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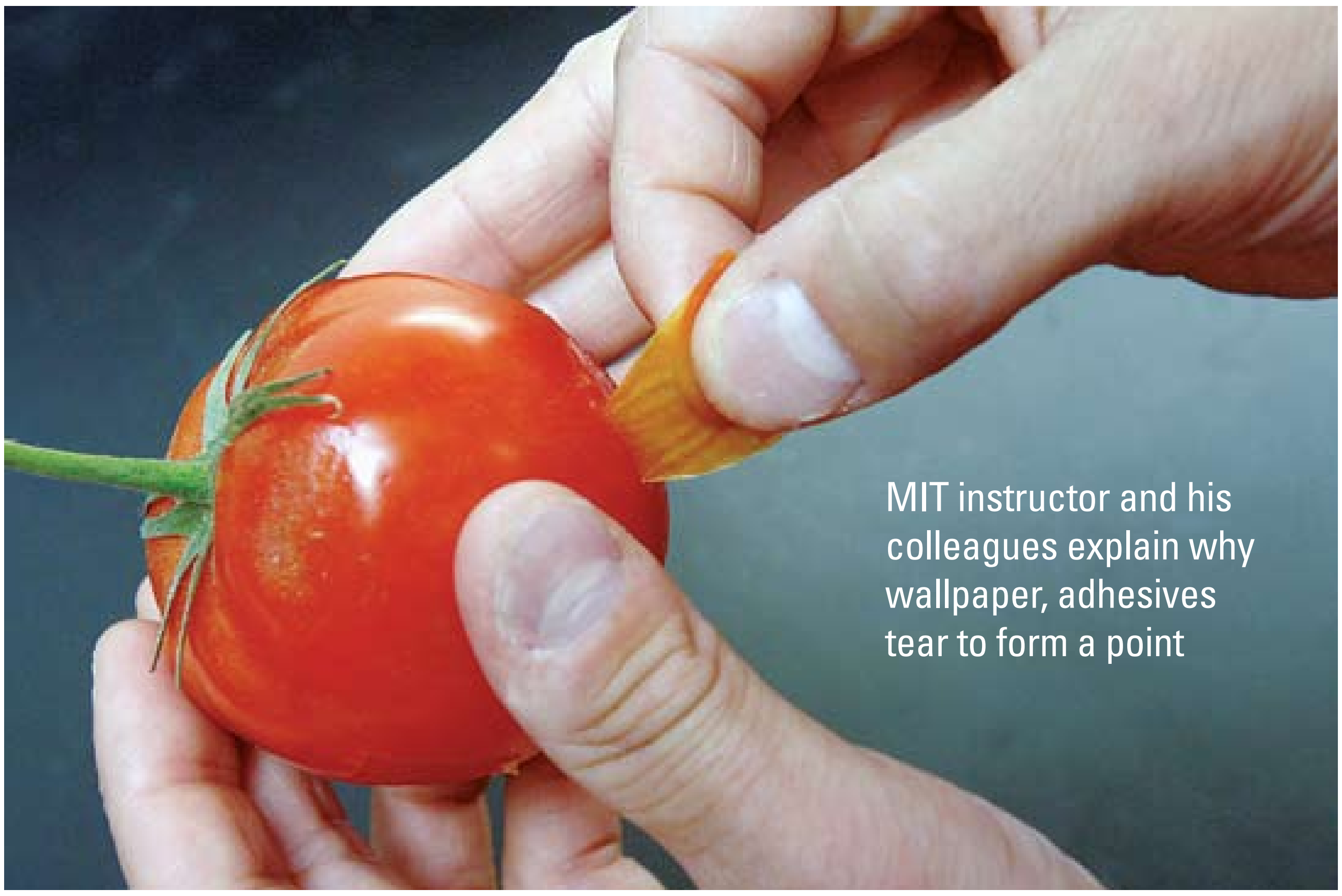
TechTalk
SERVING THE MIT COMMUNITY

A sticky situation



PHOTOS / **DONNA COVENEY**

Pedro Reis, an instructor in applied math, and colleagues are studying how adhesive materials tear. Above, he demonstrates how a peeling tomato skin forms a triangle as it tears. Below, the same thing happens with adhesive tape.

Anne Trafton
News Office

Frustrated by tape that won't peel off the roll in a straight line? Angry at wallpaper and posters that refuse to tear neatly off the wall?

A new study reveals why these efforts can be so aggravating. Wallpaper is not out to foil you—it's just obeying the laws of physics, according to a team of researchers from the Centre National de la Recherche Scientifique (CNRS) in Paris, the Universidad de Santiago, Chile, and MIT.

The report, published in the March 30 online issue of Nature Materials, sheds light on a phenomenon many people have experienced, which the researchers dubbed "the wallpaper problem."

"You want to redecorate your bedroom, so you yank down the wallpaper. You wish that the flap would tear all the way down to the floor, but it comes together in a triangle and you have to start all over again," said Pedro Reis, one of the authors of the paper and an applied mathematics instructor at MIT.

This pattern, where two cracks propagate toward each

▶Please see TEAR, **PAGE 4**

$500K helps MIT walk the talk on energy conservation

Institute retrofitting buildings with green technology

Deborah Halber
News Office Correspondent

Office lights that turn themselves off when no one is around and lab bench fans that shut down when you walk away are two of a series of new campus energy conservation projects that will help MIT reduce its carbon footprint.

With the help of $500,000 in seed funding from the office of Executive Vice President Theresa M. Stone, the Department of Finance and the Department of Facilities, select MIT buildings will undergo a variety of basic improvements in the next few months. The funding is a modest but significant step in initiating energy conservation measures Institute-wide on a grand scale, said Stone, who is also co-chair of the MIT Energy Initiative (MITEI) Campus Energy Task Force.

Pilot projects include retrofitting light bulbs and fixtures, adding and adjusting motion sensors, monitoring buildings to gauge energy use and automating fume hood controls.

Students in a recent MIT-Sloan School of Management course partnered with the Department of Facilities to identify an additional $14 million of potential investments with a three-year return. These include a major revamping of the heating system in Building 13 to include heat recovery; continuous building commissioning that assesses and optimizes building energy systems in real time; and strategic maintenance

▶Please see RETROFIT, **PAGE 3**

Researchers achieve dramatic increase in thermoelectric efficiency

Researchers at Boston College and MIT have used nanotechnology to achieve a major increase in thermoelectric efficiency, a milestone that paves the way for a new generation of products—from semiconductors and air conditioners to car exhaust systems and solar power technology—that run cleaner.

The team's low-cost approach, details of which were published last week in the online version of the journal Science, involves building tiny alloy nanostructures that can serve as microcoolers and power generators. The researchers said that in addition to being inexpensive, their method will likely result in practical, near-term enhancements to make products consume less energy or capture energy that would otherwise be wasted.

The findings represent a key milestone in the quest to harness the thermoelectric effect, which has both enticed and frustrated scientists since its discovery in the early 19th century. The effect refers to certain materials that can convert heat into electricity and vice versa. But there has been a hitch in trying to exploit the effect: Most materials that conduct electricity also conduct heat, so their temperature equalizes quickly. In order to improve efficiency, scientists have sought materials that will conduct electricity but not similarly conduct heat.

▶Please see EFFICIENCY, **PAGE 7**

PHOTO COURTESY / **SCIENCE/AAAS**

This simple closed-circuit module was used by Boston College and MIT researchers to confirm how a re-engineered semiconductor alloy, in bulk form, achieved a significant improvement in performance.

AWARDS & HONORS

An MIT team, under the leadership of Boeing Assistant Professor of Aeronautics and Astronautics **Nicholas Roy**, tied for first place in the First U.S.-Asian Demonstration and Assessment of Micro-Aerial and Unmanned Ground Vehicle Technology Conference, held March 10-15 in Agra, India. The MIT team was also awarded Best Rotorcraft and was recognized for special achievement by the U.S. Army Aviation and Missile Research, Development and Engineering Center.

MIT team members were aero-astro graduate student **Ruijie He**, EECS graduate student **Abraham Bachrach** and project scientist Sam Prentice. All team members are also part of the Computer Science and Artificial Intelligence Laboratory. The demonstration involved a competition among 12 teams in a hostage-rescue scenario. The objective of the competition was to deploy a micro air vehicle (smaller than 30 centimeters) over a distance of 1 kilometer, identify the presence of hostages and coordinate with ground vehicles in recovering the hostages. MIT's entry, developed in collaboration with Ascending Technologies GmbH in Germany, used a six-rotor, 30 centimeter helicopter to demonstrate autonomous navigation, intelligent machine planning and adaptive image processing at various stages of the mission. The team was awarded first place in a tie with University of Arizona and ENAC/Martin-Mueller Engineering.

PHOTO / **NICK ROY**

(Front row, from left) aero-astro graduate student Ruijie He; project scientist Sam Prentice; EECS grad student Abraham Bachrach; (back row, from left) aero-astro Professor Nicholas Roy and Ascending Technologies (Germany) partners Michael Achtelik, Jan Stumpf and Daniel Gurdan.

MIT Institute Professor **Sheila Widnall** will receive three honorary degrees this spring. Between May and June, the University of Oxford in England, Claremont Graduate University in California and Northwestern University in Illinois will present her with honorary doctor of science degrees. Widnall '61, SM '61, SCD '64, was MIT's first woman professor of engineering. Between 1993 and 1997, she was secretary of the U.S. Air Force.

Two MIT faculty have been awarded Office of Naval Research Young Investigator Awards: **Michael Strano**, the Charles (1951) and Hilda Roddey Career Development Associate Professor of Chemical Engineering, for his proposal, "Short Wavelength Optical Modulators for Undersea Communications via Franz-Keldysh Oscillations in Electronically Sorted Single Walled Carbon Nanotubes," and **Markus Buehler**, the Esther and Harold E. Edgerton Assistant Professor of Civil and Environmental Engineering, for "Hierarchical Nanomechanics of Amyloid Protein Fibers."

Buehler also received a grant through the Air Force's Young Investigator Research program to investigate structural hierarchies in biomimetic materials. Other MIT faculty receiving this award are **Aslan Kasimov**, an instructor in applied mathematics, who will investigate accurate numerical simulation and analysis of multidimensional shock and detonation waves; and **Lizhong Zheng**, KDD Career Development Associate Professor in Communications and Technology, who will study dynamic wireless networks based on open physical media.

In addition, Buehler received the DARPA Young Faculty Award for University Microsystems Research, as did Assistant Professor **Tomas Palacios** of EECS and Assistant Professor **Evelyn Wang** of mechanical engineering.

OBITUARIES

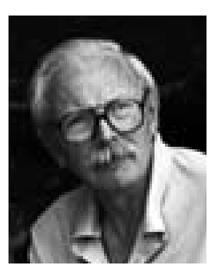
William L. Kraushaar, high-energy astronomy pioneer, 88

Professor William L. Kraushaar, a former MIT physics professor and a pioneer in the field of high-energy astronomy, died March 21 of complications from Parkinson's disease. He was 88.

Kraushaar received his bachelor's degree from Lafayette College in 1942. During World War II he worked at the National Bureau of Standards on projects that included development of the proximity fuse for artillery shells. After the war he earned his doctorate at Cornell University. In 1949, he was appointed research associate at MIT where he made the first measurements of the mean life of the pi meson at the MIT electron synchrotron. Over the next 15 years he rose through the faculty ranks, becoming a full professor before leaving MIT for the University of Wisconsin-Madison in 1965.

In 1957, Kraushaar began a decade-long effort to map the sky in the "light" of cosmic gamma rays. Their detection promised to open new ways to investigate high-energy processes in the universe. Initial balloon-borne experiments failed due to background gamma rays generated in the residual atmosphere above the highest attainable altitudes.

In 1958, Kraushaar seized the new opportunity for experiments above the atmosphere. Working with George Clark, he directed the development in the MIT Laboratory for Nuclear Science of a gamma-ray detector for a satellite experiment that was launched in April 1961 as Explorer 11. It registered 31 events with the electronic signatures of cosmic gamma rays with energies greater than 50 MeV. Kraushaar then initiated a second and more refined experiment to be carried on OSO 3. In this project, Kraushaar and Clark were joined by Gordon Garmire, a former student of Kraushaar. The OSO 3 experiment, launched in March of 1967, registered 621 cosmic gamma ray events. It yielded the first all-sky map of high-energy cosmic gamma rays showing a concentration of gamma rays from directions in the Milky Way where gamma-ray producing interactions of charged cosmic rays with interstellar matter are most abundant. It also demonstrated the existence of extra-galactic gamma ray sources that have since been identified as giant black holes at the centers of distant galaxies. The OSO 3 experiment opened the field of high-energy gamma-ray astronomy, which has become one of the most active areas of space research.



William Kraushaar

Upon his move to Wisconsin, Kraushaar established a research group in the new area of X-ray astronomy. Using instruments flown on "sounding" rockets, he and his colleagues produced the first all-sky map of low-energy X-rays that revealed the spatial distribution of million-degree interstellar gas. They extended these results in several satellite experiments. Kraushaar was appointed the Max Mason Professor of Physics in 1980.

Kraushaar was a fellow of the American Physical Society, and a member of the American Astronomical Society, the International Astronomical Union, the National Academy of Sciences, and the American Academy of Arts and Sciences. He received Fulbright and Guggenheim fellowships and the Senior Scientist Award of the Humboldt Foundation. He served on numerous advisory committees of the National Academy of Sciences and NASA. He co-authored with Professor Uno Ingard a college text, "Introduction to Mechanics, Matter, and Waves."

After his retirement, Kraushaar moved to Maine, where he resided in Scarborough with summers at his cabin in Denmark, Maine. He is survived by his wife, the former Elizabeth Rodgers, and by three children from his first marriage.

Albert Hollander Sr., research engineer, 95

Albert Alfred Hollander Sr., who spent more than three decades as an engineer in the MIT Instrumentation Laboratory, died Friday, Feb. 7, at the South Shore Hospital. He was 95.

Hollander was a well-known and accomplished research engineer, inventor and sportsman. He graduated from Mechanics Arts High School in Boston and the Lowell Institute School at MIT. He went on to work in the Instrumentation Laboratory, later the Charles Stark Draper Laboratory, from 1940 to 1974. He was involved at the onset of the Gyroscopic Inertial Guidance System for detecting weapons and controlling flight vehicles, and he was instrumental in the invention of the Mark XIV Gunsite used to defend Naval vessels. In 1960, he worked on the development of the Inertial Guidance System for the Apollo lunar landing, and worked on the MX Peacekeeper Guidance System and the IBM Trident Missile Guidance System.

Hollander was an avid sportsman and fisherman, and enjoyed boating and bass fishing especially at Popponessett Bay on Cape Cod. He invented a fishing reel device for backlash prevention called "A-Square" in 1949 that was sold all over the world to fishermen.

Hollander was born in Boston to Finnish parents and was very proud of his ancestry. He had lived in Weymouth since 1938 and was a summer resident of Popponessett Island in Mashpee and wintered in Stuart, Fla.

Hollander is survived by three children, six grandchildren and seven great-grandchildren. His wife, Lillian, died in 2002; three grandchildren predeceased him.

A funeral service was held in February; memorial donations may be sent to the Salvation Army, 6 Baxter St., Quincy, MA 02169.

Two MIT student projects win peace grants

Awarded $10K Davis prizes

Sarah H. Wright
News Office

Two MIT student projects to promote peace in Sudan and in Bangladesh have won Davis Projects for Peace grants of $10,000 each.

The Davis Projects for Peace, now in its second year, awards funding for grass-roots projects designed by undergraduates. This year, the program funded projects from 81 schools and universities. MIT was one of 20 schools in which two projects were funded.

Zahir Dossa

"I am very proud that our students' projects stood out in the Davis committee process," said Matthew McGann, associate director of admissions.

The MIT projects, which will be implemented this summer, focused on the link between economic and educational development and peace.

Mustafa Dafalla, a junior, and Zahir Dossa, a senior, designed Selsabila, the Sudan project, as a self-sustaining NGO that will sell and distribute treadle irrigation pumps to low-income farmers who often rely on buckets to water their crops. Dafalla and Dossa propose to use the Davis funds to purchase Selsabila's first pumps.

Shammi Quddus

"Winning the Davis prize is a great privilege and honor; it affirms our message of sustainable development through the creation of social enterprises," Dossa said.

Sophomore Shammi S. Quddus' project, "Building Bridges through Leadership Training, Chittagong, Bangladesh," proposes to unite high school students from three separate schooling systems in activities to help them discern their common interests and work toward common goals. Quddus visited City Year headquarters in Boston to gain insight on how best to work with high school students.

Quddus will use the Davis funds to pay for printing brochures and applications as part of recruitment for Building Bridges, she said.

For more information on Selsabila, please go to: http://web.mit.edu/newsoffice/2008/itw-sudan-0123.html

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MIT makes strong showing in Putnam math competition

Anne Trafton
News Office

MIT's math team made a strong showing at the William Lowell Putnam intercollegiate mathematics competition, finishing in third place.

Nearly 3,800 students from across the country took the six-hour mathematics exam, and two MIT math majors finished in the top six: sophomore Qingchun Ren and junior Xuancheng Shao.

Those students earned recognition as Putnam fellows and will each receive $2,500.

Overall, 21 MIT students finished in the top 74, earning honorable mentions.

"The spectacular results on the Putnam competition are just further evidence for what we already know: MIT students are fantastic," said Michael Sipser, head of the math department. "We are proud of them."

The annual 12-question test, first administered in 1938, is given on the first Saturday in December. There are two three-hour sections, one in the morning and one in the afternoon.

The questions require students to be creative in applying their knowledge of basic calculus and algebra. The test is extremely difficult—out of a possible 120 points, the median score this year was 2. The highest score was 110.

Before the exam, each participating school chooses three of its participating students to form a team whose combined scores determine the overall school winner. MIT's team members this year were junior math major Hansheng Diao, senior electrical engineering and computer science major Eric Price and sophomore math major Yufei Zhao.

Zhao finished in the top 16, and Diao and Price each earned honorable mentions.

The team's third-place finish earned $15,000 for the MIT math department, and each team member received $600. Harvard's team took first place in the competition, with Princeton second.

Other MIT students in the top 16 were senior math majors Oleg Golberg and Yuncheng Lin. Senior math majors Anand Deopurkar and Anders Kaseorg finished in the top 24.

The team was coached by Professor Hartley Rogers; Richard Stanley, the Norman Levinson Professor of Applied Mathematics; and Associate Professor Kiran Kedlaya.

"I'm deeply grateful to professors Hartley Rogers and Richard Stanley, who have helped prepare our Putnam contenders for many years, and to Associate Professor Kiran Kedlaya who has recently joined them in ably coaching our students," Sipser said.

PHOTO COURTESY OF JERUSALEM 2050

Participants in a Baqaa filming workshop from 'Envisioning Jerusalem through Media Barrios and Performance Spaces,' one of the top prize winners in the recent 'Just Jerusalem' contest sponsored by the Jerusalem 2050 Program at MIT. For more information on the contest, and a full list of winners, visit the News Office web site at http://web.mit.edu/newsoffice.

MIT launches global network of supply chain centers

MIT's Center for Transportation and Logistics (MIT-CTL) last week announced the creation of the MIT Global SCALE Network, an international alliance of leading research and education centers dedicated to the development of supply chain and logistics excellence through innovation.

The Global SCALE (Supply Chain and Logistics Excellence) Network spans North America, Latin America and Europe, with plans to expand into Asia and Africa. The network currently includes the MIT Center for Transportation & Logistics (MIT-CTL) in Cambridge, Mass.; the Zaragoza Logistics Center in Zaragoza, Spain; and the Center for Latin-American Logistics Innovation in Bogotá, Colombia.

The network will allow faculty, researchers, students and affiliated companies from all three centers to pool their expertise and collaborate on projects that will create supply chain and logistics innovations with global applications and help companies to compete in an increasingly complex business environment.

"Today's supply chains stretch around the world and back again, requiring successful organizations to have an on-the-ground understanding of the logistics, supply chain and general business challenges and opportunities in every region," said MIT-CTL Director Yossi Sheffi, a professor of engineering systems at MIT and director of the Engineering Systems Division. "The Global SCALE Network will provide that global context through research projects that will literally be taking place around the world."

RETROFIT: $500K helps MIT walk the talk on energy conservation

Continued from Page 1

to improve energy efficiency in existing ventilation systems, among others.

"Identifying these strategic investments in energy conservation and the cost-benefit analysis was a year-long collaborative effort among the Department of Facilities, faculty, students and the administration," Stone said. "This is tangible evidence of MIT walking the talk on a huge campus issue that everyone feels passionately about."

While MITEI has helped focus attention on energy issues, "MIT has over the years had a high sensitivity to energy efficiency—the cogeneration plant [a 10-year, $40 million project in which MIT generates its own electrical and thermal power] is an example of that," Stone said. "This program identified a portfolio of very basic improvements that would result in substantial energy cost paybacks. If we execute everything outlined in the portfolio, the savings would equal 9 percent of the energy commodities budget here."

The analysis came out of Sloan's innovative new Laboratory for Sustainable Business (S-Lab), taught most recently in spring 2007. Students from Sloan and other MIT departments explored real-world sustainability challenges with clients such as Nike, Disney, the World Bank, start-ups and nonprofits, said S-Lab co-creator John Sterman, the Jay W. Forrester Professor of Management and director of the MIT System Dynamics Group.

One of the S-Lab "clients" was MIT. With the help of MIT Facilities, students conducted an in-depth analysis of campus energy conservation opportunities and "identified $14 million in investments that MIT could make today that would not only significantly reduce energy use but also have a positive economic return," Sterman said.

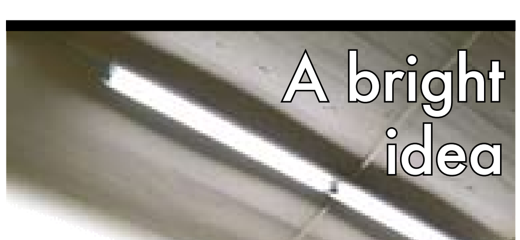
The $500,000 funding is "the first tranche of a new portfolio approach to energy conservation investments based on long-term financial cost-benefit analysis, greenhouse gas emission impact, and scaleable pilot projects," said Steven M. Lanou, deputy director of environmental sustainability at MIT.

According to Walter E. Henry, director of the Department of Facilities' Systems Engineering Group, "Rather than funding individual projects here or there or waiting for problems to pop up, this is a more comprehensive approach. With a campus-wide program, we know what we expect things to cost and what we can expect to save."

A previous campus-wide effort to upgrade steam traps—devices that regulate gas discharge in steam heating systems—cost $1.1 million and resulted in more than $3 million in savings. "The highest payoffs come from things as basic as replacing broken steam traps, cleaning heat exchanger coils and caulking windows," Sterman said.

"This is just a start," Stone said. "We're currently identifying related steps that will keep chipping away to reduce our carbon footprint and energy expenditures on campus."

Glicksman, professor of building technology and mechanical engineering and co-chair of the MITEI Campus Energy Task Force, said the goal of the energy fund program is to make MIT an example for other large organizations.



The $500,000 first round of investments includes the following modifications on campus:

- Retrofitting outdated, inefficient fluorescent light fixtures with new ballasts; replacing bulbs with energy-efficient models; implementing lighting systems designed by students during an Independent Activities Period class; installing and adjusting occupancy sensors that shut off lights in a room where there is no activity for 20 minutes.
- Using remote monitoring systems developed by a Boston company to analyze the function of automatic temperature control systems. Such systems installed in E25, the chemistry building, and the Zesiger Center uncovered incorrectly set controls and a hidden collapsed bulkhead, which, when fixed, saved hundreds of thousands of dollars in energy costs.
- Automated fume hood sash controls that sense the presence or absence of a person in front of a laboratory bench air-circulating hood and open or close its sashes accordingly. Monitoring and reporting fume hood energy use to researchers have prompted them to close hoods more consistently when not in use, and retrofitting hoods to operate at lower, yet safe, fan speeds has resulted in savings.
- Changing to a new type of central heating and cooling filter and cleaning dust-laden fan coils resulted in significant improvements in a campus-wide pilot program.

Dower to deliver Killian Award lecture

John Dower, Ford International Professor of History, will deliver the 36th annual Killian Award lecture at 4:30 p.m. Monday, April 7, in Kirsch Auditorium.

Winner of the 2007-2008 James R. Killian Jr. Faculty Achievement Award, Dower will speak on "Cultures of War: Pearl Harbor/ Hiroshima/9-11/Iraq."

Dower is renowned for his expertise in modern Japanese history and U.S.-Japan relations. His book, "Embracing Defeat: Japan in the Wake of World War II," won the 2000 Pulitzer Prize for general nonfiction and the 1999 National Book Award for nonfiction, among many other awards.

Dower's MIT courses include the innovative "Visualizing Cultures," co-taught with Professor Shigeru Miyagawa of foreign languages and literature. Using web technology, they apply visual materials and other expressions of popular culture to the study of Japanese and U.S.-Asian history.

Established in 1971 as a tribute to MIT's 10th president, the Killian Award recognizes extraordinary professional accomplishment by an MIT faculty member. The winner delivers a lecture in the spring term.

Gathering 'concrete' evidence

MIT class explores controversial pyramid theory with scale model

David Chandler
News Office

PHOTOS / **DONNA COVENEY**

ABOVE: From left, MIT freshman Daniel Sauza, sophomore Stephanie Brown and seniors Ceryen Tan and Joyce Chen (in mask) work with materials science and nuclear engineering professor Linn Hobbs to cover limestone blocks with mortar as they build up their pyramid on the sixth floor of Building 16.
BELOW: Stephanie Brown feeds limestone chunks into a machine to pulverize it into a form the class can later turn into concrete.

Even though they are among the best-known structures on Earth, the pyramids of Egypt may still hold surprises. This spring, an MIT class is testing a controversial theory that some of the giant blocks that make up the great pyramids of Giza may have been cast in place from concrete, rather than quarried and moved into position.

In order to help identify blocks that were cast rather than quarried, students in the class, Materials in Human Experience (class 3.094), are assembling a small pyramid using a combination of both kinds of material. They will then use techniques such as microscopic imagery and chemical analysis to look for signs that might provide ways of telling the difference on samples from the Great Pyramid itself.

While many people think of concrete as a recent material, in fact the Romans used a version made from volcanic ash and lime extensively for most of their famous buildings, including the Pantheon. But although the idea that the Egyptians may have used a kind of concrete in building the pyramids was first suggested in the 1930s, with a specific material that could have been used proposed in 1988, so far there has been no proof and the idea has remained mired in controversy.

In fact, the very idea has been so controversial that "you can't get research funding, and it's difficult to get a paper through peer review," says Linn Hobbs, professor of materials science and engineering and professor of nuclear science and engineering at MIT and coteacher of the pyramid-building class.

Hobbs says that actually building a small-scale model of the pyramid using the materials and methods the Egyptians may have used is far more than just an educational exercise for the students. "Like any other investigation of ancient technologies, you can only get so far by speculating, and even only so far by looking at evidence. To go the rest of the way, you have to do the thing yourself. You have to get acquainted with the materials."

The materials and know-how needed to cast the pyramids' giant 2-1/2 ton blocks in place, rather than quarrying and moving blocks of solid limestone, was definitely available to the Egyptians, Hobbs explains. At least 90 percent of the material would have consisted of powdered limestone, and Egyptian limestone is especially fragile and can easily be reduced to finely divided sludge simply by soaking it in water. The rest—the binder or cement—could have been made from materials they were known to have had and used for other purposes.

The binder, known as a geopolymer, could have been made from lime, kaolinite (a kind of clay), a fine silica (such as diatomaceous earth) and natron (sodium carbonate). The same ingredients were used by the Egyptians to make self-glazing pottery ornaments, a material called Egyptian faience, and well known to archeologists. When fired at high temperature, the material produces a rich blue glaze on the surface. But if left for days or weeks at room temperature, it self-cures into a rock-hard material that could have provided a binder for cementing the disaggregated limestone together into cast blocks.

Hobbs suggests that some ancient craftsman may have inadvertently left some faience material unfired, and discovered by accident the hard material that resulted. In building pyramids, especially the higher layers as the structure grew, casting blocks in place would have been a far easier task than carving them to precise sizes and shapes and then moving them up long earthen ramps into their final positions — a process that has never been described or pictured in any of the vast number of Egyptian texts and murals that have been found.

While wet, the consistency of the material is quite different from modern Portland cement, Hobbs says. "It's like something between mortar and Jell-O. When you try to pack it, it kind of ripples," he says. "It's rather like Silly Putty."

But the unusual material has a significant advantage: It doesn't shrink when it sets. "With most cements, you worry about shrinkage," Hobbs says, but not with this kind.

> ❞ *This is not a cookbook class.*
>
> **Linn Hobbs, professor**

The class has been experimenting with different proportions and variations in ingredients for the geopolymer, to see which produces the strongest, most durable and limestone-like results. "This is not a cookbook class," Hobbs explains—he and the students are figuring things out as they go along.

Hobbs is not pushing the cast-block theory, which was first advanced by French materials chemist Joseph Davidovits, who invented (or perhaps reinvented) the geopolymer formula. Hobbs calls himself an agnostic on the matter, but thinks that it is a theory that deserves serious study and investigation.

"My own take is, they probably did both—cut some and cast some," he says.

"It's not science unless we formulate hypotheses that can be proved or disproved," he says. He hopes the class will produce a scientific paper detailing how the question could be resolved more definitively through microscopic and microchemical analysis. "It's good that the students can see a real scientific controversy being addressed in productive ways."

TEAR: MIT researcher and colleagues tear away at the mystery of the 'wallpaper problem'

Continued from **Page 1**

other and meet at a point, is extremely robust. It applies not only to wallpaper but to other adhesives such as tape, as well as nonadhesive plastic sheets such as the shrink-wrap that envelops compact discs. It even extends to fruit: The skin on a tomato or a grape typically forms a triangle when peeled off.

"This has happened to everyone. It's frustrating," said Reis, who collaborated with Enrique Cerda and Eugenio Hamm of the Universidad de Santiago, Benoit Roman of CNRS and Michael LeBlanc of the University of Chicago.

Pedro Reis

The team found that those ubiquitous triangular tears arise from interactions between three inherent properties of adhesive materials: elasticity (stiffness), adhesive energy (how strongly the adhesive sticks to a surface) and fracture energy (how tough it is to rip).

The researchers developed a formulation that predicts the angle of the triangle formed, based on those three properties.

They also figured out just how those triangular tears arise. As the strip is pulled, energy builds up in the fold that forms where the tape is peeling from the surface. The tape can release that energy in two ways: by unpeeling from its surface and by becoming narrower, both of which it does.

In a possible industrial application, materials engineers could use this method to calculate one of the three key properties, if the other two are known. This could be particularly useful in microtechnologies such as stretchable electronics, where the characterization of thin material properties is very difficult.

Reis, who now works in MIT's Applied Mathematics Laboratory, and his collaborators at CNRS and Universidad de Santiago got the idea for the project after noticing consistent tearing patterns in plastic sheets such as the plastic wrapping of CDs.

The researchers tried controlled experimental versions of the same process in their lab and got the same results. "This shape is really robust, so there must be something fundamental going on that gives rise to these shapes," Reis said.

However, the shapes formed by tearing nonadhesive sheets proved difficult to study because they are not perfect triangles, and without adhesion, the physics of the problem is more complicated. Instead, the researchers turned their attention to adhesives, which do form perfect triangles when torn.

The triangular shapes can also be seen in the work of French artist Jacques Villeglé. His art consists of posters taken from the streets of Paris and other French cities, complete with the same sort of rips that the researchers studied. One of the posters may be featured on the cover of Nature Materials to illustrate the team's paper.

Torn posters, tape and tomato skins may seem like strange research topics for physicists and applied mathematicians, but it's perfectly normal to Reis and his colleagues, who draw inspiration from an array of everyday objects.

Such real-world applications are not only fun to study, but "we can really learn things that will be useful for industry and help us understand the everyday world around us. It is also a great way to motivate students to be interested in science," Reis said.

The research was funded by FONDAP, CIMAT, France's Ministry of Research and MechPlant.

Catching planets in the making

Team sees first signs of formation's middle stages

David Chandler
News Office

For many years, astronomers have had a clear, though ever-evolving, picture of how planets are born. It starts with a disk of dust swirling around a newborn star, and then gradually the dust particles stick together to form ever-larger pieces—grains, pebbles, boulders, protoplanets and ultimately planets.

Though the theory was clear, the only parts that could actually be observed in the real cosmos were the very beginning and end—disks of dust that have yet to form planets, and fully formed planets. Many examples of both have been found over the last decade or two. But until now, nobody had been able to detect any of the intermediates.

That changed this March, when a team of astronomers including MIT's Joshua Winn reported the first observations of a disk of this mid-sized material around a star—a swarm of stuff that has already progressed from dust grains up to particles the size of a grain of sand.

But it took a real oddball of a star—or rather, pair of stars—to provide the exceptional conditions that made this detection possible.

Dust-sized material can be detected around distant stars because it gets warmed up by the star's light and emits infrared light, also known as thermal radiation, that can be detected by telescopes. Large planets, on the other hand, have enough gravitational pull to produce wobbles in the motions of the stars they orbit, and these wobbles can be detected by measuring the doppler shifts in a star's spectrum caused by its back-and-forth motion—the same principle used by a police radar gun to measure a car's speed.

But there's no such indicator for the in-between matter. "When it comes to sand or boulders, they don't emit light directly, and they don't produce wobbles," explains Winn, assistant professor of physics in MIT's Kavli Institute for Space Science and Astrophysics. "So these in-between stages are still just theoretical."

The team's new findings may have changed all that. The discovery of clear signs of sand-sized grains came as a complete surprise to the researchers, Winn says, as they studied a star called KH 15D, whose behavior had seemed just downright weird.

Like an ordinary variable star of a type called eclipsing binaries, it seemed to go through regular, periodic dimming, but these dark spells lasted for much longer and were much darker than could be explained by one star blocking another. The star's odd behavior was first documented in 1995 by William Herbst, an astronomer at Wesleyan University, and his graduate student Kristin Kearns. Later, observers noticed that the dark periods were getting longer and longer, and soon astronomers figured out that the dimming seemed to be caused by an unusually oriented disk of material surrounding a pair of stars.

Like a windowshade drawn to block the light, the disk was blocking the view of the stars. But as they circled each other on long elliptical orbits, one of the stars would periodically get far enough to the side to peek out from behind the shade, allowing its light to be seen. And the angle was slowly changing, obscuring the star for longer and longer periods.

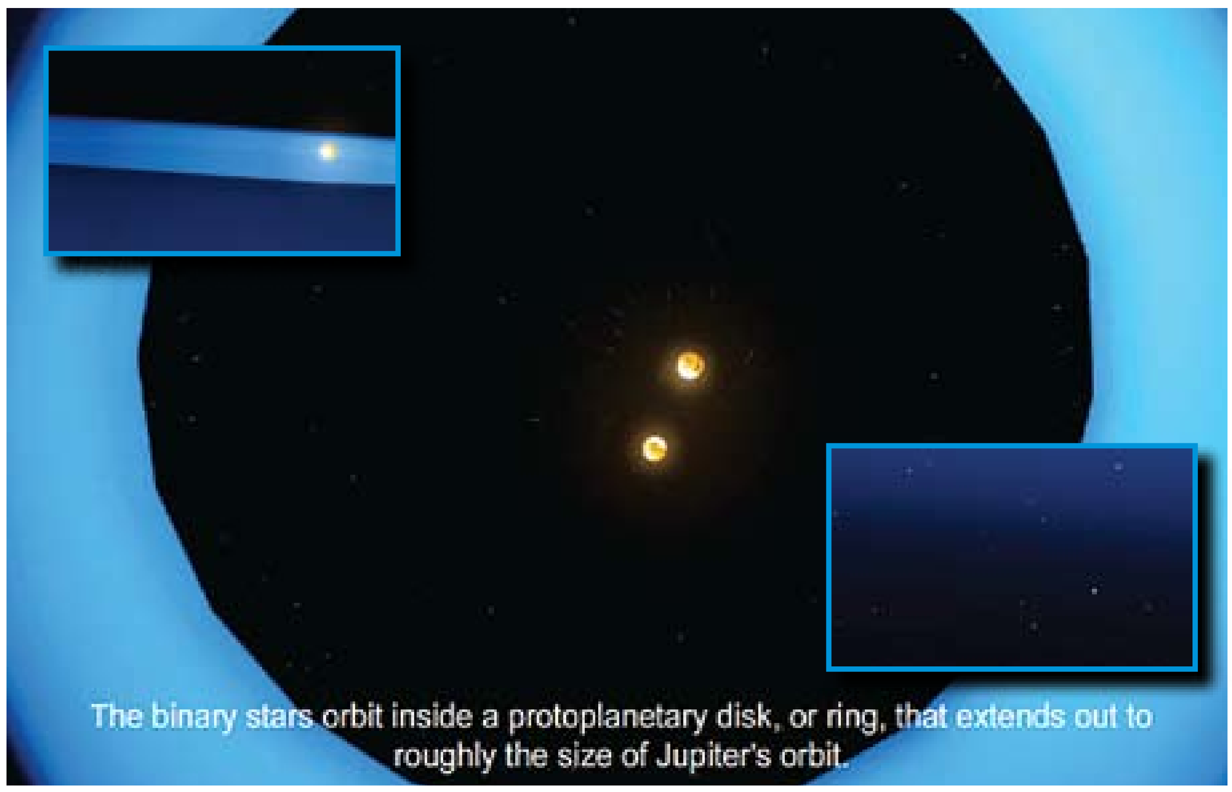
That solved the mystery of this oddball star's on-and-off appearance, but the star had another surprise in store. Using the powerful Magellan telescope in Chile, a joint venture in which MIT is a partner, they noticed that when the star went dark it didn't disappear completely: There was still a bit of light there.

Analysis of the spectrum showed a revealing clue: Like most stars, light, as seen from Earth, was shifted toward the red end of the spectrum, showing that it was moving away from us. During the dark spells, the opposite happened—the light shifted toward the blue, indicating it was coming toward us, at exactly the same speed it had been retreating.

The team soon figured out what this enigmatic shift meant. While the starlight was blocked by one part of the disk, the other side of the disk—the part farther away from us—was catching the star's rays and reflecting them back toward us, like a huge mirror. As the star sped away from us, its mirror reflection appeared to be coming toward us.

The light was not reddened, as it would be by dust particles, so the team calculated that in order to reflect the star's light in this way, without changing its color, the disk had to be made of particles that are about 1 millimeter across—the size of a typical grain of sand.

"We don't know for sure" if the grains will indeed go on to form planets in this particular oddball stellar system, Winn says. "But it seems reasonable that the material is representative of the material that could have existed around our sun" as the planets began to form. And eventually, Winn says, "we ought to be able to tell what it's made of."



IMAGES COURTESY OF WESLEYAN UNIVERSITY

The unusual geometry of this star system made it possible for researchers to discover the first evidence of the middle stages of planet formation. Inset left, one star rises above the obscuring disk of matter, and its light becomes visible. Center, as seen from above, the two stars are in center of a large disk of sand-sized grains. Inset right, when the stars' light is obscured, except for a faint reflection from the disk's far side.

Gene's 'selective signature' helps scientists identify instances of natural selection in microbial evolution

Denise Brehm
Civil & Environmental Engineering

Microbes, the oldest and most numerous creatures on Earth, have a rich genomic history that offers clues to changes in the environment that have occurred over hundreds of millions of years.

While scientists are becoming increasingly aware of the many important environmental roles played by microbes living today—they process the food in our intestines, they keep carbon moving through the ocean food web, they can be harnessed to process sewage and build specific proteins—they still know little about these tiny critters, particularly marine microbes, which generally are classified into species based on their ecological niche. For instance, two species of marine microbe might look very similar physically, but one may have adapted to life in a particularly dark part of the ocean, while its sister species may have adapted to feeding off a nutrient that is rare in most parts of the ocean, but exists in abundance in one small area.

Scientists at MIT who are trying to understand existing microbes by studying their genetic history recently created a new approach to the study of microbial genomes that may hasten our collective understanding of microbial evolution.

The researchers have reversed the usual order of inquiry, which is to study an organism, then try to identify which proteins and genes are involved in a particular function. Instead, they have come up with a simple mathematical formula that makes it possible to analyze a gene family (a single type of gene or protein that exists in many creatures) simultaneously in a group of ecologically distinct species.

This means that we can begin to identify occurrences of natural selection in an organism's evolution simply by looking at its genome and comparing it with many others at once. This would allow them to take advantage of the nearly 2,500 microbes whose genomes have already been sequenced.

The new method determines the "selective signature" of a gene, that is, the pattern of fast or slow evolution of that gene across a group of species, and uses that signature to infer gene function or to map changes to shifts in an organism's environment.

"By comparing across species, we looked for changes in genes that reflect natural selection and then asked, 'How does this gene relate to the ecology of the species it occurs in?'" said Eric Alm, the Doherty Assistant Professor of Ocean Utilization in the Departments of Civil and Environmental Engineering and Biological Engineering. Natural selection occurs when a random genetic mutation helps an organism survive and becomes fixed in the population. "The selective signature method also allows us to focus on a single species and better understand the selective pressures on it," said Alm.

> *These are experiments we could never perform in a lab.*
>
> **Eric Alm**

"Our hope is that other researchers will take this tool and apply it to sets of related species with fully sequenced genomes to understand the genetic basis of that ecological divergence," said graduate student B. Jesse Shapiro, who coauthored with Alm a paper published in the February issue of PLoS Genetics.

Their work also suggests that evolution occurs on functional modules—genes that may not sit together on the genome, but that encode proteins that perform similar functions.

"When we see similar results across all the genes in a pathway, it suggests the genomic landscape may be organized into functional modules even at the level of natural selection," said Alm. "If that's true, it may be easier than expected to understand the complex evolutionary pressures on a cell."

For example, in Idiomarina loihiensis, a marine bacterium that has adapted to life near sulfurous hydrothermal vents in the ocean floor, the genes involved in metabolizing sugar and the amino acid phenylalanine underwent significant changes (over hundreds of millions of years) that may help the bacterium obtain carbon from amino acids rather than from sugars, a necessity for life in that ecological niche. In one of I. loihiensis' sister species, Colwellia psychrerythraea, some of those same genes have been lost altogether, an indication that sugar metabolism is no longer important for Colwellia.

Shapiro and Alm focused on 744 protein families among 30 species of gamma-proteobacteria that shared a common ancestor roughly one to two billion years ago. These bacteria include the laboratory model organism E. coli, as well as intracellular parasites of aphids, pathogens like the bacteria that cause cholera, and soil and plant bacteria. They mapped the evolutionary distance of each species from the ancestor and incorporated information about the gene family (for instance, important proteins evolve more slowly than less-vital ones) and the normal rate of evolution in a particular species' genome in order to determine a gene's selective signature.

"These are experiments we could never perform in a lab," said Alm. "But Mother Nature has put genes into an environment and run an evolutionary experiment over billions of years. What we're doing is mining that data to see if genes that perform a similar function, say motility, evolve at the same rate in different species. To the extent that they differ, it helps us to understand how change in core genes drives functional divergence between species across the tree of life."

This work is part of the Virtual Institute for Microbial Stress and Survival. The research was also supported by additional grants from the U.S. Department of Energy Genomics: GTL Program, the National Institutes of Health, and a scholarship from the Natural Sciences and Engineering Research Council of Canada.

Schmill named new dean of admissions

Stuart Schmill '86 has been named MIT's next dean of admissions, Dean for Undergraduate Education Daniel Hastings announced last week.

Schmill has been serving as MIT's interim director of admissions since last April, and Hastings said he has done a "remarkable job" in that capacity.

"Under his committed leadership, the office successfully completed the 2007-2008 admissions cycle—a cycle that saw a record number of applicants and which we have every reason to believe will yield a diverse and talented class," Hastings said.

Hastings commended the search committee, chaired by Professor and MIT President Emeritus Paul Gray, for its work in picking Schmill.

Schmill said he was "deeply honored" to be given the chance to lead the office on a permanent basis.

"I appreciate the confidence that Dan Hastings, Paul Gray and the rest of the administration have in me," he told the MIT News Office. "MIT is a very special place and the students who come here bring vibrancy and energy with them, and I respect the importance of the role the admissions office plays in bringing these outstanding students to campus.

"I also want to say what an outstanding admissions staff we have and what a pleasure it's been to work with them in this role," he added. "I'm humbled to be able to lead this group going forward."

Schmill has served in several committed leadership roles during his 20 years at MIT, including as senior associate director of admissions and director of the Educational Council. Prior to working in admissions, Schmill worked in the Alumni Office, where he served most recently as director of Parent, Student and Young Alumni Programs.

A native of Little Neck, N.Y., Schmill received his SB from MIT in mechanical engineering in 1986.

PHOTO / **DONNA COVENEY**

Dean of Admissions Stuart Schmill

Engineering again tops U.S. News graduate rankings

MIT's School of Engineering was again ranked No. 1 nationwide in U.S. News & World Report's annual evaluation of American graduate school programs, released online Friday and available at newsstands Monday, March 31.

The School of Engineering's graduate program has achieved the top score in the U.S. News rankings each year since 1994, the earliest date for which the Office of the Provost's Institutional Research team has records.

In addition to having the top U.S. graduate engineering school, MIT placed first in six of 10 engineering specialties—aeronautics and astronautics, chemical, computer, electrical, materials and mechanical engineering. The Institute's nuclear engineering program was ranked second, civil engineering fourth, biomedical engineering sixth and environmental engineering 10th.

The magazine's criteria for determining overall engineering rankings include peer assessment, recruiter assessment, research activity, faculty resources and student selectivity.

In business, MIT's Sloan School of Management was rated the nation's fourth MBA program—a position it has held for the past seven years. This year, Sloan shared the fourth-place spot with Northwestern's Kellogg School of Management.

Sloan's specialty programs in information systems, production/operations and supply chain/logistics were each ranked first.

The magazine this year updated its rankings of several doctoral programs, and MIT earned top honors for its computer science and physics specialties. The Institute's graduate program in mathematics tied for second place with Harvard and Stanford universities.

It is important to note that U.S. News does not issue annual rankings for doctoral programs but, instead, revisits them every few years. For example, in the most recent rankings for biology doctoral programs (2007), MIT tied for second with Berkeley. In the most recent rankings of doctoral programs in chemistry (2007), MIT was locked in a four-way tie for first with Caltech, Stanford and Berkeley. And in the most recent rankings for doctoral programs in economics (2005), MIT was tied for first with the University of Chicago.

The magazine's annual rankings of U.S. undergraduate schools is due to be published in August.

Faculty approve exploratory subject, Pass/D/Fail measures at March 13 meeting

Patrick Gillooly
News Office

Faculty members approved making permanent the exploratory subject option for sophomores and offering a Pass/D/Fail option for graduate students during the monthly faculty meeting on March 13.

Faculty also heard proposals to allow double majors at MIT and to make permanent the SB program in Comparative Media Studies. Both proposals will be voted on at the April faculty meeting.

Currently, a student who wishes to pursue a double degree must complete 17 General Institute Requirement courses, take all of the required classes in each of the two departments and complete 270 units outside of the GIRs—90 units more than a student pursuing one degree.

The new proposal, submitted by the Committee on the Undergraduate Program (CUP), follows a recommendation of the Task Force on the Undergraduate Educational Commons to allow a student to receive one SB degree, but with two majors. Those electing to pursue this path would only have to complete 180 units outside of the GIRs and satisfy the requirements of the two programs they are in.

The measure was presented at the faculty meeting by Professor of Electrical Engineering Dennis Freeman and by Professor and Dean for Curriculum and Faculty Support Diana Henderson. Freeman and Henderson said the plan makes sense because it mirrors the real world and the research pursuits of many MIT faculty.

"Much like our faculty, many of our students have an interest in working in multiple fields," said Freeman, the CUP chair.

"Multidisciplinary education has never been more important," he added. "Our graduates increasingly face real-world problems whose solutions draw on multiple disciplines."

Separately, professors Henry Jenkins and Bill Uricchio outlined a measure to make permanent the SB program in comparative media studies.

The program, created in 2003, allows undergraduate students to study the effect of media across history, culture, disciplines and the humanities.

Chancellor Phillip Clay made a presentation to the faculty on the financial aid enhancements for the 2008-2009 academic year, including the decision to make MIT tuition-free for families, with typical assets, that earn less than $75,000 a year.

Professor Lawrence Vale, head of the Department of Urban Studies and Planning, delivered a moving eulogy of Professor J. Mark Schuster, who died in February of complications from melanoma.

PHOTO COURTESY OF GARY VAN ZANTE FROM 'NEW ORLEANS 1867: PHOTOGRAPHS BY THEODORE LILIENTHAL'

Looking back at the Big Easy

New Orleans was closer to the Big Muddy than the Big Easy in the aftermath of the Civil War, and leaders of the bankrupt city turned to public relations to solve its staggering economic problems, according to a new book by Gary Van Zante, curator of architecture and design at the MIT Museum.

Van Zante's book, "New Orleans 1867: Photographs by Theodore Lilienthal" (Merrell), shows Lilienthal's richly detailed black and white images and discusses what they reveal—and what they obscure—about the city's state.

"Lilienthal created one of the most important photographic surveys of the century and one of the best visual documents we have of city building in the Civil War era," says Van Zante, whose architectural essays in the book touch on technology, society, politics and history.

Lilienthal's photo of St. Charles and Poydras streets features granite-block pavement and a prosperous store, Fresh Pond Ice, at one corner.

"Frederic 'Ice King' Tudor sold ice from Cambridge's Fresh Pond. When Lilienthal took this photo, New Orleans was Tudor's best customer," Van Zante says.

For more information and more photos, visit http://web.mit.edu/newsoffice.

–Sarah H. Wright

CDC chief Gerberding speaking at MIT today

Anne Trafton
News Office

Julie Gerberding, director of the Centers for Disease Control and Prevention, will talk about how to deliver cutting-edge biomedical innovations to patients in a lecture at MIT today.

Gerberding's talk, sponsored by MIT's Center for Biomedical Innovation (CBI), is titled "Health System Transformation: Getting Our Money's Worth of 'Healthness.'"

Gerberding will touch on some of the challenges facing the U.S. health system, including rising costs of health care and the need to focus on prevention. She will also talk about how to translate biomedical advances into practical treatments for patients.

"It's very important when we talk about innovation that we make sure research innovations have an impact on the real world of patient care," said Gigi Hirsch, executive director of the CBI.

The lecture, which is open to the public, begins at 2 p.m. in Kresge Auditorium. Gerberding will be introduced by MIT President Susan Hockfield.

Gerberding will also participate in a roundtable discussion Wednesday morning with representatives from academia, industry and government.

The panel, called "The Role of Government in Health Innovation," will focus on how to pursue biomedical innovations in the face of lost government funding for health research.

"As government funding is cut, it will require new ways of moving forward, new models of collaboration, and new types of relationships across academia, industry and government," said Hirsch.

The panel, which requires advance registration, will be held in the Broad Institute auditorium from 9:30 to 11:30 a.m.

Moderated by Charles Cooney, the Robert T. Haslam Professor of Chemical Engineering at MIT, the panel will feature Randall Lutter, acting deputy commissioner of the FDA; Mark McClellan, director of the Engelberg Center for Health Care Reform at the Brookings Institution; Alan Krensky, deputy director of the Office of Portfolio Management and Strategic Initiatives at the National Institutes of Health; Robert Langer, MIT Institute Professor; Phillip Sharp, MIT Institute Professor and Nobel laureate; Edward Roberts, the David Sarnoff Professor of Management of Technology; Burt Adelman, former executive vice president for portfolio strategy at Biogen Idec; and Fiona Murray, associate professor at the MIT Sloan School of Management.

Julie Gerberding

Gerberding's lecture is cosponsored by MIT's Department of Biological Engineering, MIT's Center for Environmental Health Sciences and the Harvard-MIT Division of Health Sciences and Technology.

The roundtable discussion is cosponsored by the MIT Sloan School of Management, MIT's Department of Biology and the New England Healthcare Institute.

EFFICIENCY: BC, MIT researchers make thermoelectric breakthrough

Continued from **Page 1**

Using nanotechnology, the researchers at BC and MIT produced a big increase in the thermoelectric efficiency of bismuth antimony telluride—a semiconductor alloy that has been commonly used in commercial devices since the 1950s—in bulk form. Specifically, the team realized a 40 percent increase in the alloy's figure of merit, a term scientists use to measure a material's relative performance.

The achievement marks the first such gain in a half-century using the cost-effective material that functions at room temperatures and up to 250 degrees Celsius. The success using the relatively inexpensive and environmentally friendly alloy in bulk form means the discovery can quickly be applied to a range of uses, leading to higher cooling and power generation efficiency.

"By using nanotechnology, we have found a way to improve an old material by breaking it up and then rebuilding it in a composite of nanostructures in bulk form," said Boston College physicist Zhifeng Ren, one of the leaders of the project. "This method is low cost and can be scaled for mass production. This represents an exciting opportunity to improve the performance of thermoelectric materials in a cost-effective manner."

"These thermoelectric materials are already used in many applications, but this better material can have a bigger impact," said Gang Chen, the Warren and Towneley Rohsenow Professor of Mechanical Engineering at MIT and another leader of the project.

At its core, thermoelectricity is the "hot and cool" issue of physics. Heating one end of a wire, for example, causes electrons to move to the cooler end, producing an electric current. In reverse, applying a current to the same wire will carry heat away from a hot section to a cool section. Phonons, a quantum mode of vibration, play a key role because they are the primary means by which heat conduction takes place in insulating solids.

Bismuth antimony telluride is a material commonly used in thermoelectric products. The researchers crushed it into a nanoscopic dust and then reconstituted it in bulk form, albeit with nanoscale constituents. The grains and irregularities of the reconstituted alloy dramatically slowed the passage of phonons through the material, radically transforming the thermoelectric performance by blocking heat flow while allowing the electrical flow.

In addition to Ren and six researchers at his BC lab, the international team involved MIT researchers, including Chen and Institute Professor Mildred S. Dresselhaus; research scientist Bed Poudel at GMZ Energy Inc, a Newton, Mass.-based company formed by Ren, Chen and CEO Mike Clary; as well as BC Visiting Professor Junming Liu, a physicist from Nanjing University in China.

Thermoelectric materials have been used by NASA to generate power for far-away spacecraft. These materials have been used by specialty automobile seat makers to keep drivers cool during the summer. The auto industry has been experimenting with ways to use thermoelectric materials to convert waste heat from a car exhaust systems into electric current to help power vehicles.

The research was supported by the Department of Energy and by the National Science Foundation.

–Greg Frost and Anne Trafton, News Office; Ed Hayward, Boston College Office of Public Affairs

NEWS IN BRIEF

Media Lab, Bank of America create new center

The MIT Media Laboratory and Bank of America this week announced the creation of the Center for Future Banking, which will seek to transform the ways banking will be conducted in a world of rapidly changing social, economic, and information landscapes.

The center will explore new ideas in banking by inventing technologies that reveal and leverage insights across a wide range of physical and social scales, from one-on-one customer interactions to global transactions.

Frank Moss, director of the Media Lab, said the center represents a powerful new model by which academia and business will partner to invent the future of entire industries.

"We are bringing together the creative, multidisciplinary research of Media Lab faculty and students with the real-world business experience and deep-domain knowledge of our Bank of America colleagues—all in a highly innovative environment that promotes unconventional thinking and risk-taking," Moss said. "In doing so, we hope not only to discover the principles that will transform banking in the next decade, but also to advance our basic understanding of the rapidly changing relationship between people, technology and society in the 21st century."

Microsoft joins MIT Kerberos Consortium

Software giant Microsoft has joined the MIT Kerberos Consortium, a move that has significant ramifications in the information technology sector.

The MIT Kerberos Consortium launched in September with the support of Apple, Centrify, Google, Sun, Stanford University, TeamF1 and the University of Michigan; it has since welcomed several other members. Microsoft's decision to join effectively means that all the major operating-system and software vendors are now backing the security authentication and authorization group.

Kerberos, which grew out of MIT's Project Athena, is a network authentication protocol that aims to offer consumers the same single sign-on authentication and authorization system that corporate America has been using to allow employees to access network services. It is the first consortium to emerge from MIT's Information Systems and Technology organization.

Microsoft uses the Kerberos protocol in a number of its products including Windows 2000, Windows XP, Windows Server 2003, Windows Vista and Windows Server 2008. Kerberos is also the primary authentication mechanism offered by Microsoft Active Directory.

"Microsoft joining the Kerberos Consortium is significant," said Stephen Buckley, consortium executive director. "They represent a vast number of users of Kerberos. It is an important step forward toward our common ambition to create a universal authentication platform for the world's computer networks."

MIT, government of Portugal sign key energy agreement

MIT and Portugal have formed a partnership to address critical energy issues and strengthen transatlantic cooperation in energy research.

Portugal will become the inaugural Sustaining Public Member of the MIT Energy Initiative (MITEI), giving a designated representative of the government of Portugal a seat on the MITEI Governing Board, which provides key input on the direction and success of the Initiative's overall research portfolio. The collaboration enhances the MIT-Portugal Program, a major initiative undertaken by the Portuguese government in 2006 to strengthen the country's knowledge base at an international level.

Portuguese Prime Minister José Socrates presided at the March 26 signing of the MITEI agreement between MIT and his country. He emphasized the key role that the MIT-Portugal Program is playing in the modernization of Portuguese universities, including the promotion of new industry research relationships, and the new frontiers for this collaboration through Portugal's engagement in MITEI.

The MITEI agreement was signed in Lisbon during the MIT-Europe Conference by Jose Mariano Gago, Portugal's minister of science, technology and higher education; Paulo Ferrão, the director in Portugal of the MIT-Portugal Program; and Ernest Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems and director of MITEI.

Moniz said the agreement will enhance the already-robust relationship between MIT and Portugal and create new opportunities to help meet Portugal's energy and environmental needs through critical analysis and research.

The path established under the agreement will enable the government of Portugal to leverage the talent and expertise of its universities and key energy industry sectors with the expertise and capabilities of MIT researchers and faculty. Specifically, the agreement establishes a framework for the government of Portugal and MIT, through MITEI, to enhance the understanding of key energy systems and associated technology development and deployment in Portugal, including the development and demonstration of innovative technologies for sustainable energy systems and transportation systems; decentralized energy; urban metabolism and green mobility; and advanced energy technologies and analysis.

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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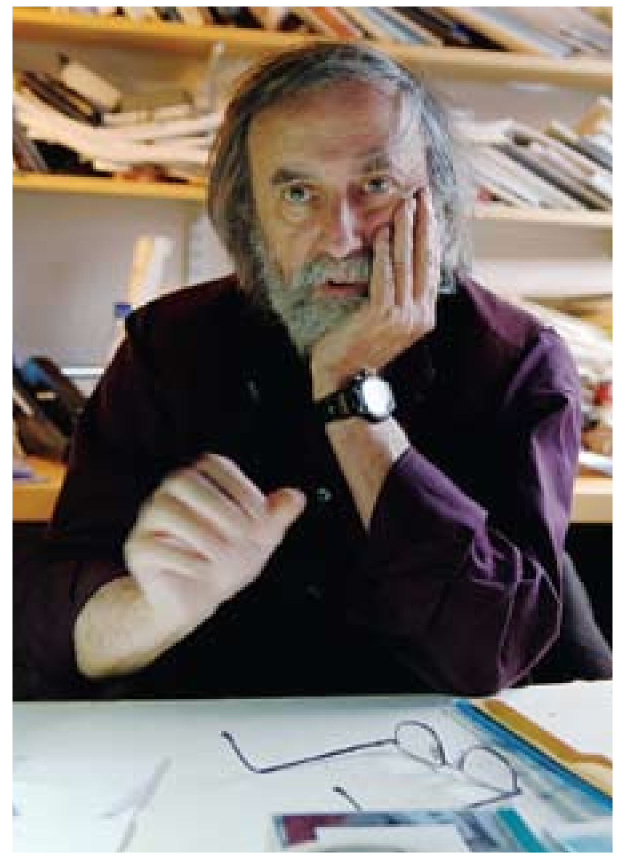


Seeing ‘Visions’

Andrea Frank's book shines light on the minds at work at MIT

Sarah H. Wright
News Office

When Andrea Frank came to MIT in 2003, she found exactly what she expected, and more: World-class minds were conducting cutting-edge research throughout the Institute, and they would eagerly discuss their work when she asked them about it.

A photographer and lecturer in architecture, Frank set out in 2005 to weave together those voices and faces in a collective portrait. Two year later, the result is “Visions: MIT Interviews,” a book of Frank’s photographs and interviews with 33 MIT professors and researchers.

An exhibition of the work opened with a reception and book launch on March 18 at the MIT Museum’s Mark Epstein Innovation Gallery.

Frank had a larger vision for “Visions,” one that transcends MIT’s boundaries.

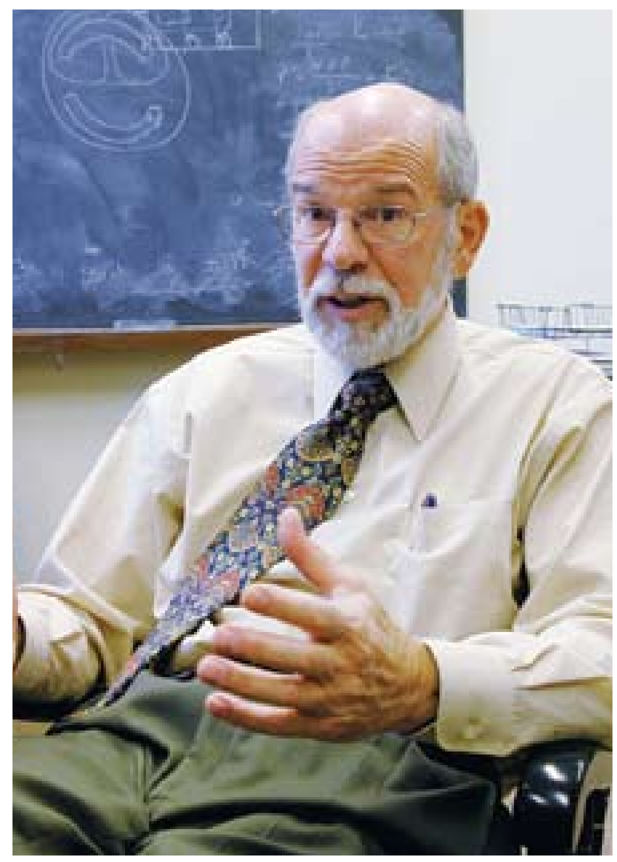
“We’re facing a difficult moment in history. Urgent global challenges are now converging on the human race, and I wanted to learn how MIT researchers looked at the world’s problems,” she said in an interview at MIT. “‘Visions’ was designed to illuminate where we are now and where we may be going.”

Frank used economical means to achieve her goals for the book and exhibit. All 33 interviews were recorded and based on the same topics—current work, recent changes in the interviewee’s field, the global context of current research in that field and its possible implications, including any downsides.

Frank photographed each subject in his or her office, using a Nikon D2x with a wide-angle zoom lens and relying on natural light.

“‘Visions’ was full of unexpected, super-interesting tangents. I had material for many more books,” Frank said.

“Visions” was edited by Jerry Adler and produced at the MIT Visual Arts Program. It was funded in part by the Council for the Arts at MIT and supported through a grant by the Humanities, Arts, and Social Sciences Fund at MIT.



PHOTOS / **ANDREA FRANK**

Clockwise, from top left: chemistry professor Alice Ting; political science professor Suzanne Berger; architecture professor Jan Wampler; John Kassakian, director of the Lab for Electromagnetic & Electronic Systems; Sebastian Seung, professor in the Department of Brain and Cognitive Sciences; history professor Meg Jacobs; and linguistics professor Noam Chomsky.