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TechTalk
SERVING THE MIT COMMUNITY

MIT team finds Mars southern pole mostly water

Anne Trafton
News Office

An MIT-led team of planetary scientists has found that the southern pole of Mars contains the largest deposit of frozen water in the inner solar system, outside of Earth.

The new results show that water, not carbon dioxide, is the predominant frozen liquid found in the southern polar region of Mars, said Maria Zuber, MIT professor of geophysics.

Zuber said scientists have suspected that the southern polar cap of Mars is comprised of a thin veneer of carbon dioxide that rests atop a layer of dust and ice. However, scientists have also observed a surrounding area much larger than the polar cap that is dark and smooth, and it was uncertain whether that region was also composed of dust or ice—or both.

"What we found is that water ice is the dominant constituent beneath a thin dust veneer," said Zuber, lead author of a paper on the work that appeared in the Sept. 21 issue of Science.

Ever since carved channels were first observed on the surface of Mars, scientists have suspected that water once flowed across the surface.

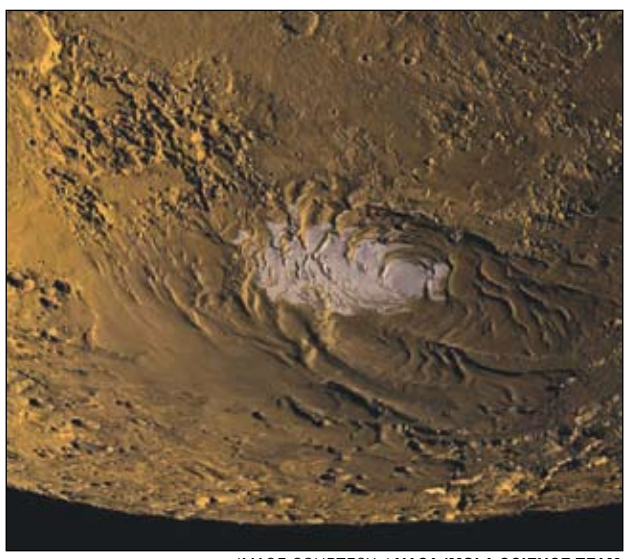

IMAGE COURTESY / **NASA/MOLA SCIENCE TEAM**

This image of Mars' south polar region shows the ice cap (in white) within the smooth layered deposits that overlie the cratered southern highlands.

Scientists also wondered whether the Martian poles held large reserves of water. However, because the Mars atmosphere is 95 percent carbon dioxide with only trace amounts of water, some researchers theorized that the polar caps were frozen carbon dioxide, or dry ice.

Zuber's team identified the composition of the southern polar cap by calculating its density. Their results show the density of the polar cap as well as the surrounding smooth layered deposit region is about 1,220 kilograms per cubic meter, which indicates that it is made of mostly water, with about 15 percent silicate dust mixed in.

(The density of water ice is 1,000 kilograms per cubic meter, and the density of dry ice is 1,600 kilograms per cubic meter.)

Zuber and her colleagues used topographical and gravitational data gathered by three Mars orbiters to find the volume and mass of the ice cap, allowing them to calculate its density.

"It's a really simple experiment but you have to measure things very precisely," said Zuber, who is head of MIT's Department of Earth, Atmospheric and Planetary Sciences.

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MIT hosts conference on 'Emergent India'

Sarah H. Wright
News Office

Thirty experts on energy, education, industry, finance and urban design discussed India's economic growth, the foreseeable difficulties in sustaining and widening it, and the country's rising national energy needs in "Emergent India: An Engagement With MIT," a daylong conference held in Bartos Theater on Sept. 21.

Dean of Engineering Subra Suresh, opening the event, characterized it as an opportunity to reinforce and reinvigorate the 100-year history tying MIT and India—the first Indian alumnus of MIT graduated in 1907—and to explore future collaborations.

Adi Godrej (S.B., S.M. 1963), chair of the Godrej Group, an influential industrial conglomerate based in Mumbai, India, served as the morning keynote speaker. He noted his management studies at MIT helped him modernize and systematize the management structures in the Godrej Group, a century-old family business.

According to Godrej, capitalism is working for India, the world's fourth-largest economy: Bombay airport runs smoothly thanks to a public-private partnership, and steady service-sector employment, especially in IT, is expanding the middle class and driving private consumption as well as commercial and residential construction.

Godrej pointed to mobile telephony as a symbol of India's economic growth—7 million cell phones are sold there each month—and of its potential for wider social equality, essential if that growth is to be sustained.

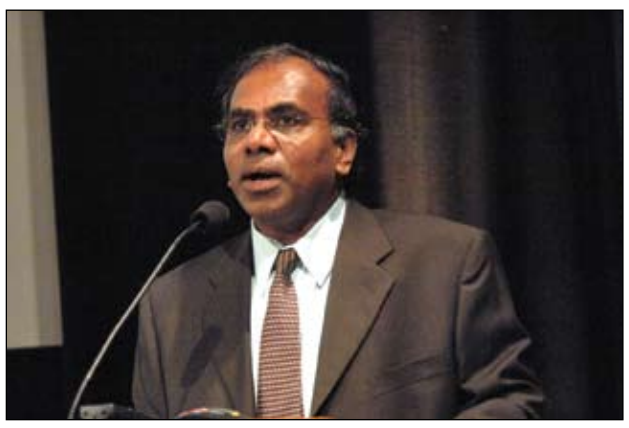

PHOTO / **DONNA COVENEY**

Dean of the School of Engineering Subra Suresh gave the welcoming address at the Emergent India conference, held at Bartos Theatre at the Media Lab on Friday, Sept. 21.

"The sun doesn't shine equally on India: The western half of the country receives more investment than the eastern, and that geographical divide needs to be corrected. The biggest bottleneck is education. We have the largest illiterate population in the world, and the private sector should join in addressing this as it has other problems," he said.

Researchers specializing in energy, industry and public health echoed Godrej's views, with several conjuring a dire imaginary Venn diagram in which poverty, pollution and educational deficits overlap.

"Energy and India: Looking Into the Future," a panel moderated by Sanjoy Mitter, professor of electrical engineering and computer science, set the conceptual Venn overlap in a global context, with India as an urgent but hardly isolated case.

"India faces a perfect storm of energy challenges, and we will need a multiplicity of solutions to solve the problem. These are good opportunities for partnerships and for global collaboration," said Ernest Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems and director of the MIT Energy Initiative.

The elements of India's perfect storm include the anticipated tripling of its energy demands by 2050; the probability of disruptions in oil transportation and supply; and the mounting environmental problems caused by carbon dioxide (among other pollutants), Moniz said.

Moniz noted that solving the world's energy problems is a central concern for MIT: While developing nations may face India's perfect storm directly, no nation is immune from global climate change and impending energy crises.

Gregory Stephanopoulos, Bayer Professor of Chemical Engineering, focused on processes to convert biomass to biofuel and urged the audience to consider visionary approaches.

Three issues are central to framing any picture of India's—and the world's—future use of biofuels, he said. There must be sufficient biomass and efficient bio-refineries to generate fuel supply; there must be alternative means of transporting the fuels, as in pipelines; and there must be investment in human infrastructure as well as engineering and distribution.

Charles Cooney, professor of chemistry and biochemical engineering, praised the MIT Deshpande Center's

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After 12 years at MIT, recent Ph.D. grad makes history

Anne Trafton
News Office

AliciA Jillian Hardy entered MIT in the fall of 1995 as one of the handful of freshmen who come to the Institute planning to major in the humanities.

AliciA Hardy

Although she loved MIT's writing program, she eventually switched her major to mechanical engineering. She stayed in the department for 12 years, and earlier this month she became the first black American woman to earn a Ph.D. from MIT in that field.

She's now doing a six-month internship at BMW in Munich, but she hopes to eventually use her degree to develop technologies to improve the cleanliness of power generation, particularly in developing nations. "As developed nations, we have a responsibility to help developing nations to make sure their power generation is clean," she said.

In March, she will start her new job at GE, where she will be working on biofuel technology. Hardy's master's thesis focused on improving the efficiency of large-scale hydrogen and methane power plants, which could be useful in industrializing nations that now burn a lot of coal, such as China and India.

Hardy says she enjoyed her time at the Institute even though she wasn't sure she wanted to attend MIT in the first place. As a high school student in Philadelphia, where she attended public schools, Hardy won numerous math and science awards and was recruited by many colleges.

"I applied to every possible school I could," she said. In the end she had 14 offers and couldn't decide which one to accept. Her older brother, Cordell, encouraged her to

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NEWS

ARTS

ENERGY

Sheffi named director of Engineering Systems Division

Professor Yossi Sheffi has been appointed director of the Engineering Systems Division, effective Nov. 15, Dean of Engineering Subra Suresh announced this week.

Sheffi received his B.Sc. from Technion in Israel in 1975, his S.M. from MIT in 1977, and his Ph.D. from M.I.T. in 1978; he holds faculty appointments in the Engineering Systems Division and the Department of Civil and Environmental Engineering. An expert in systems optimization, risk analysis and supply chain management, Sheffi serves as director of the MIT Center for Transportation and Logistics, a position he will continue to hold as ESD director. Under his leadership, the center has experienced substantial growth, launching many educational, research and industry/government outreach programs.

Yossi Sheffi

Sheffi is the author of numerous research articles and two books, including the bestseller "The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage," published by the MIT Press in 2005. It received rave reviews from The New York Times, Wall Street Journal and The Economist, as well as dozens of trade publications; The Financial Times chose it as one of the best business books of 2005; and it was awarded the "2005 Book of the Year" in the category of Business and Economics by Forward Magazine.

Since 1998, Sheffi has served as the director of MIT's Master of Engineering in Logistics degree, a program he founded. The program grew from 17 applications at its inception to hundreds of applications today and has inspired the creation of dozens of similar programs worldwide.

In 2003, Sheffi founded and has since led the MIT-Zaragoza International Logistics Program, an international collaboration among academia, industry and government. This program has led to substantial economic growth in Aragon, and in 2006, he received the Aragon's presidential award for "the most substantial contribution to the regional economy."

Outside the university, Sheffi has consulted with numerous governments and leading manufacturing, retail and transportation enterprises around the world. He is also an active entrepreneur, having founded five successful companies, and is a sought-after speaker for corporate and professional events.

Sheffi has been recognized with numerous awards and honors in academic and industry forums and was on the cover of Purchasing Magazine and Transportation and Distribution Magazine. In 1997 he won the Distinguished Service Award, the highest honor given by the Council of Supply Chain Management Professionals. He is also a life fellow of Cambridge University's Clare Hall College.

In his announcement, Suresh also thanked Institute Professor Joel Moses, who has graciously served as the Interim Director of ESD since January 2006, and added that he is looking forward to working with Sheffi and colleagues in ESD.

Corrections

In an article in the Sept. 19 issue of Tech Talk, "Fulbright scholar in new adventure," the name of MIT Professor C. Forbes Dewey was misstated. Tech Talk regrets the error.

In an obituary in the Sept. 19 issue of Tech Talk, the name of MIT alumnus Hayward R. Alker was misstated. Tech Talk regrets the error.

MIT alums win MacArthur 'genius' awards

Sarah H. Wright
News Office

MIT alumni Saul Griffith (S.M. 2001, Ph.D. 2004) and Yoky Matsuoka (S.M. 1995, Ph.D. 1998) have been awarded 2007 MacArthur fellowships, more commonly known as "genius" grants.

Griffith, an inventor who received the 2004 Lemelson-MIT Student Prize for creating a "desktop printer" that makes low-cost eyeglasses for use in underserved communities, was honored for "engineering innovations spanning optics, high-performance materials and nanotechnology in the service of the world community," according to the John D. and Catherine T. MacArthur Foundation.

Saul Griffith

Yoky Matsuoka

Matsuoka, an associate professor and robotics expert in the Department of Computer Science and Engineering at the University of Washington in Seattle, was chosen for "devising complex prosthetic devices and rehabilitation strategies that hold life-changing potential for those suffering from brain injuries and manipulation disabilities," the foundation said.

Griffith and Matsuoka are among the 24 MacArthur fellows chosen this year for their creativity, originality and potential to make important contributions in the future. Fellows receive $500,000 in "no strings attached" support over five years; in other words, they may spend the money as they see fit.

According to The Seattle Times, the MacArthur Foundation official who notifies award winners issues a standard warning when the unsuspecting recipients pick up the phone: "I've got shocking news," he says. "If you're holding anything fragile—like a baby—you might want to set it down."

Matsuoka told the paper that she just happened to be nursing her 8-day-old son when the special call came in.

"He told me I was the very first one in 20 years who actually was holding a baby," Matsuoka, 36, was quoted as saying.

According to a biography provided by the foundation, Matsuoka is transforming experts' understanding of how the central nervous system coordinates musculoskeletal action and of how robotic technology can enhance the mobility of people with manipulation disabilities.

Working at the intersection of computer science, biophysics, materials science, biomechanics, and psychophysics, Matsuoka creates sophisticated prosthetic devices and designs complementary rehabilitation strategies.

In one line of research, she constructed an anatomically correct robotic hand, complete with an intricate tendon structure that enables it to respond to sensor signals closely resembling neural commands.

This model has facilitated investigations into the neuromuscular forces necessary for precise finger movement and constitutes an important step toward the development of a dexterous prosthetic hand that can be controlled by the brain's neural signals.

Another major project Matsuoka is working on involves the use of virtual environments and visual feedback to distort recovering stroke patients' perceptions of tasks they perform during therapy.

Prior to receiving advanced degrees from MIT, she received a B.S. from the University of California, Berkeley. From 2001 to 2006, she was an assistant professor affiliated with the Robotics Institute, the Department of Mechanical Engineering and the Center for the Neural Basis of Cognition at Carnegie Mellon University.

'Boundless energy'

According to the foundation, Griffith, 33, shares his "boundless energy" for inventing across several disciplines. Already the holder of several patents in optics, textiles, and nanotechnology, Griffith is a "prodigy of invention in service of the world community," the foundation said.

While a graduate student at MIT, Griffith designed the low-cost eyeglass maker and invented the I-cycle, a bicycle made of plywood; a 3-D chocolate printer; a 3-D microfabrication method for rapid construction at the nanoscale, and the e-rope, a smart rope that can sense and report the strain of the load it bears and where it has frayed.

In 2005, Time magazine named Griffith's e-rope as one of that year's 40 most amazing inventions. Also in 2005, Technology Review ranked Griffith as one of the world's 35 top innovators under the age of 35.

Griffith credits his MIT peers for inspiring him, noting that the Institute is "highly dense with people who are obsessive and passionate about what they do."

A native of Sydney, Australia, Griffith currently invents at Squid Labs, the California-based engineering/technology company he and his colleagues founded in 2004. The low-cost lenses and accessible eye-exam technologies are a major focus of research and development energy at Squid Labs, which also developed the e-rope.

As technical advisor at Potenco, a spin-off company, Griffith initiated the project design for a hand-held human-powered generator, which has the potential to improve access to electronic devices such as laptops and water purifiers throughout the world.

Before receiving advanced degrees from MIT, Griffith received a B.MET.E. from the University of New South Wales and an M.E. from the University of Sydney.

Griffith and Matsuoka join 29 current and former members of the MIT community who have won MacArthur Fellowships, according to the Office of the Provost. They include 13 current faculty, seven former faculty and four research staff.

New Cambridge Science Festival director

P.A. d'Arbeloff has been named director of the new Cambridge Science Festival, MIT Museum Director John Durant announced earlier this month. D'Arbeloff, a former journalist, press secretary and fundraiser, was most recently the executive director of the Boston Public Library Foundation. As director of the Cambridge Science Festival, d'Arbeloff will lead the celebration of the breakthrough scientific research and contributions made by those living and working in Cambridge.

"We are looking forward to P.A. taking over this important community-wide initiative," Durant said. "Her expertise in working with a variety of community institutions will build on the early success of the first Cambridge Science Festival and will strengthen our ties with the many people and organizations that created, funded and managed events during the first festival."

"It's an exciting time for both the MIT Museum and the Festival," said d'Arbeloff. "I am especially interested in making sure that elementary and high school students are benefiting from festival programs. I will also assure that the many outstanding educational opportunities that the business community offers to inspire students and to promote science literacy in the Cambridge community are effectively communicated, and taken advantage of by students and their families."

D'Arbeloff, who was national press director for the Tsongas for President campaign in 1992 and press secretary for the successful Menino for Mayor campaigns in the 1990s and in 2001, has extensive community relations and events management experience. In her previous roles, d'Arbeloff spearheaded far-reaching community outreach programs and ran highly successful city-wide literacy programs honoring children and engaging entire families. In her role as Cambridge Science Festival Director, d'Arbeloff will be a staff member of the MIT Museum. Her responsibilities include oversight of all festival activities, including fundraising, programming and media relations.

D'Arbeloff earned a B.A. in communications from Ithaca College, and an M.S. in broadcast journalism from Boston University.

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MIT appoints 23 faculty to named professorships

Twenty-three MIT faculty members have been appointed to named professorships. All are effective July 1, 2007.

Professor **Edward H. Adelson** of brain and cognitive sciences will hold a five-year John and Dorothy Wilson Professorship. John J. Wilson (S.B. 1929, S.M. 1930), a life member of the MIT Corporation since 1958, established the professorship.

Assistant Professor **Sandy Alexandre** of the literature section in the School of Humanities, Arts, and Social Sciences will hold the three-year Class of 1948 Career Development Professorship, established by the Class in celebration of its 40th reunion.

Assistant Professor **Markus J. Buehler** of civil and environmental engineering will hold an Esther and Harold E. Edgerton Career Development Professorship for a three-year term. The Edgerton professorships were established in 1973 by the MIT Corporation to honor the Edgertons.

Associate Professor **Ian Condry** of the foreign language and literature section in the School of Humanities, Arts, and Social Sciences will be the next holder of the three-year Mitsui Career Development Professorship. The Mitsui Group established the Mitsui Chairs in 1980 to encourage cultural and technological exchange between the United States and Japan.

Assistant Professor **Alexander D'Hooghe** will be the next holder of the Class of 1922 Career Development Professorship for a three-year term.

Professor **Jesus A. del Alamo** of electrical engineering and computer science will hold the five-year Donner Professorship, established with a grant from the Donner Foundation in 1945.

Assistant Professor **Vivek Goyal** of electrical engineering and computer science will hold an Esther and Harold E. Edgerton Career Development Professorship for a three-year term. The Edgerton professorships were established in 1973 by the MIT Corporation to honor the Edgertons.

Assistant Professor **Michael Hemann** of biology will hold the three-year Latham Family Career Development Professorship, established by Allen Latham Jr. (S.B. 1930) and his wife, Ruth.

Associate Professor **Dina Katabi** of electrical engineering and computer science will hold the Class of 1947 Career Development Professorship for a three-year term.

Assistant Professor **Manolis Kellis** of electrical engineering and computer science is the next holder of the three-year Van Tassel Career Development Professorship. Van Tassel, a member of the Class of 1925, established the chair in 1986.

Assistant Professor **Katherine C. Kellogg** of MIT Sloan will hold the Class of 1954 Career Development Professorship for a three-year term. The Class established this chair in celebration of its 40th reunion.

Assistant Professor **Michael T. Laub** of biology will be the Whitehead Career Development Professor for a three-year term.

Professor **Richard Locke** of MIT Sloan was selected as a Class of 1960 Fellow for a two-year term; he won a Class of 1960 Innovation in Education Award.

Associate Professor **John Maeda** of the MIT Media Lab was selected as a Class of 1960 Fellow for a two-year term; he also won a Class of 1960 Innovation in Education Award.

Professor **Dianne Newman** of biology will hold a five-year John and Dorothy Wilson Professorship, established in the 1960s by John J. Wilson (S.B. 1929, S.M. 1930), a life member of the MIT Corporation since 1958.

Professor **Jonas Peters** of chemistry will hold the W.M. Keck Professorship of Energy for a five-year term. The Keck Foundation established the professorship.

Professor **Ram Sasisekharan** of biological engineering will hold the five-year Underwood-Prescott Professorship of Toxicology, established in 1972 by a gift from the Underwood Company.

Associate Professor **Jay Scheib** of the music and theater arts section in the School of Humanities, Arts, and Social Sciences will hold the three-year Class of 1958 Career Development Professorship, established by the Class of 1958 in celebration of its 25th reunion.

Assistant Professor **Gabriella Sciolla** of physics will hold the Cecil and Ida Green Career Development Professorship for a three-year term. Cecil, a member of the Class of 1923, and Ida Green established the professorship.

Professor **Gigliola Staffilani** of mathematics is the next holder of the five-year Abby Rockefeller Mauze Professorship, established in 1963 by Laurence Rockefeller and the Rockefeller Brothers Fund.

Professor **Donca Steriade** of linguistics will hold the five-year Class of 1941 Professorship, established by the Class of 1941 in celebration of its 40th reunion.

Assistant Professor **Collin Stultz** of electrical engineering and computer science will hold the W.M. Keck Career Development Professorship for a three-year term. The Keck Foundation established the professorship.

Assistant Professor **Katrin Wehrheim** of mathematics will hold the Rockwell International Career Development Professorship for a three-year term. The Rockwell International Corporation Trust endowed the Rockwell Professorship in 1985.

PHOTO / **DONNA COVENEY**

The long shadows of autumn

Light in late afternoon in Lobby 7 makes long shadows as the days get shorter.

CLASSIFIED ADS

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

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Crate & Barrel tables: console table w/espresso finish & black side table. Ikea laptop table. Baby items: Peg Perego stroller, car seat & base; Eddie Bauer infant swing & bassinet. Contact Paige at paigeparis@yahoo.com.

HOUSING

Apt. for rent near Cleveland Circle, Brookline - 3 rooms, bath, kitchen. Newly renovated, in private house. Parking, electricity, heating/AC, water all incl. Private entrance & balcony. 2 blocks - 300m to Green Line D station. $1,280/month. 12-mo lease + two mo. sec. deposit required. E-mail efrankel@mit.edu.

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HR @ Your Service

Profile in Excellence: Anne Deveau

Janet Walzer
Human Resources Communications Manager

This is what you should know about Anne Deveau. Her colleagues adore her. She consistently goes above and beyond the call of duty. She is a pleasure to be around. No surprise, then, that Deveau, an administrative assistant II in the Department of Architecture, received the MIT Excellence Award for Serving the Client in 2007.

The annual MIT Excellence Awards are an opportunity to celebrate extraordinary staff like Deveau. "Part of our mission is to recognize and reward staff. MIT has one of the more robust rewards and recognition programs among our peer institutions," said Human Resources Vice President Alison Alden. "Participating in the Excellence Awards is a win-win for the nominator and the nominee."

It is a win-win because faculty and staff want to acknowledge the people who facilitate their work—and who wouldn't be appreciative of recognition? As Deveau said, "Support staff like myself often work with mostly faculty and/or students with few or no other support staff. By receiving the award I felt a sense of connection to my local MIT communities and beyond, such that I feel strengthened further to take on new projects."

Deveau felt this connection to the MIT community, and likewise, those who nominated her zeroed in on this.

"Her leadership advances the quality and life of the MIT community and our ability to function with the exemplary standards MIT is known to foster," said Joseph Hankins, Deveau's colleague.

This leadership includes direct support of three faculty in the department and assistance to seven faculty altogether. Deveau became involved with the Working Group on Support Staff Issues "to build her connections so she could serve faculty better," noted Hankins. Not surprisingly, her peers in the Working Group then selected her to be a co-convener.

Among her many accomplishments, Deveau spearheaded her own task force on peer resources, designed a web site, and managed communications issues for both individuals and the department. Another nominator, Professor Mark Jarzombek, said, "Anne helps us run the program so effortlessly because of her uncanny ability to adjudicate situations, to notice coherencies and incoherencies, and to respond appropriately."

It's no wonder that faculty outside of Deveau's department have what Jarzombek calls "Deveau envy." Thanks to the Excellence Awards, Deveau's colleagues were able to shine the light on one of their own.

Nominations for this year's Excellence Awards are due Oct. 17. For more information and to nominate someone, go to http://web.mit.edu/hr/rewards/excellence.

HR @ Your Service is a monthly column from Human Resources.

MIT model could improve some drugs' effectiveness

Anne Trafton
News Office

MIT researchers have developed a computer modeling approach that could improve a class of drugs based on antibodies, molecules key to the immune system. The model can predict structural changes in an antibody that will improve its effectiveness.

The team has already used the model to create a new version of cetuximab, a drug commonly used to treat colorectal cancer, that binds to its target with 10 times greater affinity than the original molecule.

The work, which appeared Sept. 23 in an advance publication of Nature Biotechnology, results from a collaboration using both laboratory experiments and computer simulations between MIT Professors Dane Wittrup and Bruce Tidor.

"New and better methods for improving antibody development represent critical technologies for medicine and biotechnology," said Wittrup, who holds appointments in MIT's Department of Biological Engineering and Department of Chemical Engineering. Tidor holds appointments in biological engineering and the Department of Electrical Engineering and Computer Science.

Antibodies, which are part of nature's own defense system against pathogens, are often used for diagnostics and therapeutics. Starting with a specific antibody, the MIT model looks at many possible amino-acid substitutions that could occur in the antibody. It then calculates which substitutions would result in a structure that would form a stronger interaction with the target.

"Combining information about protein (antibody) structure with calculations that address the underlying atomic interactions allows us to make rational choices about which changes should be made to a protein to improve its function," said Shaun Lippow, lead author of the Nature Biotechnology paper.

"Protein modeling can reduce the cost of developing antibody-based drugs," Lippow added, "as well as enable the design of additional protein-based products such as enzymes for the conversion of biomass to fuel." Lippow conducted the research as part of his thesis work in chemical engineering at MIT and is now a member of the protein engineering group at Codon Devices in Cambridge.

"Making drugs out of huge, complicated molecules like antibodies is incredibly hard," said Janna Wehrle, who oversees computational biology grants at the National Institute of General Medical Sciences, which partially supported the research. "Dr. Tidor's new computational method can predict which changes in an antibody will make it work better, allowing chemists to focus their efforts on the most promising candidates. This is a perfect example of how modern computing can be harnessed to speed up the development of new drugs."

Traditionally, researchers have developed antibody-based drugs using an evolutionary approach. They remove antibodies from mice and further evolve them in the laboratory, screening for improved efficacy. This can lead to improved binding affinities but the process is time-consuming, and it restricts the control that researchers have over the design of antibodies.

In contrast, the MIT computational approach can quickly calculate a huge number of possible antibody variants and conformations and predict the molecules' binding affinity for their targets based on the interactions that occur between atoms.

Using the new approach, researchers can predict the effectiveness of mutations that might never arise by natural evolution.

"The work demonstrates that by building on the physics underlying biological molecules, you can engineer improvements in a very precise way," said Tidor.

The team also used the model with an antilysozyme antibody called D44.1, and they were able to achieve a 140-fold improvement in its binding affinity. The authors expect the model will be useful with other antibodies as well.

The research was funded by the National Science Foundation and the National Institutes of Health.

Wittrup and Tidor also co-teach a class focusing on connecting fundamental molecular and cellular events to biological function through the use of mathematical models and computer simulations.

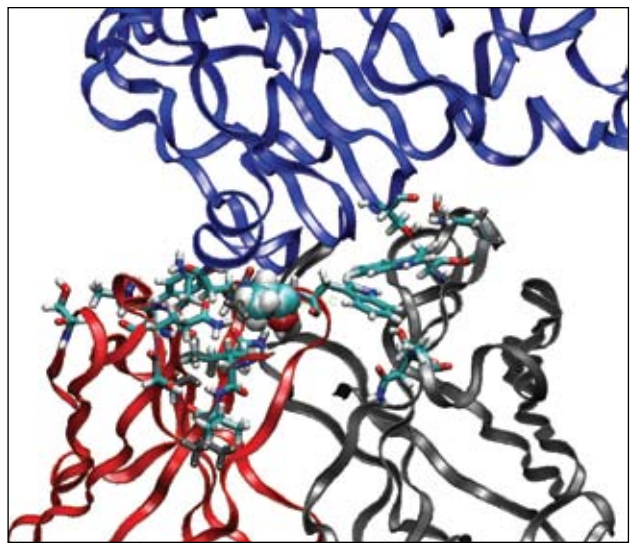
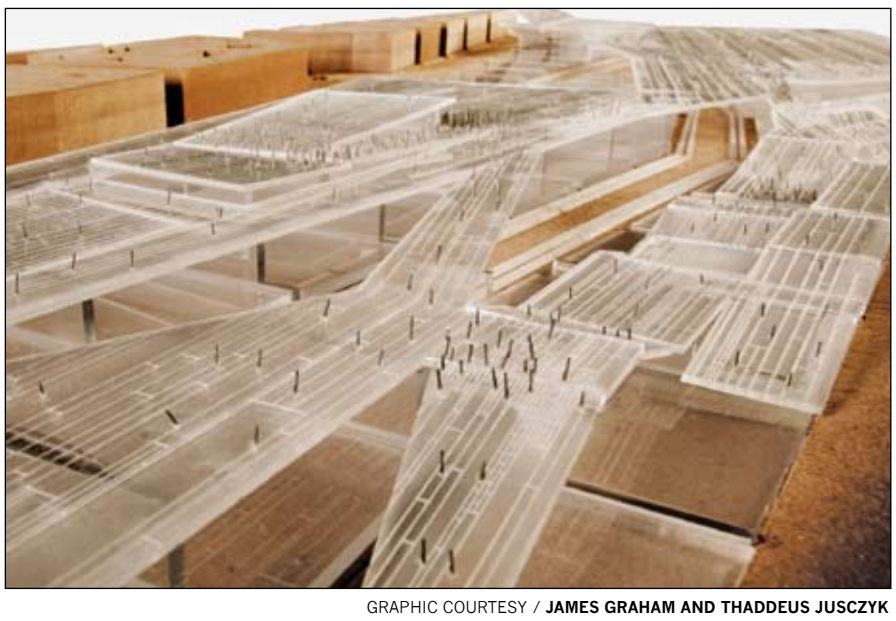


IMAGE COURTESY / **SHAUN LIPPOW**

In this image, a fragment of the antibody Erbitux (cetuximab) binds to its target, a fragment of epidermal growth factor receptor (EGFR). The blue ribbon at the top is the backbone of the EGFR fragment, and the red and gray ribbons at the bottom are the backbone of the antibody fragment. The licorice sticks and the balls in the central portion represent protein side chains making close interactions between the antigen (EGFR) and the antibody, with the balls representing one of the mutations designed computationally.

PHOTO / **DONNA COVENEY**

MIT researchers have developed a computer model that can design improved antibodies for therapeutic use. From left to right, Shaun Lippow, a recent Ph.D. recipient in chemical engineering; Karl Dane Wittrup, professor of chemical engineering and biological engineering; and Bruce Tidor, professor of biological engineering and electrical engineering and computer science.



GRAPHIC COURTESY / **JAMES GRAHAM AND THADDEUS JUSCZYK**

Joining the crowd

MIT architecture graduate students James Graham and Thaddeus Jusczyk received global media attention over the summer after the MIT News Office publicized their idea for a device that would turn the mechanical energy of human footsteps into a source of electricity. The duo's proposed "crowd farm," as shown in this model, was featured in more than 40 media outlets, including The Boston Globe, The Chronicle of Higher Education, The Times of London and MSNBC.

BP, MIT form research partnership

Global energy giant BP and MIT have announced a major research partnership around energy conversion technologies. The program will explore the conversion of low-value carbon feedstocks such as petcoke and coal to high-value products such as electricity, liquid fuels and chemicals while minimizing carbon dioxide emissions.

In establishing this partnership, BP also becomes the inaugural founding member of the MIT Energy Initiative (MITEI), which was created in 2006 to address global energy issues.

In announcing the partnership, MIT President Susan Hockfield praised the collaboration: "This exciting partnership between MIT and BP epitomizes what the MIT Energy Initiative is designed to accomplish: the pairing of innovative MIT researchers across the entire campus with results-oriented scientists, engineers and planners in industry, working together to transform the world's energy marketplace."

The BP-MITEI collaboration will support a flagship energy research program, the BP-MIT Advanced Conversion Research Project, which includes several interrelated research thrusts including advanced simulation of processes for feedstock conversion and decarbonisation and multiscale simulation of gasification.

BP America Chair and President Bob Malone said: "Conversion technologies will play a critical role in regional energy security and will provide access to clean energy sources in both the developed and developing world. The BP-MIT Advanced Conversion Research Project is a natural research extension to our successful executive development programs at MIT."

As the founding member, BP will also support MITEI's Energy Research Seed Fund program. This program will fund novel energy research concepts generated from an annual campus-wide solicitation. In addition, BP will support 10 BP-MIT energy fellows at the Institute each year of its five-year commitment.

Professor Ernest J. Moniz, director of MITEI, also applauded BP's commitment to energy research and education. "This will help transform how the world uses its abundant coal resources and demonstrates a strong commitment to developing the next generation of energy technologists, supporting 50 energy fellowships over the length of the collaboration."

Total funding for the BP Advanced Conversion Research Program and for the associated MITEI commitments will be at least $5 million per year for five years.

21st-century pack mule: MIT's 'exoskeleton' lightens the load

Anne Trafton
News Office

Researchers in the MIT Media Lab's Biomechatronics Group have created a device to lighten the burden for soldiers and others who carry heavy packs and equipment.

Their invention, known as an exoskeleton, can support much of the weight of a heavy backpack and transfer that weight directly to the ground, effectively taking a load off the back of the person wearing the device.

In the September issue of the International Journal of Humanoid Robotics, the researchers report that their prototype can successfully take on 80 percent of an 80-pound load carried on a person's back, but there's one catch: The current model impedes the natural walking gait of the person wearing it.

"You can definitely tell it's affecting your gait," said Conor Walsh, a graduate student who worked on the project, but "you do feel it taking the load off and you definitely feel less stress on your upper body."

The research team was led by Hugh Herr, principal investigator of the Biomechatronics Group and associate professor in the MIT Media Lab. Earlier this summer, Herr and his colleagues unveiled the world's first robotic ankle for lower-limb amputees.

Eventually Herr hopes to create assistive leg devices that can be useful for anyone. Herr said he envisions leg exoskeletons that could help people run without breathing hard, as well as help to carry heavy loads.

"Our dream is that 20 years from now, people won't go to bike racks—they'll go to leg racks," he said.

Exoskeleton devices could boost the weight that a person can carry, lessen the likelihood of leg or back injury and reduce the perceived level of difficulty of carrying a heavy load.

The person wearing the exoskeleton places his or her feet in boots attached to a series of tubes that run up the leg to the backpack, transferring the weight of the backpack to the ground. Springs at the ankle and hip and a damping device at the knee allow the device to approximate the walking motion of a human leg, with a very small external power input (one watt).

Other research teams have produced exoskeleton devices that can successfully carry a load but require a large power source (about 3,000 watts, supplied by a gasoline engine).

When the MIT researchers tested their device, they found that although it helped to lighten the load, the user had to consume 10 percent more oxygen than normal, because of the extra effort to compensate for the gait interference.

The team hopes to revise the design so the exoskeleton more closely mimics the movement of a human leg, allowing for more normal walking motion. The most important result of this study, says Walsh, is that the team's spring-based, low-energy design shows promise.

"This is the first time that it has been tested," he said. "We didn't know what to expect."

Other Biomechatronics Group members who contributed to the project were Daniel Paluska, Ken Pasch, Andrew Valiente and William Grand. The research was funded by the Defense Advanced Research Projects Agency.

PHOTO / **SAMUEL AU**

Graduate student Conor Walsh demonstrates a prototype of the 'exoskeleton' he and other MIT researchers have devised. The invention can successfully take on 80 percent of an 80-pound load carried on a person's back.

MIT tether could aid asteroid missions

Anne Trafton
News Office

Using a tether system devised by MIT researchers, astronauts could one day stroll across the surface of small asteroids, collecting samples and otherwise exploring these rocks in space without floating away.

The ability to visit asteroids could also be invaluable for testing equipment for a mission to Mars by humans. Further, knowing how to tether an asteroid could be helpful if we need to tow one away from a potential collision course with Earth, says Christopher Carr, a postdoctoral associate in MIT's Department of Earth, Atmospheric and Planetary Sciences.

Carr and Ian Garrick-Bethell, a graduate student in the department, describe their system in an upcoming issue of the journal Acta Astronautica.

Walking on an asteroid is much more difficult than walking on a planet because asteroids have so little gravity. An astronaut who tried to step onto one would likely fly off or hover above the surface.

Now Carr and Garrick-Bethell say that tying a lightweight rope completely around an asteroid could solve that problem. Once the rope is in place, astronauts could attach themselves to it and maneuver or possibly even walk along the surface.

That would allow an in-depth exploration of the composition and history of asteroids, which could shed light on some of the big questions about our solar system, such as how the planets formed, said Carr.

"This is an innovative approach to a task nobody has spent much time thinking about," said former astronaut Jeffrey Hoffman, an MIT professor of aeronautics and astronautics who sponsored the paper. "NASA has taken a brief look at a human visit to a Near Earth Object, and it may be something we can do long before going to Mars. Clever ideas will be necessary to allow people to do useful work near objects on which you cannot 'land,' but only 'dock.'"

An asteroid's gravity varies depending on its density and size, which can range from a speck of dust to something hundreds of kilometers in diameter. On an asteroid that has a diameter larger than eight kilometers, an astronaut who jumps will probably come back to the surface, Carr said. But if the asteroid is smaller than that, the astronaut may float away.

Even if an asteroid has enough gravity to keep an astronaut on the surface, it would be difficult to move around or collect samples. "You couldn't touch anything without sending yourself on a new trajectory or spinning yourself around," said Garrick-Bethell, who is the first author of the Acta Astronautica paper.

Some people have suggested that astronauts could bolt themselves directly to the asteroid, but the granular material covering the asteroids could prevent this.

"It would be like trying to bolt yourself to a pile of gravel or sand," Garrick-Bethell said.

The MIT researchers envision deploying their system with an astronaut or a remote-controlled rocket that unwinds a spool of rope while flying around the asteroid. When the craft reaches the starting point, a loop is formed and tightened. Astronauts could then be held to the asteroid using one or more ropes, permitting them to work on the surface.

One unknown is whether the rope would cut into the granular surface of an asteroid, hindering the system's effectiveness. But even if the rope does not allow astronauts to walk on the surface, it could at least give them something to hold onto as they pull themselves along the asteroid without floating away, said Carr.

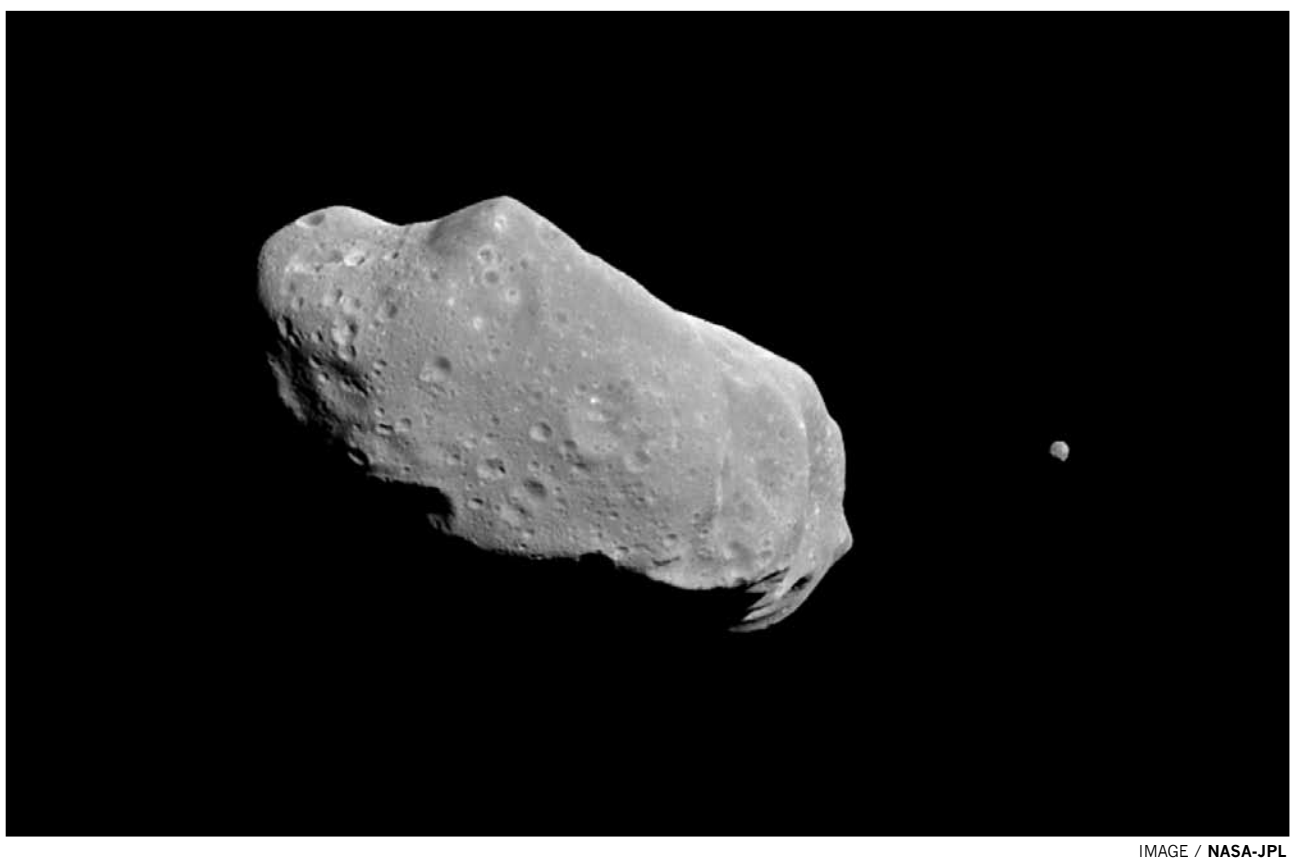


IMAGE / **NASA-JPL**

Asteroid 243 Ida, a heavily cratered, irregularly shaped space rock in the main asteroid belt between Mars and Jupiter, is shown here with its moon in an image transmitted to Earth from NASA's Galileo spacecraft. MIT researchers say a tether system could one day allow astronauts to stroll across the surface of asteroids without floating away.

NEWS YOU CAN USE

Chaplain to the Institute

Robert M. Randolph will be formally installed as MIT's first chaplain to the Institute during a ceremony at 5:30 p.m. Sunday, Sept. 30, in Kresge Auditorium. President Susan Hockfield will speak at the service, as will the Rev. Peter J. Gomes, minister in the Memorial Church at Harvard University.

Randolph has spent more than a quarter-century at MIT in various roles. As chaplain to the Institute, Randolph will be charged with working alongside the members of the Board of Chaplains, who represent many religious traditions, in fostering interfaith discourse and educating the MIT community about the history and role of religions around the world. His portfolio includes coordinating pastoral response in times of crisis at the Institute, raising the profile of religious life at MIT and leading reflection on issues of social justice and core values.

MIT Generator

The MIT Generator, an event focused on bringing students together and finding ways to improve campus energy and sustainability, will take place from 6:30 to 9:00 p.m. on Sept. 27 in 32-123. Last year's event drew more than 100 students.

The MIT Generator will include information on how students can get involved in "greening" the campus and will also feature the chance to join or initiate action teams focused on targeted improvement areas (e.g., behavior change campaigns, energy maps and audits, lab-to-campus technology transfer, transportation, recycling, campus energy and carbon goals, funding mechanisms and more).

For more information on the MIT Generator, please visit http://sustainability.mit.edu/Generator.

MIT 401(k) Investment Fair

Whether you're already participating in the 401(k) plan or haven't enrolled yet, the MIT Retirement Programs Office hopes you can attend the MIT 401(k) Investment Fair Oct. 2 at the Stratton Student Center. The 9 a.m. to 3:30 p.m. event will feature a series of seminars and activities focused on retirement planning and portfolio management for investors at all levels. You'll have the opportunity to enroll in the plan or to make changes to your account online. Fidelity and MIT retirement counselors will be available all day for individual consultations. In addition, there will be a gift for participants, raffles every half hour and refreshments. Look for a complete agenda in your mail.

Seth Alexander, president of the MIT Investment Management Company, will be the keynote speaker; his presentation, "Considerations for Successful Investing," will be held in the Sala de Puerto Rico room at noon.

Socially responsible investing

Last May MIT issued a statement recognizing the abhorrent acts taking place in the Darfur region of Sudan. Since then some MIT employees have expressed concern about their investments in the MIT Supplemental 401(k) Plan in relation to Sudan, as Fidelity Investments has several funds with significant holdings in companies that are supporting the government of Sudan.

Benefits recognizes that some employees will want to learn about other options and how to go about adjusting their investments or future contributions. Visit http://hrweb.mit.edu/401k/sudan/ to learn more about socially responsible investing and about these investment offerings in the MIT Supplemental 401(k) Plan.

MIT Libraries' booksale

MIT Libraries' book sale will be held Oct. 2 from 10 a.m. to 3 p.m. in the Bush Room (10-105).

The sale offers a selection of material from diverse areas including biology, chemistry, computer science, engineering, fiction, history, linguistics, management and music. Some free materials will be available. Proceeds will benefit the Libraries' Preservation Fund. The sale is open to the MIT community only.

For more information, contact Charlene Follett or Betsy Granese at x3-5693 or gifts-lib@mit.edu.

INDIA

Continued from **Page 1**

model of selecting research, directing projects and forging connections between researchers and the marketplace as a guide to building international teams for addressing energy problems.

(Gururaj "Desh" Deshpande, CEO of Sycamore Networks and founder of the Deshpande Center for Technological Innovations, gave the event's closing address.)

The panel, "Microfinance, Primary Education and Health: Understanding Poverty," gave a view from the ground of difficulties in meeting Godrej's goal of correcting inequities among India's 1 billion people.

PHOTO / **DONNA COVENEY**

Esther Duflo, Abdul Latif Jameel professor of Poverty Alleviation and Development, from the department of Economics, was on a panel called "Microfinance, Primary Education and Health: Understanind Poverty" at the Emergent India conference, held at Bartos Theatre at the Media Lab on Friday, Sept. 21.

Abhijit Banerjee, professor of economics, described how application of large-scale randomized experiments to measure the effectiveness of anti-poverty programs in India revealed the workings of a public health disaster in one Indian district. The experiments, conducted by MIT's Abdul Latif Jameel Poverty Action Laboratory (J-PAL), illuminated the morbid interplay among low immunization rates, high absentee rates among doctors and nurses, and unpredictable clinic hours.

Esther Duflo, Abdul Latif Jameel Professor of Poverty Alleviation and Development, applying the J-PAL method to measure primary education programs, discovered the toll of teacher absenteeism and remote school administrators.

Nachiket Mor, deputy managing director of ICICI Bank (formerly the Industrial Credit and Investment Corporation of India), discussed strategies to widen access to credit and the importance of understanding household finances.

Panelists on "Competitiveness in Indian Industry" agreed generally that India resembles China in its shift from a low- to a high-tech work force and in its approach to faculty teaching loads: In both countries, faculty have very heavy teaching loads, which take time from research and slow industrial development.

Discussants included Steve Eppinger, deputy dean and professor at MIT Sloan; Yasheng Huang, associate professor of management; Shekhar Chowdhury, director of the Indian Institute of Management, and S.P. Kothari, Gordon Y. Billard Professor of Accounting.

Adele Naude Santos, dean of the School of Architecture, led the presentations on the role of design and urban planning in India. Panelists included Rahul Malhotra, professor of architecture; Balakrishnan Rajagopal, associate professor of urban studies and planning; and Bish Sanyal, professor of urban planning.

Sanyal urged conference participants to view India's challenges as more universal than unique: The future of the world is already here.

"Emergent India: An Engagement With MIT" was organized by the MIT-India Program, the Office of the Provost and the foreign languages and literatures section.

HARDY

Continued from **Page 1**

attend MIT because it was "the best possible school."

She hesitated because she wanted to study writing but went along with her brother's suggestion. She ended up loving MIT's writing program. "It's a great writing program," she said. "The lecturers and professors are excellent."

However, toward the end of her sophomore year Hardy decided to make the jump to engineering, because she wanted to be sure she could get a good job after graduation. "Writing you can always go back to," she said. "I had the chance to change, so I decided I should do it."

Hardy ended up doing all of the coursework for a major in writing except for the thesis. Taking so many classes in the writing program turned out to be very beneficial for her personal development, she said. "There's another side of you that's not expressed if you only do engineering the whole way through."

Being part of the writing program also helped Hardy feel like she belonged to a small community, which she said is important at a large institution like MIT. She also found homes as part of the women's crew, Experimental Studies Group and as a teaching assistant for Course 18.02 (Multivariable Calculus).

She earned her bachelor's degree in 2000 and her master's in 2004. For her Ph.D. thesis, Hardy studied automotive engineering and did much of her research at the Ford Research and Innovation Center in Dearborn, Mich. Through the Ford-MIT Alliance, she worked with Ford engineers and MIT's John Heywood to investigate a new type of internal combustion engine with improved fuel-efficiency potential.

"She was able to work with a research focus on a new engine combustion technology, bring some of that work to an industrial setting, and combine those elements into her thesis," said Heywood, the Sun Jae Professor of Mechanical Engineering.

Hardy credits much of her success to the inspiration and encouragement of her mother, who holds a doctorate in education and instilled in her at a very young age the importance of education, and her brother, who is a year and a half older and has a doctorate in chemical engineering.

The scarcity of black women in MIT's graduate engineering programs also inspired her to continue her studies as far as possible. She hopes to encourage others to follow in her footsteps.

"I would love to find a way to encourage more people to do it," she said. "MIT is welcoming and open to everyone."

MARS

Continued from **Page 1**

The experiment reveals that the southern Martian polar region is the largest body of frozen water on the planet and the largest, outside of Earth, in the inner solar system, which includes Mars, Earth, Venus and Mercury.

Until now, scientists were puzzled by the observation that a large percentage of the southern polar region surface does not reflect much light, as it would if there were ice on the surface. This study shows that much of the ice is covered in a layer of dust, but it remains unknown why the dust only covers certain areas, Zuber said.

She plans to undertake a similar density study of the northern polar cap, which does not appear to have a covering of dust but which abuts against a large apparent dune field that is not now thought to contain significant ice.

Zuber is the lead investigator for gravity for the Mars Reconnaissance Orbiter and deputy principal investigator for the altimetry experiment aboard the Mars Global Surveyor. The team also used data from the Mars Odyssey satellite.

Such collaborations among teams "really increase the value of what any single experiment could show on its own," Zuber said.

Jeffrey Andrews-Hanna, an MIT postdoctoral associate in the Department of Earth, Atmospheric and Planetary Sciences, is also an author on the paper. Other authors are Roger Phillips of Washington University; Sami Asmar, Alexander Konopliv, Jeffrey Plaut and Suzanne Smrekar of the Jet Propulsion Laboratory at Caltech; and Frank Lemoine and David Smith of the Planetary Geodynamics Laboratory at the NASA Goddard Space Flight Center.

The research was funded by the NASA Mars Program.

Hosts Needed

The MIT Hosts to International Students Program (5-133) helps new international students with their transition to life in the United States by pairing them with faculty, staff, alumni/ae and friends of MIT, including singles, families with children and retirees. The program is looking for new hosts and host families to offer hospitality and friendship to incoming students.

Many hosts invite their students to share holiday dinners, and students generally love the chance to partake in a new set of foods and rituals. Hosts might answer questions about puzzling phenomena such as decorating lawns in December with plastic reindeer sporting illuminated red noses, or carving faces in pumpkins in October. Depending on their interests, hosts and students might enjoy local excursions or share common interests such as going to museums, playing sports or watching movies.

To find more information about this MIT volunteer program, visit http://web.mit.edu/iso/resources/host_program. Potential hosts should contact Janka Moss at janka@mit.edu, call x3-3795, or visit the International Student Office in Room 5-133.

NSF fellow to appear on 'Dancing with the Stars'

Lois Slavin
MIT Engineering Systems Division

MIT Ph.D. student and NSF fellow Rhonda Jordan, whose passions include engineering and rhythm tap, is scheduled to perform Sept. 26 with accomplished tap dancer and choreographer Savion Glover on ABC Television's "Dancing with the Stars." Jordan will appear during the final day of the program's three-day season kick-off.

Rhonda Jordan

Jordan has been studying dance since age 6 and has formal training in ballet, jazz, lyrical and tap. When she was just 8, she became the youngest dancer selected to participate in the Dance Theater of Harlem residency program in classical ballet, co-sponsored with the John F. Kennedy Center for the Performing Arts in Washington. She has performed in various venues across the U.S. and around the world and has taught dance to elementary and middle-school children in inner-city schools.

However, dance isn't Jordan's only love. When she was 16 she entered the Fu Foundation School of Engineering and Applied science at Columbia University to major in electrical engineering. She graduated magna cum laude from Columbia with a Bachelor of Science in Electrical Engineering and a Master of Science in Electrical Engineering, with a concentration in fiber optics and lightwave communications.

Jordan was named a National Science Foundation fellow and was awarded a full fellowship to pursue her doctoral studies. She is now a Ph.D. student in MIT's Engineering Systems Division, where she will pursue research interests that include applying systems thinking to address complex societal problems.

Jordan's advisor, Professor Richard Larson, described her as a "hard-core electrical engineer" who decided a couple of years ago that traditional engineering was too narrow and technocratic. She took a hiatus from graduate school to teach inner-city children in New York City, which so energized her that she sought out MIT's Engineering Systems Division as a place to develop her diverse skills and broadening interests.

"Because this is her first year at ESD, it's too early to say exactly what her ultimate research interest may be. However she seems to be leaning towards education systems, focusing on technology-enabled education systems that can multiply by orders of magnitude the number of children in poor communities who can benefit from excellent teachers," Larson said. "We welcome Rhonda's intellect, energy and enthusiasm and wish her well on network TV!"

MIT Museum expands with new gallery

Grand opening of new addition this weekend

The MIT Museum will celebrate the grand opening of its new 5,000-square-foot addition with a Sept. 29 ribbon-cutting, new exhibits and events, and free admission for all visitors to the museum Sept. 29 and Sept. 30.

The $3 million addition will house the Mark Epstein (S.B. 1963, S.M. 1964) Innovation Gallery, MIT 360, a media-rich program and activity area, a new museum store and a new street-level entryway.

"With this major expansion, the Museum will establish a bold public presence on lower Massachusetts Avenue. For the first time, we'll have enough space to feature highlights of some of the most current research and innovation here at MIT," said John Durant, MIT Museum director.

John Durant

One of the museum's goals for the addition, which converted offices into exhibition spaces, was to permit visitors easier access to the museum as well as to provide "vivid examples of the ways in which MIT researchers are continuing to invent the future," Durant noted.

The celebration starts with a ribbon cutting at 10:00 a.m. Sept. 29 and launches a weekend full of exciting activities.

Exhibits in the ground floor gallery will feature first-time presentations of MIT science and technology research. These include:

The MIT Media Laboratory City Car

This lightweight, intelligent electric vehicle radically reduces urban energy consumption and carbon footprints. It's not only completely electric, but also stacks for easy parking.

IMAGE / **FRANCO VAIRANI, SMART CITIES GROUP**

The MIT Media Lab's stackable City Car will be featured in the MIT Museum's expansion.

MIT and the Sea: Pioneers in Ocean Exploration

MIT's collaborations with the Woods Hole Oceanographic Institution, the U.S. Navy and industry have illuminated the darkest mysteries of the sea. The multimedia exhibition showcases work by MIT engineers in developing undersea robots for ocean exploration.

No Ordinary Fish: Zebrafish as a Model for Cancer Research

Set in the middle of the new gallery is an aquatic habitat system that houses 10 aquariums filled with zebrafish, which are used in MIT cancer research.

The gallery will also feature sculptural works by Arthur Ganson created specifically for the gallery.

"We are very grateful to the MIT alumni and museum board members who jumpstarted this hugely important project," said Mary Leen, associate director of the museum.

Leen also noted, "When the Mark Epstein Innovation Gallery opens, the museum's capacity for event rental space will also increase, opening up the possibility to not only host MIT events, but local, corporate and community events as well."

To read the full Epstein Innovation gallery schedule, go to http://web.mit.edu/museum/about/news/fall07.html#Innovation.

PHOTO / **DONNA COVENEY**

PHOTO / **ANNATINA CAPREZ**

Main squeeze

For any artist, the opening of a new show is always a high-wire act, but Wendy Jacob, associate professor in visual arts, conveyed that fleeting drama with a literal high-wire act at the Sept. 20 reception to celebrate "Between Spaces," her new exhibit in Wolk Gallery.

Over the course of one long minute (6:45 p.m. to 6:46 p.m.), tightrope walker Madeleine Prévost-Lemire walked between an open window in Wolk Gallery and the fourth floor of Rotch library, making art imitate life.

Jacob's work in "Between Spaces" focuses on emotional states, expansion and contraction, risk and refuge, and on sensations of safety and diffusion.

Squeeze Chair, her best-known work, is featured in the Wolk Exhibit. In it, Jacob has reconfigured the living room chair as a soft foam cube with a keyhole-like space carved out to accommodate a solo sitter. Air pockets embedded in the cube create a muscle around the sitter that tightens and relaxes, replacing anxiety with a cozy sense of safe and neutral containment. A foot pump operates the mechanism.

In developing Squeeze Chair, Jacob collaborated with Temple Grandin, an autistic artist and animal activist.

Jacob's other work includes breathing walls and ceilings, warm rosettes, hugging life vests, and tightropes through living rooms. Her projects involve collaboration with circus performers, homeowners, engineers and scientists.

Jacob has exhibited internationally at the Centre Georges Pompidou, the Whitney Biennial, the MIT List Visual Arts Center, the Chicago Project Room, and Krome (Cologne), among others. She is the recipient of numerous awards and grants including a Louis Comfort Tiffany Foundation Artist Fellowship, Creative Capital Artist Fellowship, New Forms Regional Initiative Grant, and an Illinois Arts Council Artist Fellowship.

Since 1988, she has been a member of HaHa, the Chicago-based art collective that has produced installations, sculpture and video works in the U.S. and Europe. HaHa's ephemeral pieces have been sited in galleries and museums as well as in storefronts, outside the legislative chambers, and on the roof of a taxi.

Before coming to MIT in 2003, Jacob taught in the sculpture department at the College of Fine Arts, Illinois State University, and in the performance department at the School of the Art Institute of Chicago. She received the B.A. degree from Williams College and the M.F.A. from the Art Institute of Chicago.

"Between Spaces" runs through Dec. 21. The Elliott K. Wolk Gallery (Rm. 7-338) is free and open to the public Monday through Friday, 9 a.m. to 5 p.m.

Students help MITEI 'walk the talk' on energy

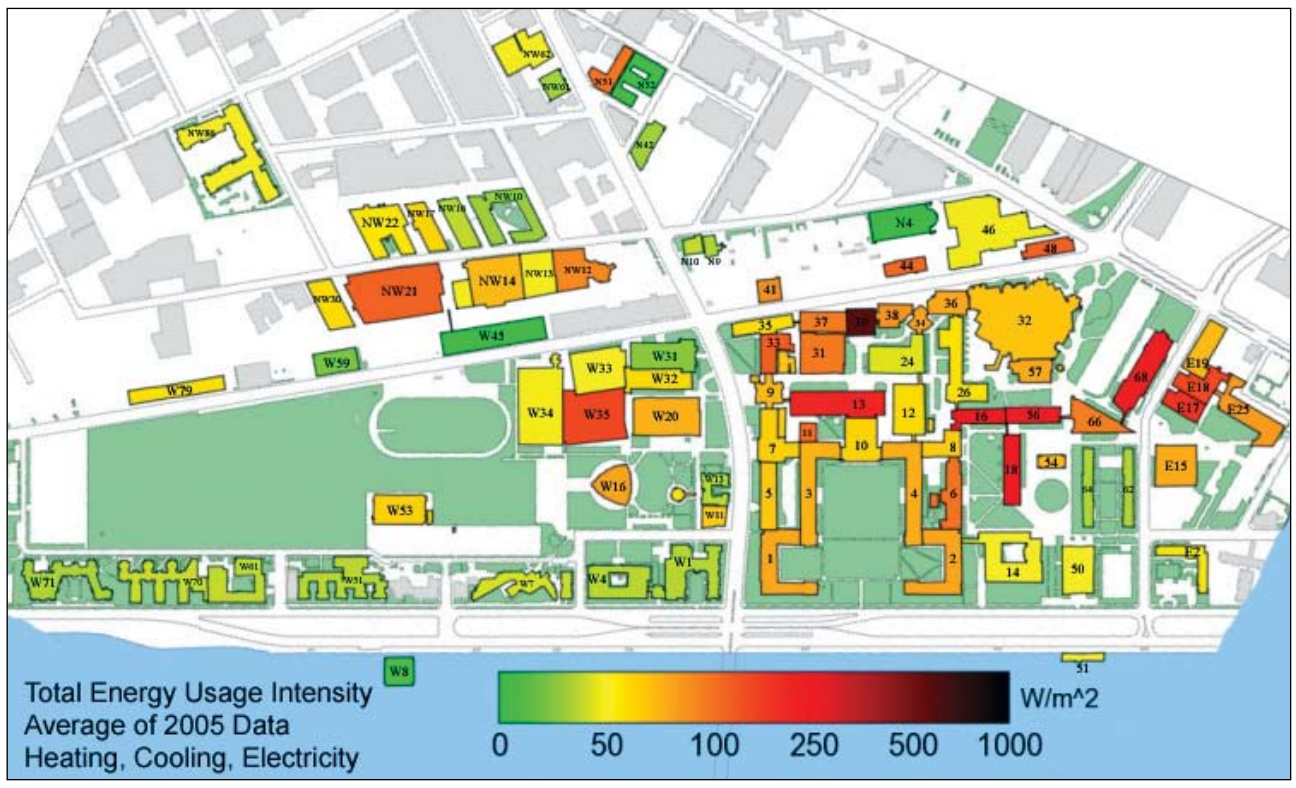
Dan Wesolowski looked out from the second floor of MIT's Building E25, watching in dismay as students and faculty alike ignored signs to use the revolving door below him and save energy. Person after person coming from the nearby Kendall Square subway walked through the swing door to the side of the revolving door.

"A single person walking through a revolving door in February saves enough energy to light a 60-watt light bulb for 23 minutes," said Wesolowski, a fourth-year Ph.D. candidate in materials science and engineering. If everyone used the revolving doors, MIT would save about $7,500 in natural gas a year in E25 alone, which has two of the 29 revolving doors on campus.

The MIT Energy Initiative (MITEI) is now supporting a student plan to encourage that behavior.

Wesolowski and three classmates started their Revolving Door Campaign a couple years ago as part of a project for a class in sustainability and planning in the Department of Urban Studies and Planning. In tests around campus, their 11- x 17-inch signs saying "Help Conserve Energy, Please Use the Revolving Door" improved revolving door use to 65 percent from 23 percent. Based on those results, MITEI is providing funds for printing and installing pedestal-mounted signs at five revolving doors across campus.

"I didn't set out to be a revolving-door activist," Wesolowski admitted. "But once I crunched the numbers I saw an opportunity to save energy. Every time you feel a breeze, that's energy blowing out the door." The energy savings have to do with heat transfer: revolving doors prevent the free exchange of conditioned indoor air with outdoor air.



GRAPHIC COURTESY / **STEVEN PETERS, TAREK RACHED AND ELSA OLIVETTI**

Software developed by MIT students generated this map showing energy use intensity across campus. Last spring, MITEI awarded funds for this work and for six other student projects aimed at cutting campus energy use and encouraging adoption of sustainable energy practices. MITEI is now seeking proposals for new student projects relating to campus sustainability. Applications are due Oct. 1.

The project was one of seven selected earlier this year by MITEI's new Student Campus Energy Project Fund. The fund makes money available twice yearly to students to undertake projects in line with the Energy Initiative's Campus Energy Task Force. The task force recently issued another request for proposals, with a submission deadline of Oct. 1. The fund was seeded by MITEI with $10,000, plus a supplemental donation of $5,000 from Shell Oil Company.

Other projects funded in the first round include:

* The Wind Turbine Design Competition will be run for the first time during Independent Activities Period 2008. Students will have an opportunity to design and build a wind turbine capable of harvesting electrical energy from the wind.

* MIT Generator is a coalition of student groups aiming to catalyze and support student projects with a focus on energy, environment and sustainability issues on MIT's campus. The goal for 2007-08 is to expand the community of students involved in campus energy projects through more extensive outreach. The next Generator event will be held Sept. 27 from 6:30 to 9:00 p.m. in the Stata Center's Kirsch Auditorium (32-123).

* Publicity and Recruitment Booklets for the MIT Sustainability Community is an Undergraduate Association Campus Sustainability Committee project. It published a booklet for freshman orientation to recruit incoming students for sustainability activities on campus. The booklet contains information about many of MIT's student groups, clubs and initiatives involved with energy, the environment and sustainability.

* The Campus Climate Project (Focus the Nation) aims to widen awareness and conversation about climate change on campus and to motivate and empower students to take action on these issues. The project will be part of the national events of Jan. 31, 2008, known as "Focus the Nation: Global Warming Solutions for America." It will include seminars during the second week of spring semester in February 2008.

* Plug Load Meters for Appliance Use Case Studies will measure energy consumption in more detail than at the general building level to include items such as appliances. The goal is to influence user behavior by providing information about how much and for what purpose energy is consumed within each building.

* The Energy Map Project (see graphic above) has developed a prototype map that displays energy use intensity in various MIT buildings with a color scale.

"This first round of projects is just the tip of the iceberg," said Steven Lanou, deputy director of MIT's sustainability program and a member of the grant review committee. "With another round of funding available this semester, I expect to see the ingenuity and creativity of student projects continue to grow and inspire us to do more to reduce our energy footprint and lead with innovative approaches."

While the projects place a demand on students' time, they can be a welcome diversion from daily studies, said Tarek Rached, a second-year student going for a master's degree in technology and policy. "This is relaxing," he said. Rached and fellow student Steven Peters are involved in the Energy Map Project, which is designed to reduce energy use in MIT's buildings (see accompanying graphic).

Energy consumption in buildings accounts for the vast majority of campus energy use and produces more than 90 percent of MIT's greenhouse gas emissions, but most buildings are used without any feedback to the occupants and operators. The project aims to develop tools to measure and analyze MIT's campus energy use, such as the energy map.

The students are now getting monthly data from MIT's Department of Facilities on energy use in MIT buildings dating back five years. "The next phase is to launch an automated display system to get real-time data on the web so people can see what is going on in their building," Rached said. "We want to get people involved to change behavior."

That includes getting incoming freshmen involved in campus energy activities from the get-go. Austin Oehlerking, a senior, became interested in sustainable energy after taking a course during Independent Activities Period last year. He changed from studying economics and finance to mechanical engineering. Oehlerking was instrumental in developing the orientation booklet for 2007 to get freshmen interested in sustainability communities throughout MIT. "There are at least 12 different student groups," he said. "There are so many different projects going on that it is hard for people to grasp. The booklet is a great opportunity for them to find their niche among sustainability efforts on campus."

Oehlerking said he's seen a marked increase in interest in energy since he was a freshman at MIT. "A lot of people didn't know about energy initiatives, including me," he said. "I've seen a major shift in interest in the past couple years because of events like the $100K competition, which is seeing a lot more energy business plans and creating huge excitement among undergraduates. I've also seen a huge change since MIT President Susan Hockfield came in and focused on energy."

Freshmen get DEEP into energy and environment

Deborah Halber
News Office Correspondent

It was uncharacteristically cool during the day last month when MIT atmospheric chemistry graduate student Matthew J. Alvarado found himself talking about global warming to a troupe of newly arrived MIT freshmen.

But that was OK. The 20 students who signed up for a first-of-its-kind preorientation session Aug. 21-24 were savvy enough to know the difference between weather and climate, Alvarado said. At the Public Garden, along the Freedom Trail and through Haymarket, Alvarado talked about how global warming could significantly raise the level of storm surges Boston experiences in the coming centuries.

The tour was just one of the ways members of the Class of 2011 learned about energy and environment in and around MIT through Discover Energy and Environmental Programs at MIT (DEEP@MIT), a new freshman preorientation program (FPOP) created with support from the d'Arbeloff Fund for Excellence in Education.

Participating students learned about relevant academic programs, green campus operations and pioneering student projects such as the Biodiesel@MIT initiative and the Generator, an event introducing students to energy-related opportunities around campus. DEEP rounded out existing FPOP programs on literature, engineering and outdoor adventures.

"We were able to give our first-year students a whirlwind tour of MIT's energy and environmental programs in research labs, campus operations and student initiatives, while also highlighting some of the pressing challenges and complex questions that they can explore during their MIT career," said Beth C. Conlin, education program coordinator for the Laboratory for Energy and the Environment (LFEE) and the MIT Energy Initiative.

PHOTO / **MARK MORELLI**

Left to right, freshmen Ian Tracy, Tung Shen Chew, Hannah Farrow and Melissa Diskin develop their strategy for conquering the fishing industry in the FishBanks game, part of a preorientation session last month.

"Everyone should learn about energy and be aware and proactive about their world," said participant Denys Zhuo. "I learned a great deal about alternative energy while getting to see some of MIT's cutting edge research performed by students as well as an awareness in my everyday activities of how to live more green and energy efficient." Zhuo, from Lafayette, La., is interested in materials science and engineering.

Patrick Ernst from Brecksville, Ohio, said, "I feel that my generation must make great progress in the field of energy production. Participating in DEEP allowed me to become familiar with programs at MIT that deal with energy and environmental issues."

DEEP program components included activities gauging the individual, campus and global impact of energy and resource use; interactive discussions with faculty on issues of science, technology and policy; conversations with students about how to get involved in energy and environmental activities; and tours of MIT facilities such as the Plasma Science and Fusion Center and the lab of Heidi Nepf, professor of civil and environmental engineering.

The most substantial activity of the week was a one-day audit of the energy and environmental footprint of Burton-Connor House, an MIT dormitory. The students approximated the dorm's—and an individual student's—impact in terms of electricity, heating, water use and recycling. Students calculated both the resource and financial savings of efficiency improvements in each of these areas.

DEEP organizers also collaborated with the Terrascope Program to play the interactive FishBanks game, in which students take on the role of fishing companies in a competitive fishery, attempting to preserve the long-term health of their industry. The game holds lessons on the management of common resources in a competitive market.

Amanda C. Graham, education program manager for LFEE and MITEI, oversaw the planning and implementation of DEEP@MIT. "It was terrific fun to meet students in their first few days at MIT who were excited and committed to making a positive environmental difference," she said.