboration with students from the MIT Sloan School of Management and the Department of Facilities, identified a series of measures whose total cost would be about \$14 million, which have the potential to pay back their costs in the form of energy savings within three years or less.

At an Energy Futures Week kickoff event on Monday, Stone emphasized that a variety of other measures can make a big difference in campus energy use but depend on changes in personal habits. For example, studies of the use of fume hoods on campus, initiated by students a few years ago, found that a single fume hood can use up as much energy as two single-family houses — and there are more than 1,000 fume hoods on campus.

Simply getting people to remember to lower the fume hood sash when it's not in use can make a significant dent in energy use. As part of the Greening MIT initiative, activities to raise awareness of the savings opportunity will be deployed across campus including offering signs that can be posted next to fume hoods reminding people of this. Similarly, encouraging people to use revolving doors instead of swinging doors (which let out eight times as much heated air), to use two-sided printing whenever possible to reduce waste, turn off lights and computers when they are not in

use, and similar personal measures can have a big overall impact if enough people do them.

"We know that these kinds of things work, we know they're doable," Stone said. "The question is how can we build this awareness across the campus."

But it's not enough just to make the changes in buildings and behavior, Stone added. "This is MIT, and we need to be very responsible as far as the measurement techniques." Whenever changes are being made, in order for them to have the maximum impact not only here but on other campuses and in the nation at large, results need to be quantified and "the measurements need to be as clear and defensible as possible," she said.

Jason Jay, a Sloan graduate student and member of the Campus Energy Task Force, pointed out that in some cases, official policies were found to encourage energy waste. For example, custodians had been instructed that when checking offices after hours, lights were to be left as they were found. Now, the Department of Facilities is consulting with key occupants to consider whether, as a policy, custodians should instead turn the lights off unless there was a specific reason not to. "We need to make doing the right thing easier and more obvious," he said.

The Energy Futures Week activities include a workshop today from noon to 2 p.m. (with a light lunch included) called "Sustainability in Action: Greening Your Place at MIT," which will help members of the MIT community identify ways to reduce the energy footprint of their own offices, labs, dorms and classrooms.

A complete list of the week's activities is available on the MIT Energy Initiative web site, at web.mit.edu/mitei.



PHOTO / DONNA COVENEY

Leon Glicksman and Theresa Stone



SMART UROP

The Singapore-MIT Alliance for Research and Technology (SMART) is pleased to sponsor paid summer undergraduate research opportunities in Singapore. This research opportunity will enable undergraduates to participate in an MIT's faculty member's Singapore research project and, through an international experience be exposed to a foreign culture and interact with students and faculty from diverse backgrounds. Each undergraduate will have an MIT faculty member as a mentor/supervisor and conduct research within the faculty member's Singapore research program. The undergraduate will have access and use of the faculty's laboratory and equipment.

Eligibility:

MIT undergraduates in good standing who have already or will have successfully completed their first year are eligible to apply.

Requirements:

Applicants should contact an MIT faculty member participating in the SMART program (refer to <http://web.mit.edu/smart/> to view the list of faculty participants) and based upon interaction with that faculty member, submit an application that contains:

- A 1-3 page description of the research that you would like to conduct in Singapore.
- A recommendation from the MIT faculty.
- An indication of your supervisor(s) while in Singapore (faculty member, staff, graduate students).
- The period you propose to spend in Singapore, in general not less than two (2) months.
- Upon your return to MIT two evaluations: one from you faculty supervisor and the other from you. The faculty evaluation should assess your progress and inform us about your contributions to the research program. Your evaluation should describe the progress of your research project, both accomplishments and challenges, as well as an assessment of your academic and personal experience in Singapore.

Compensation:

- Hourly rate of US\$10.00 per hour
- Roundtrip economy class airfare
- US\$25.00 per diem per day (food and transportation)
- Accommodations

Applications:

Applications should be submitted by March 1ST to Jocelyn Sales at jsales@mit.edu.

MIT Alert testing text-message system

Be on the lookout this month for a test of the MIT Alert text-messaging service, a key component of the Institute's emergency notification program.

In the event of a major life-safety or public-health emergency on campus, MIT Alert will notify and advise students, faculty and staff via a number of communication channels, including text message, Institute phone and e-mail, as well as through MIT's emergency web site.

This month, the office of Security and Emergency Management (SEMO) is working closely with staff in IS&T to test the MIT Alert text-messaging service. Members of the community who have signed up to receive a text message by providing their cell phone number are being contacted to validate that information. Later in the month, randomly selected individuals will receive test text messages on their cell phone or other mobile device.

Bill VanSchalkwyk, co-director of SEMO, hopes that individuals who receive a test text message will acknowledge receipt by visiting MIT's emergency web site, <http://emergency.mit.net/>. For more information about the MIT Alert emergency communications program, please visit <http://web.mit.edu/mitalert>.

CLASSIFIED ADS

HOUSING

FOR SALE OR RENT: Sale: 235k Rent: \$1,350 a month. Available NOW! First and last month. 2-bed with a balcony and hardwood floors. This unit includes heat, hot water and 2-parking spots! Laundry, outdoor pool, tennis courts. Near Mall and Boston College. Email me at cocoarismiguel@hotmail.com or call at 617-817-2783.

Charming large one bedroom floor-thru apartment in Boston brownstone townhouse, just off Mass Ave. at Symphony. Secure, clean, non smoking, well-maintained, owner-occupied building. One block to Whole Foods Market, subway and #1 bus. \$1,600/mo. rombult@gmail.com

Northeast Vt. 3 bedroom house 10 private hilltop acres, over 10,000 acres of State Wildlife Management Area. Joe 617-823-9930 jakejake707@yahoo.com Please call or e-mail for more info/pics. 110,000.00

\$2000. Adorable 1 bdrm in Back Bay. Excellent location (Newbury, Copley, Green line). Bay windows, light, open modern kitchen, dish washer, garbage disposal, beautiful hard-wood floors, washer+dryer

in basement. Lease runs through Sept. w/ option. Contact okedar@mit.edu

FOR SALE

Bathroom faucet - polished brass with j-spout drain. Brand: American Standard. Style: Williamsburg. Model # 2904.222.099. See website: www.americanstandard-us.com. Excellent condition. \$50 (paid \$130). Call Cheryl 617-258-5673 or cheryl@mit.edu

Crate & Barrel frames - flip to reveal another photo! Mounts to wall. 3 espresso frames on silver rod. 3 sets...holding a total of 18 pictures. \$25 for all. wdeolive@mit.edu

Coat: Ladies grey tweed-look winter coat, size 12, below-knee length, like new, \$35. Men's ties, like new, \$2 each. Rosalie, 781-391-1307.

MISCELLANEOUS

Seeking a copy of Scott's Linear Circuits Volumes I and II, "Time and Frequency Domain Analysis." Contact Michael 781-306-0636 or michaelstuarts@hotmail.com.

Awards & Honors



Dewey, Greitzer named Royal Academy of Engineering fellows

Britain's Royal Academy of Engineering (RAEng) named Forbes Dewey, professor of mechanical engineering and bioengineering, and Ed Greitzer, the H.N. Slater Professor of Aeronautics & Astronautics, as fellows for 2008. Including the two MIT professors, 44 new fellows were elected to the RAEng in 2008.

The academy brings together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering.

McKernan wins Frank Nelson Cole Prize

James McKernan, a professor in the Department of Mathematics, was named one of two recipients of the 2009 American Mathematical Society's Frank Nelson Cole Prize in Algebra. Presented every three years by the AMS, the Cole Prize is one of the highest distinctions in algebra. The prize was awarded on Tuesday, Jan. 6, at the Joint Mathematics Meetings in Washington.

Economics professor wins TIAA-CREF award

The TIAA-CREF Institute recently presented the 13th annual TIAA-CREF Paul A. Samuelson Award for Outstanding Scholarly Writing on Lifelong Financial Security to Amy Finkelstein, a professor in the Department of Economics, and a colleague for their ground-breaking paper, "The Interaction of Public and Private Insurance: Medicaid and the Long-Term Care Insurance Market."

Stewart wins German research award

Physics Professor Iain Stewart has been selected as a recipient of a Friedrich Wilhelm Bessel Research Award from the Humboldt Foundation, which works to promote academic cooperation between scientists and scholars from abroad and from Germany. The award is conferred in recognition of lifetime achievements in research, and the awardee is invited to carry out research projects of his or her own choosing in cooperation with colleagues in Germany.

Wodiczko to represent Poland at Venice Biennale

Krzysztof Wodiczko, a professor of architecture, was named recently by Poland's Minister of Culture to represent Poland at the 53rd Venice Art Biennale 2009. Wodiczko, who is also the director of the Center for Advanced Visual Studies, is known worldwide for his large-scale, politically charged slide and video projections on architectural facades and monuments. In receiving this honor, Wodiczko becomes the third member of the Visual Arts faculty to represent his native country at the oldest and world's most prestigious Art Biennale.

Lander named to Obama's science team

Alumni Summers, Romer on economic team

President-elect Barack Obama recently named Eric Lander, the founding director of the Broad Institute, a co-chair of the President's Council of Advisors on Science and Technology (PCAST), a group that assists the president in making science and technology policy decisions.

Lander, widely renowned as one of the principal leaders of the Human Genome Project, is also a professor of biology at MIT and a member of the Whitehead Institute for Biomedical Research. His position on the PCAST is part-time, and

he will continue as Broad director while serving with the group.

"[The appointment] is an honor, of course, but it's more the responsibility to serve right now," Lander said. "I can't think of a time when the problems and challenges facing the country — environment and energy, health care, education — had more to do with science and technology than they do today."

In announcing his science policy advisors, Obama described Lander's work as "one of the greatest scientific achievements in history."

"I know [Lander] will be a powerful voice in my administration as we seek to find the causes and cures of our most

devastating diseases," Obama said in his radio address.

Lander added, "It is exciting to have an administration that deeply understands the importance of science and scientific thinking."

Two MIT alums are also part of President-elect Obama's economic team. Lawrence H. Summers, Obama's pick to lead the National Economic Council, graduated from MIT with an SB in economics in 1975. Christina Romer, whom Obama named to lead the Council of Economic Advisors, received her PhD in economics from MIT in 1985, and is also a parent of a 2008 graduate and a current freshman.



PHOTOS / DONNA COVENEY

From left to right, Esther Duflo, Amy Finkelstein and Iván Werning, who were named among the top eight young economists recently by The Economist.

Three from MIT named among world's top eight young economists

Survey by The Economist magazine highlights department's strength

Stephanie Schorow
News Office

Three MIT economists — Esther Duflo, Amy Finkelstein and Iván Werning — have been singled out by The Economist magazine as among the world's eight best young economists, who are "making a big splash in their discipline and beyond."

The magazine compiled the list of the top eight, who all received their PhDs in the past 10 years, by soliciting recommendations from leading economists.

Duflo, the Abdul Latif Jameel Professor of Poverty Alleviation and Development Economics at MIT and the director of the Abdul Latif Jameel Poverty Action Lab, "received more recommendations than any other economist," according to the Dec. 30 article on the selection. Duflo was lauded for carrying

out randomized trials of development projects, such as fertilizer subsidies and school recruitment.

Finkelstein, MIT professor of economics, was singled out for her work studying annuities in Britain. Economics professor and macroeconomist Werning was described by the magazine as "an economist's economist" and an "elegant theorist whose early contributions provided streamlined proofs that other thinkers could make use of."

Department of Economics Head Ricardo Caballero said The Economist "confirms that we are doing something right. We put an enormous effort in our PhD program and in hiring the best young people around. Relative to other top places in economics, who tend to hire already established people, our growth strategy has always been to bring the best young minds to the place and foster their development. This makes ours a very dynamic and exciting place to be in, where a disproportionate share of the new and exciting research is done."

Glenn Ellison, the Gregory K. Palm Professor of Economics and the associate department head, who was himself singled out as a promising young economics by the magazine 10 years ago, said it was no surprise that the three MIT professors worked in very divergent areas.

"Besides being leaders in the profession as a whole, the three faculty members the Economist identified are people we've worked hard to attract and keep because they are also great internal leaders who contribute so much to the intellectual atmosphere in their respective groups," Ellison said.

MIT named one of 100 best values among private schools

Stephanie Schorow
News Office

MIT was ranked number eight among the nation's top 50 private universities in Kiplinger's Personal Finance's annual assessment of schools that combine outstanding

academic excellence and exceptional economic value.

Using data from more than 600 institutions provided by Peterson's and additional reporting, the magazine rated the top 100 private universities and liberal arts colleges for academic quality and affordability.

MIT's inclusion on the list reflects the Institute's longstanding efforts to open its doors to students of every background — including "need blind" admissions and a commitment to meet the full need of all undergraduates.

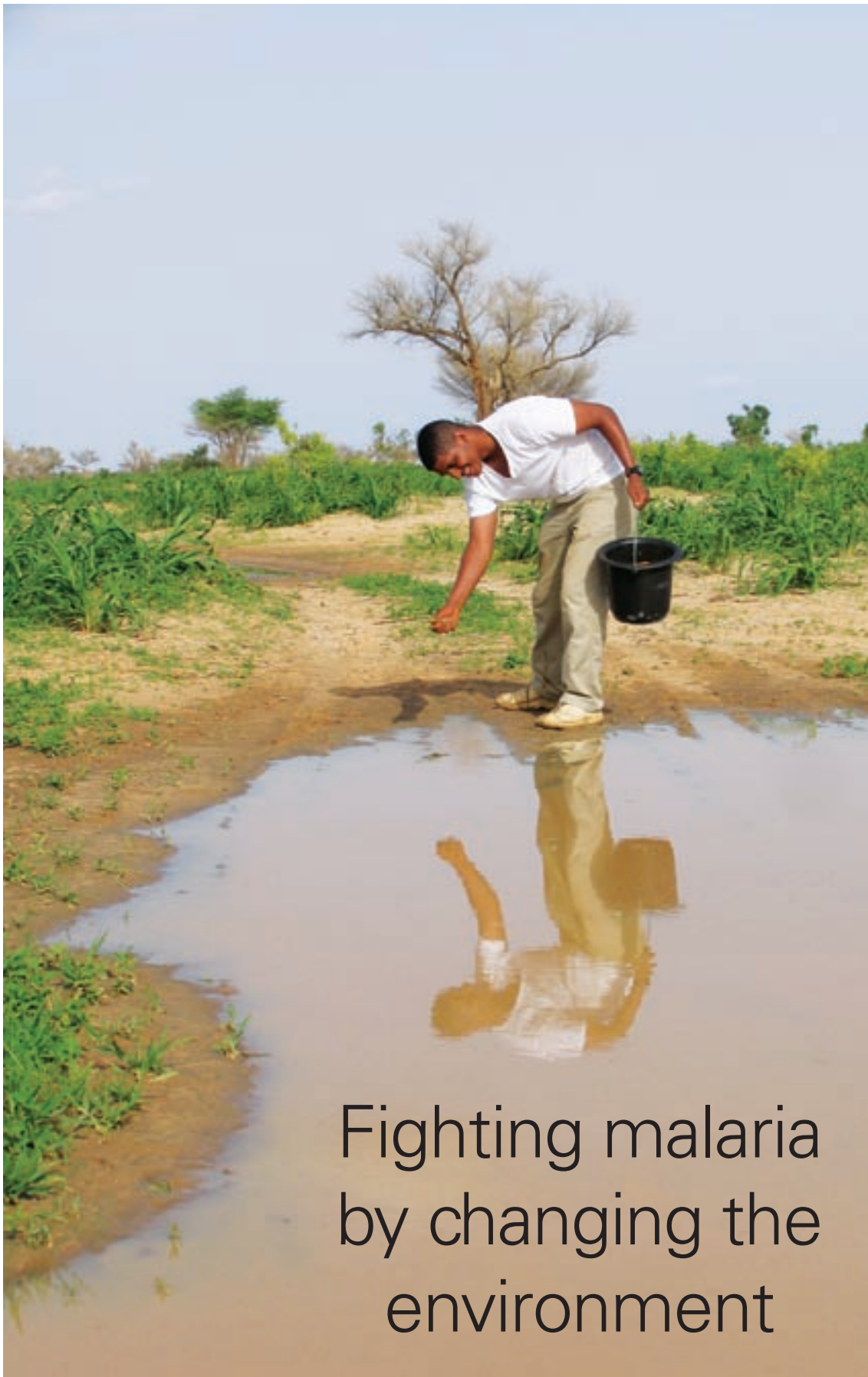
For 2008-2009, the California Institute of Technology topped the list of the 50 private universities with the best value, with Yale and Princeton rounding out the top three. MIT was ranked eighth, while the Institute's Cambridge neighbor, Harvard was deemed sixth.

"Families hit by the economic downturn may feel

that private institutions are out of their financial reach, but they will be surprised by our findings," said Janet Bodnar, editor of Kiplinger's. "Most of the top-notch schools on the Kiplinger 100 offer generous financial aid packages. And, for those who earn too much to qualify for need-based aid, many of the colleges on our list offer hefty scholarships to a few outstanding students or smaller merit awards to a bigger pool."

Criteria included admission rates, SAT scores, student-faculty ratios and graduation rates; this information is then correlated with tuition, room and board fees, financial aid and average debt a student accumulates before graduation.

The rankings appear in the magazine's February issue and at www.kiplinger.com/money/collegetvalues/.



Fighting malaria by changing the environment



PHOTOS COURTESY OF ARNE BOMBLIES

ABOVE: Civil and environmental engineering (CEE) graduate student Arne Bomblies installs instruments to monitor soil moisture in Niger.

LEFT: CEE student Mustafa Dafalla '09 gathers water samples at a pond in Niger to check for malaria larvae.



PHOTO / ISTOCKPHOTO

Leveling land can help control disease's spread, computer modeling finds

David Chandler
News Office

Modifying the environment by using everything from shovels and plows to plant-derived pesticides may be as important as mosquito nets and vaccinations in the fight against malaria, according to a computerized analysis by MIT researchers.

The researchers have developed a new computer model for analyzing different methods of trying to control the spread of malaria, one of the world's most devastating diseases. Among their findings using the model is that environmental measures such as leveling the land to eliminate depressions where pools can form can be an important part of the strategy for controlling the disease.

Reports on the work, carried out by Professor of Civil and Environmental Engineering Elfatih Eltahir and graduate students Arne Bomblies and Rebecca Gianotti, were presented in December at a meeting of the American Geophysical Union in San Francisco.

Malaria, Eltahir explained, is "a significant global health challenge" that accounts for one-third of all deaths of children under 5 worldwide. By developing new software to analyze the impacts of different methods of attempting to limit malaria's spread, which involves a complex chain of transmission between larvae, mosquitoes and humans, "we have made significant progress" toward better control of the disease, he said.

While most efforts at dealing with malaria have

focused on the human side, such as attempts to develop a vaccine, Eltahir said that efforts to control environmental factors — such as working to eliminate the low spots where pools of water collect during the rainy season, or applying locally grown plant materials to limit the growth of mosquitoes — can have a dramatic effect on controlling malaria's spread. And unlike importing expensive medicines, such an approach can rely on local efforts as simple as having people with shovels fill in the low spots in the terrain.

"By using local tools and local labor, our approach relies less on high-technology equipment from outside the region, which tends to make the local people more dependent," he said.

In addition, the new comprehensive computer model will provide a tool for analyzing how different areas' vulnerability to malaria will be affected by a changing climate.

To validate the accuracy of the computer modeling of conditions, the team has been working for the last four years in a remote area of Niger, which lies in the Sahel desert region of northern Africa. "Africa is the hot spot for malaria in general," Eltahir explained, so this fieldwork provides substantial validation of the model.

In the field, Bomblies and others have monitored every aspect of malaria's lifecycle, including doing counts of mosquito larvae and adult mosquitoes, identifying the exact species of mosquitoes (since only specific varieties carry the malaria parasite), and mapping the topography and monitoring the size and duration of pools of water where the mosquitoes breed. "We gathered data that would serve as validation for the model that we were developing," Bomblies said.

Eliminating pools of standing water, or increasing drainage so that such pools last less than the seven to 10 days it takes for the mosquitoes to mature, can be an effective strategy, the analysis shows. In addition, it allows comparison of different methods. Filling in the low spots using shovels, it turns out, is as effective at controlling the disease as plowing the land so that water more rapidly percolates down into the soil.

That is not a new idea, but the new software provides a quantitative way to compare its impact with other approaches, and to develop specific strategies for a given region. Filling in low spots "is an established technique," said Bomblies, who has spent a total of 13 months leading the fieldwork in Niger. "But it hasn't been specifically applied in the region in which we've been working."

And unlike other approaches such as vaccinations or mosquito nets, it has a relatively permanent impact. "Once a breeding site is gone, it's gone" Bomblies said.

Other methods the team has studied include spreading ground up seeds from the neem tree, which grows locally, in the ponds, which can reduce the mosquito population by about 50 percent.

"For the first time, we have a detailed computer model" of all the different factors in the disease's spread, Eltahir said. By making it possible to run detailed simulations of a wide variety of strategies, "we can do a lot of things, in this region or elsewhere, that we could never do in the past. It can allow you to do things in a more cost-effective way."

This project has been funded by the ocean and human health program of the National Oceanographic and Atmospheric Administration (NOAA), and the National Science Foundation.