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Wednesday, December 12, 2007

TechTalk

SERVING THE MIT COMMUNITY

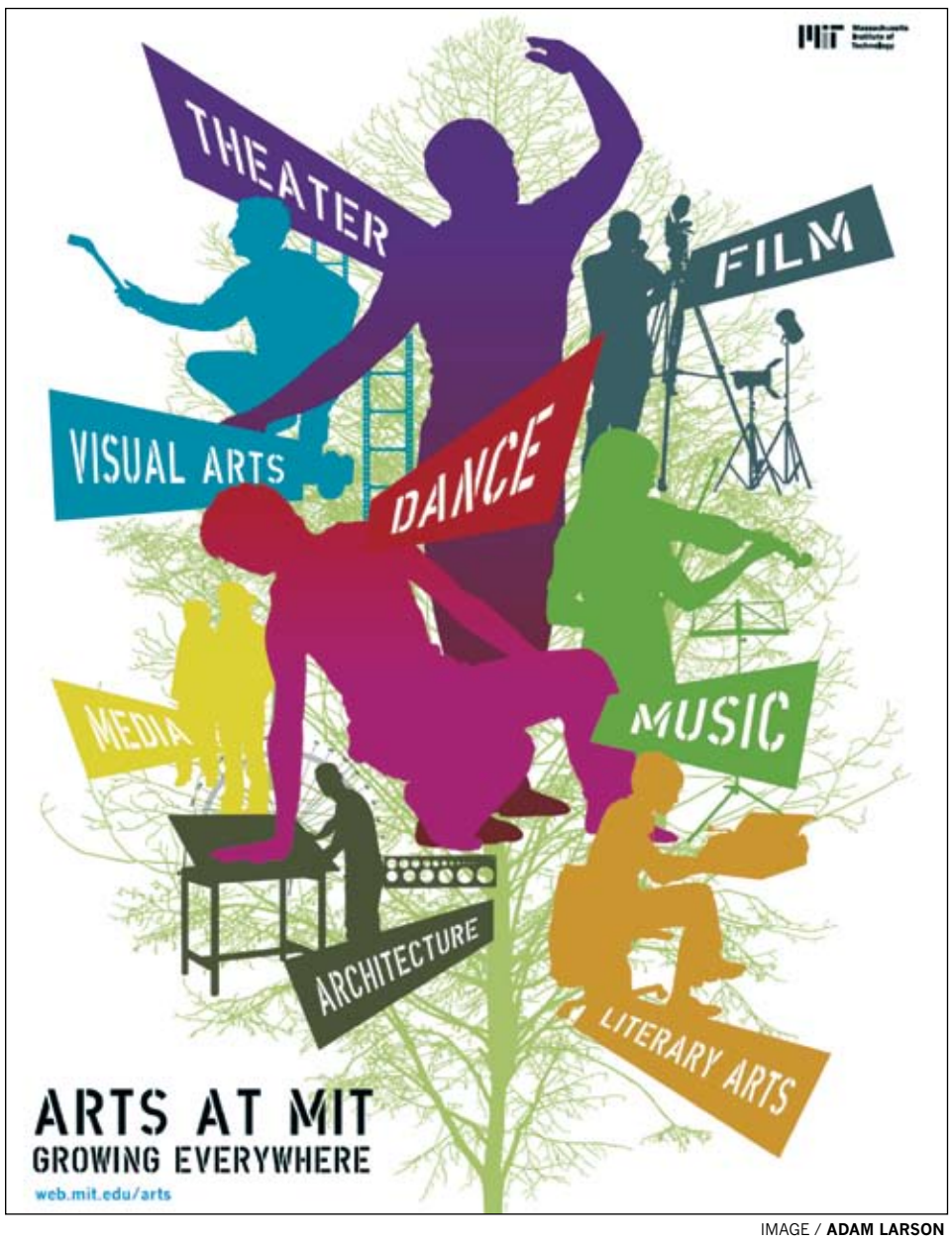

IMAGE / **ADAM LARSON**

A promotional poster launched this semester showcases the broad range of arts at MIT. Thanks to a series of technological upgrades, it is becoming easier to get information about art events at the Institute.

Students to play role in shaping future of W1

Greg Frost
News Office

W1, one of MIT's oldest and most cherished buildings, will be given new life under a major renovation plan announced this month, and students, faculty and staff will play key roles in shaping its future.

Also known as Ashdown House after a popular former housemaster, W1 is MIT's oldest graduate residence hall and arguably the cultural center of the Institute's graduate community. Its dining room has been a focal point of the MIT graduate experience, serving as a meeting place for faculty and their students.

With the scheduled opening of the new NW35 graduate residence hall next summer, administrators had been hoping to turn W1 into an undergraduate residence as early as the fall of 2008. But they have come to realize that W1 needs a major renovation, and the plan to bring the residence hall back into service has been pushed back by two years.

The delay, however, has presented a classic opportunity for MIT to do what it does best: collaborate as a group to solve a problem.

To that end, MIT has named Suzanne Flynn, professor of foreign languages and linguistics, and her husband, Jack Carroll, housemasters of the soon-to-be-renovated W1, and the pair have begun recruiting students to join a founders group that will design the building's community.

MIT has used the founders group concept for work on Simmons, the Warehouse and Sidney-Pacific. In this instance, the group will be responsible for designing a constitution and bylaws, a form of house government and committee structure, and dining options, among other things.

W1, shown in this file image, will be given new life under a major renovation plan, and students, faculty and staff will play key roles in shaping its future.

Chancellor Phillip Clay, who lived in W1 as a graduate student, recalled it as an important meeting place for faculty and students at lunch and dinner.

"Ashdown was a destination—all the rooms were filled. It was the graduate

See **ASHDOWN**
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The art of communication

Making arts information at MIT more accessible

MIT is making it easier for students, faculty and staff to learn about the hundreds of energizing performances, lectures and other art events taking place at the Institute.

A new messaging service rolled out this semester gives users up-to-the-minute information about the arts at MIT. For example, users who want to know what is happening in the arts on a given day but who aren't near a computer can text "arts@mit" to 617-785-9844 and receive a message of times and locations of all the art events occurring that day.

The service, MANGO Text, was designed by three enterprising MIT graduate students in response to the growth of rapid-fire wireless text messaging.

"More and more of what we want to do online is now available through phones," said MANGO Text's Sonya Huang, a graduate student in urban studies and planning. "MANGO will let busy students find out about the latest events while on the go."

The listings available over the messaging service are taken from the newly revamped and searchable online arts events calendar at artscal.mit.edu, which has a direct link from the MIT homepage. The calendar has been redesigned to better meet the needs of the MIT community, which are constantly evolving in this digital age of mass communication. Changing spotlights on the calendar highlight inspiring performances, lectures and exhibitions each week.

From the internationally recognized public art collection to the more than 60 performance groups, the arts are alive and blooming at MIT. Students, faculty, staff and visitors alike are attending events—most of which are free—all over campus. In November alone, there were more than 100 events to choose from, including the dance troupe Nappy Grooves' Performing Blackness workshop, a talk by artist/performer David Robbins on new styles of entertainment fostered by the digital revolution, Vikram Chandra reading from his

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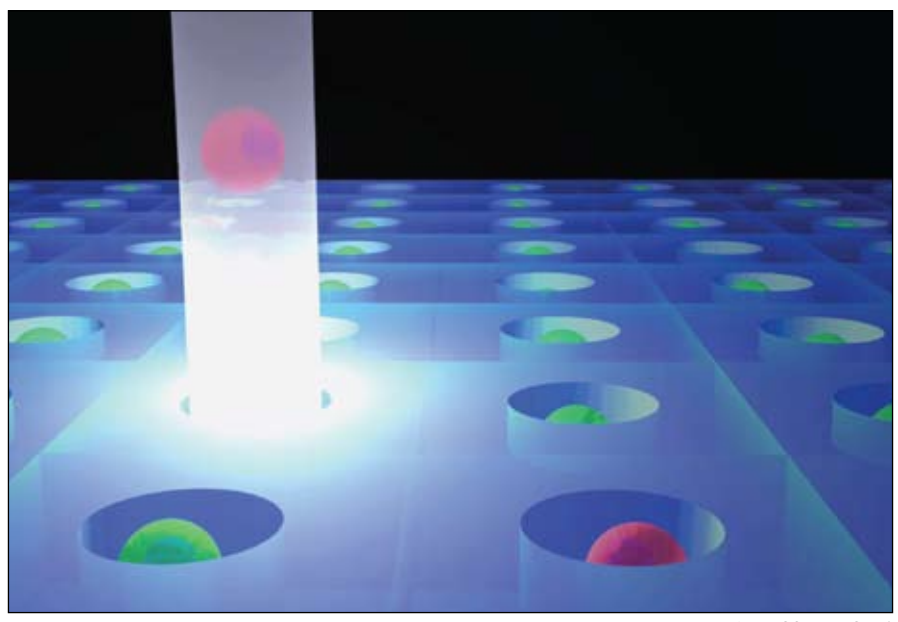

IMAGE / **JOSEPH KOVAC**

Laser beam 'fire hose'

MIT has developed a new system for sorting cells that involves special "traps" in a silicone layer bonded to a microscope slide. Cells with specific properties are then levitated out of their traps using the pressure of a laser beam "fire hose." For more, see page 5.

AWARDS AND HONORS

MIT's **School of Architecture and Planning** is the second-best U.S. graduate school of architecture, according to Architect magazine's 2008 rankings.

The rankings were compiled from 130 architecture firms, 46 architecture deans and 740 architecture students who responded to a national survey.

MIT's position in the Architect rankings was its highest in at least five years. In 2007 and 2005, MIT was ranked fourth; in 2006, eighth; and in 2004, fifth in the nation. Harvard University's Graduate School of Design topped the list this year.

JoAnne Stubbe, the Novartis Professor of Chemistry and professor of biology, will be presented with the 2008 Emil Thomas Kaiser Award for her outstanding contributions to the understanding of ribonucleotide reductases, enzymes that play a central role in nucleic acid metabolism. The award, sponsored by the Protein Society, recognizes a recent, highly significant contribution in applying chemistry to the study of proteins.

JoAnne Stubbe

Daniel Nocera

Daniel Nocera, the Henry Dreyfus Professor of Energy and professor of chemistry, has been named the 2008 recipient of the Harrison Howe Award. Presented by the Rochester Section of the American Chemical Society, the award was established to recognize a scientist who has made outstanding contributions to chemistry or closely related fields and who shows great potential for further achievement.

Ram Sasisekharan, professor of biological engineering and health sciences and technology, is one of four recipients of the 2007 Princess Chulabhorn Gold Medal. This award honors world-renowned individuals or organizations that have provided outstanding support for the activities of the Thailand-based Chulabhorn Research Institute, as well as important support for the advancement of science in developing countries.

Richard Hynes, Daniel K. Ludwig Professor for Cancer Research, has been awarded the American Society for Cell Biology (ASCB) E.B. Wilson Medal, the society's highest honor for science, which he will share with Zena Web of the University of California, San Francisco.

Hynes is recognized for his seminal contributions to cell biology, including his research on the role of extracellular matrix proteins and their receptors in normal cellular growth and development and in the process of oncogenesis. Along with Werb, he presented the E.B. Wilson Lecture at the recent ASCB annual meeting.

The American Physical Society (APS) has announced the 2007 APS Fellows, including seven MIT faculty members. APS fellowship is a distinct honor signifying recognition by one's professional peers. The fellows are:

Geoffrey Forden, research associate in the Program in Science, Technology and Society, for innovative and important contributions to arms control and international security.

Ram Sasisekharan

Richard Hynes

Neil Gershenfeld

Neil Gershenfeld, director of the Center for Bits and Atoms, for significant contributions ranging from quantum computing to advanced technologies for global development.

Mehran Kardar, professor of physics, for pioneering work in a broad range of topics in statistical physics, including the dynamics of growing interfaces and biophysical systems.

Seth Lloyd

Miklos Porkolab

Seth Lloyd, professor of mechanical engineering, for seminal contributions to the theory of quantum computation and quantum communication and their physical implementations.

Gareth McKinley, Professor of Teaching Innovation in the Department of Mechanical Engineering, for the development of methods for characterization of the rheology of complex liquids and improved understanding of elastic effects and instabilities.

Richard Milner, professor of physics and director of the Laboratory for Nuclear Science, for his leadership in the HERMES/DESY and BLAST/Bates experiments.

James Terry, principal research scientist at the Plasma Science and Fusion Center, for significant contributions in the areas of volume recombination in plasmas, plasma impurity transport, wall-conditioning with lithium, plasma transport, and plasma turbulence in magnetic fusion confinement devices.

The Hungarian Nuclear Society awarded its first annual Karoly Simony Memorial Plaque and Prize to **Miklos Porkolab**, professor of physics and Director of the Plasma Science and Fusion Center. The prize, named in memory of Karoly Simony, the first Hungarian fusion research scientist, was awarded in recognition of Porkolab's "outstanding achievements and contributions to plasma physics and fusion research."

C4FCM names research director

MIT's new Center for Future Civic Media (C4FCM) has announced that Ellen Hume has been named research director, effective Jan. 28.

A joint effort between the MIT's Media Lab and Comparative Media Studies Program, C4FCM, founded earlier this year with a $5 million grant from the Knight Foundation, develops new techniques and technologies to promote and enhance civic engagement in local communities, providing people with new means to share, prioritize, organize and act on information relevant to their communities.

As research director, Hume will collaborate closely with C4FCM principal investigators Chris Csikszentmihályi, associate professor of media arts and sciences, Henry Jenkins, the Peter de Florez Professor of Humanities and co-director of the MIT Comparative Media Studies Program, and Mitchel Resnick, the LEGO Papert Professor of Learning Research and head of the Program in Media Arts and Sciences, to define the priorities and plans for the new center.

Hume is currently founding director of the Center on Media and Society at the University of Massachusetts Boston. Previously, she served as executive director and senior fellow at Harvard University's Shorenstein Center on the Press, Politics and Public Policy, and as executive director of PBS's Democracy Project.

NEWS YOU CAN USE

Next faculty meeting Dec. 19

The next faculty meeting will begin at 3:30 p.m. Dec. 19 in 32-141. An agenda was not available as of press time.

Be part of the Cambridge Science Festival

Proposals that celebrate science and technology in ways that combine spirit, interactivity and audience appeal are being accepted for all aspects of the Cambridge Science Festival (April 26-May 4), including opening and closing ceremonies, daily events, evening celebrations, performances, and indoor and outdoor activities. Venues may include auditoriums, outdoor public spaces, theaters, storefronts, private businesses and city streets.

Community organizations, performing groups, schools, youth groups and individuals are encouraged to apply. The deadline for proposals is Dec. 15. For more information, please visit cambridgesciencefestival.org.

MIT Endicott House holiday dinner buffet

MIT Endicott House will offer a special seasonal dinner buffet Dec. 18 to celebrate the holiday season. The cost is $35 per person inclusive of service. The evening will start at 5:00 p.m. with a cash bar and complimentary hors d'oeuvres, followed by the buffet dinner at 6:00 p.m. Coffee, tea and dessert will end the evening.

Get ready for getfit@mit

Looking for ways to beat the winter blues during another long New England winter? Teams of five to eight people are invited to take part in the fourth annual getfit@mit fitness challenge, presented by MIT Medical. Participants log their exercise minutes into an online database during the 12-week competition. All teams and individuals who meet the exercise goals are eligible to win prizes. Registration opens Jan. 2 and continues until Jan. 23. In addition, an iPod nano is up for grabs in the getfit@mit T-shirt design contest. Visit getfit.mit.edu for more information.

Quit smoking in 2008

The Center for Health Promotion and Wellness will offer an evening group for individuals seeking help quitting smoking. The class starts Jan. 9 and will run for seven consecutive Wednesdays from 5:15 p.m. to 6:15 p.m. at MIT Medical (Building E-23). The sessions will cover preparation for quitting, coping skills and stress management techniques, and tips for preventing weight gain and living without tobacco. Advanced registration is required. For more information, visit web.mit.edu/medical/a-center.html or call 617-258-5363. Fees: $110/$88 for MIT Health Plan members and MIT retirees, and $55 for MIT students.

Spring 2008 Tech Talk schedule

This week's Tech Talk is the final issue of 2007.

During spring semester, Tech Talk will be published on the following dates:

Jan. 16
Jan. 30
Feb. 6
Feb. 13
Feb. 27
March 5
March 12
March 19
April 2
April 9
April 16
April 30
May 7
May 14
May 21
June 4
June 11

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Making their own music

From duck calls to harpsichords, MIT students craft their own instruments

Sarah H. Wright
News Office

When some MIT students want to hear the sounds of success, they go right to the source and build their own instruments. And whatever notes emerge, the result is always the same: Hands-on work is its own reward.

Adam Leeb (S.B. 2007) estimates that he spent about eight months researching and about 300 hours designing and building his own electric guitar. The sounds of success were apparent in the first notes he heard from its strings.

"It wasn't until the very last moments, when I plugged it in. Then I was able to see all of my labor had been worth it," says Leeb, a mechanical engineering major who finished his guitar after graduating in June. "It has a very clean sound."

Cody Edwards (S.B. 2007), an avid hunter who grew up on a farm, heard the sound of success from a different instrument—an acrylic duck call that mimics a Mallard hen.

"When I made the first squeaks on my first attempt at a soundboard, I was very happy. But it sounded terrible," he says. "Making it sound correct involved long hours with a file."

All six of Edwards' duck calls are in use; they sound great.

"Seeing a flock of migrating ducks respond to your call is one of the most satisfying aspects of a duck hunt," he says.

For Raphael Peterson, a sophomore in mechanical engineering who spent nine months building a bass guitar, the long, sometimes frustrating process was so rewarding that he plans to build another.

Currently, Zachary Bjornson, sophomore in biological engineering, is halfway through his second year of building a harpsichord.

"Historical builders, at their prime, were producing an instrument a week. I console myself by hoping that they had a staff of 50 working for them," he says.

It's a long walk from mind to hand to the sweet sounds of success, the builders admit, but the creative satisfaction has outweighed their frustrations.

"A guitar offered everything I was looking for in a project: utility, relatively few parts, lots of space for creativity," Leeb says.

That means he could go way outside the guitar-building box in his design: Furniture legs inspired his guitar's ball-and-claw shapes on the cutaways. A watchmaking technique gives its metal plates their stippled surface. And the MIT Hobby Shop's water-jet machine tapered his guitar's metal inlays.

As in any work of art, there's a leap of faith, Leeb notes.

"Reading books and looking at other guitars helped. So did designing on Solidworks [a software design program]. But in the end I had to take the plunge on things I didn't know would work until everything was finished," he says.

The true art in duck-call making is shaping the soundboard and reed, Edwards says. Mastering that consumed more than 20 hours of computer-aided design, plus four hours of machining and polishing—and those long hours with a file to make the duck call call ducks.

Along the way, many of his efforts ended in failure. "There was a big learning curve. But looking back, the learning process was the biggest reward," he notes.

As Bjornson is discovering, rewards occur even in the early stages of long-term projects: New connections open up—some leading right back to MIT.

"I hear from other harpsichord builders around the world. And R.K. Lee, who drew up the plans for the harpsichord I'm making, not only apprenticed to Frank Hubbard, who built the one at the MFA, but also went to MIT!" Bjornson says.

Both Leeb and Edwards have encouraging words for MIT students now building instruments by hand—and by choice.

For ambitious guitar-builders, Leeb urges them to just do it.

"Every project is an adventure," he says, recommending an investment in quality parts. "There is no point in putting a lot of time into a project only to have it be hampered by crappy hardware."

He also urges enthusiasts to read as much as possible about the process, to get their hands on a set of plans, and especially to talk with Ken Stone and Hayami Arakawa in the MIT Hobby Shop.

Edwards focuses on persistence. For him, every stage of the duck-call project was a challenge. "I had never used the software, or a CNC lathe. I spent at least 20 hours of solid work before I produced my first successful prototype," he says.

"Don't get disappointed in whatever your final outcome is. I found great enjoyment in setting a tough goal for myself, and overcoming unforeseen challenges," he adds.

Bjornson, who has already put in 300 hours of research on designing his harpsichord, expects to spend about 1,000 hours building it. For him, previous MIT generations are inspiring.

Plus, he can already hear the sound of success from his harpsichord. "Once I'm done, I would like to perform on it in a small concert: For a solo piece, one of Scarlatti's later sonatas; for an ensemble piece, any of Vivaldi's brighter concertos, like his one in G major," he says.

PHOTO / **DONNA COVENEY**

One of several students to craft musical instruments in the MIT Hobby Shop, sophomore Zachary Bjornson is shown above painstakingly shaping the body of his harpsichord. Below, recent graduate Adam Leeb strums a few chords on his Hobby Shop-made electric guitar.

PHOTO COURTESY / **ADAM LEEB**

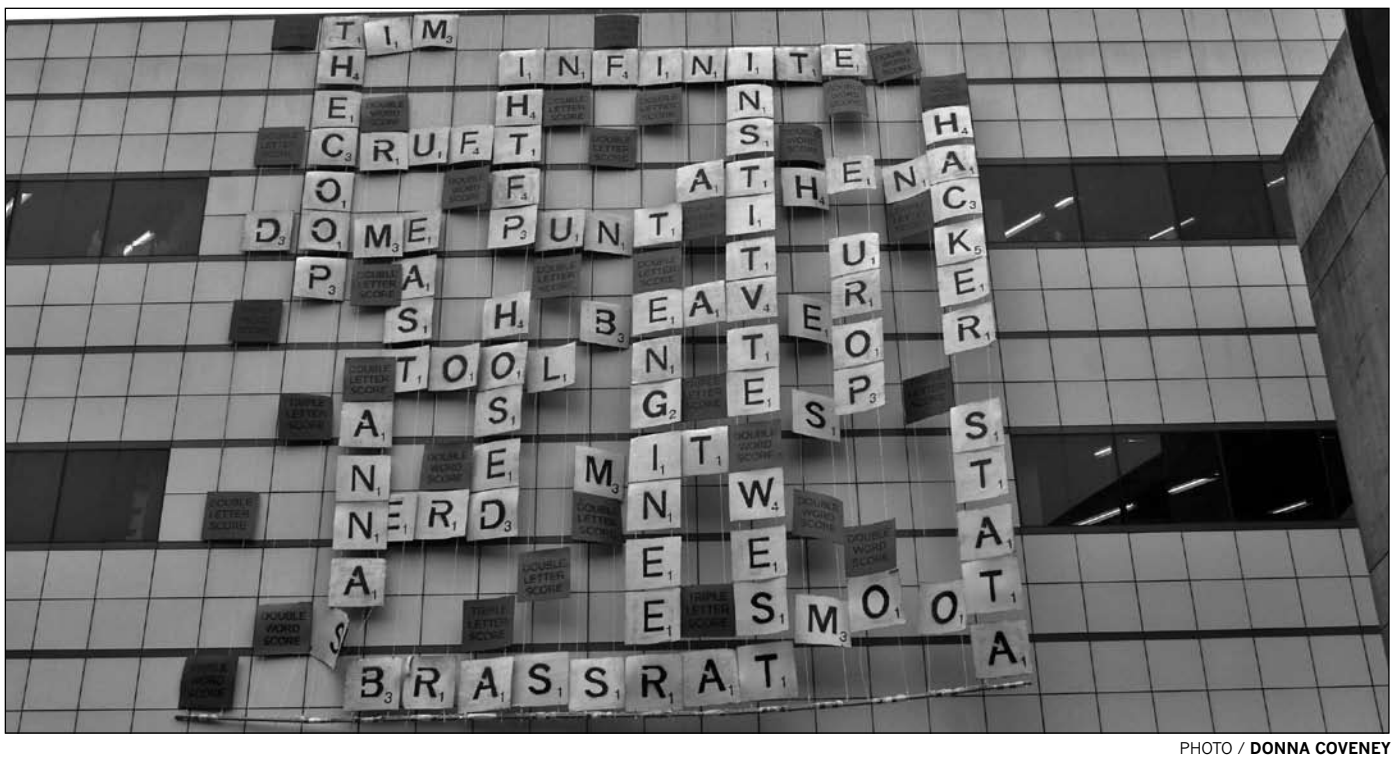


PHOTO / **DONNA COVENEY**

Game on!

Hackers hung this MIT-centric game of Scrabble on the side of Wiesner Building (E15) this week. Versions of other games, including chess and Cranium, also appeared at various spots around campus.

ASHDOWN —

Continued from Page 1

meeting place," he said, noting that the building originally served as a hotel.

Clay said the building's location and size make it a cornerstone of campus life. He added that the new plan means that after a brief delay, a "first-class" community will once again take root in W1.

"We are very excited by the interest that has already been shown in the project and we look forward to the continued support of our generous alumni who care deeply about campus life," Clay said.

Larry Benedict, dean for student life, said W1's renovation will be a major enhancement to the MIT community.

"This building is a landmark for MIT but it needs to be brought into this century," Benedict said. "The creation of a founders group is part of a rich tradition at MIT of allowing students, faculty and staff to design their own living communities."

Flynn, the future housemaster, invited any students interested in joining the founders group to contact her at sflynn@mit.edu.

"Jack and I are thrilled about this project and the possibilities it presents," Flynn said. "We very much look forward to meeting with undergraduates to begin the process of building a new community at MIT."

MIT instrument finds surprises at solar system's edge

David Chandler
News Office

The Voyager 2 spacecraft's Plasma Science instrument, developed at MIT in the 1970s, has turned up surprising revelations about the boundary zone that marks the edge of the sun's influence in space.

The unexpected findings emerged in the last few weeks as the spacecraft traversed the termination shockwave formed when the flow of particles constantly streaming out from the sun—the solar wind—slams into the surrounding thin gas that fills the space between stars.

The first surprise is that there is an unexpectedly strong magnetic field in that surrounding interstellar region, generated by currents in that incredibly tenuous gas. This magnetic field squashes the bubble of outflowing gas from the sun, distorting it from the uniform spherical shape space physicists had expected to find.

A second surprise also emerged from Voyager 2's passage through the solar system's outer edge: Just outside that boundary, the temperature, although hotter than inside, was 10 times cooler than expected. Theorists had to scramble to come up with an explanation for the unanticipated chilling effect.

"It's a different kind of shockwave than we've seen anywhere else," said John Richardson, principal investigator for the Plasma Physics instrument and a principal research scientist at MIT's Kavli Institute for Astrophysics and Space Science. The unexpected coolness, theorists now think, is caused by energy going into particles that are hotter than those that can be measured by the MIT plasma instrument.

The Voyager 1 and 2 spacecraft were designed primarily to study the planets Jupiter and Saturn and their moons. After launch, Voyager 2's path was adjusted to take it past Uranus and Neptune as well. Although the craft were built only for a five-year mission, both are still working well three decades later.

"We were incredibly lucky to have it last 30 years," said John Belcher, Class of 1922 Professor of Physics at MIT and former principal investigator for the Voyager Plasma Science instrument. The craft is now expected to keep working until about 2020, and still has important scientific objectives ahead.

It is now passing through a boundary zone called the heliosheath, a region where the solar wind interacts with the surrounding interstellar medium. Sometime in the next decade, it will cross a final edge, called the heliopause, where the sun's outflow of particles ends. At that point, it will be able to measure characteristics of the interstellar medium, for the first time, in a region unaffected by the solar wind and the sun's magnetism.

Although Voyager 1 had already crossed the termination shockwave three years ago, the MIT Plasma Science instrument on that spacecraft had by then stopped working, so the spacecraft could only indirectly detect the end of the sun's influence.

But with Voyager 2, the Plasma Science instrument not only detected the boundary, making detailed measurements of the solar wind's temperature, speed and density as the spacecraft crossed through it, but actually encountered the shockwave repeatedly. Because the outflow of the solar wind varies with changes in the sun's activity level, building up during large solar flares and quieting during lulls in sunspot activity, the boundary itself pulsates in and out. These pulsations can wash across the craft multiple times.

While Voyager 1 apparently made a single crossing, Voyager 2 crossed the boundary five times, producing a wealth of new data. It's even possible that if there are large variations in that solar outflow, the shock layer "could push past Voyager again," said Richardson. "That would give us some idea of how elastic the shock is"—that is, how far out these pulsations may stretch. Until and unless such detections are made, "we only have models" of how great such variations might be, he said.

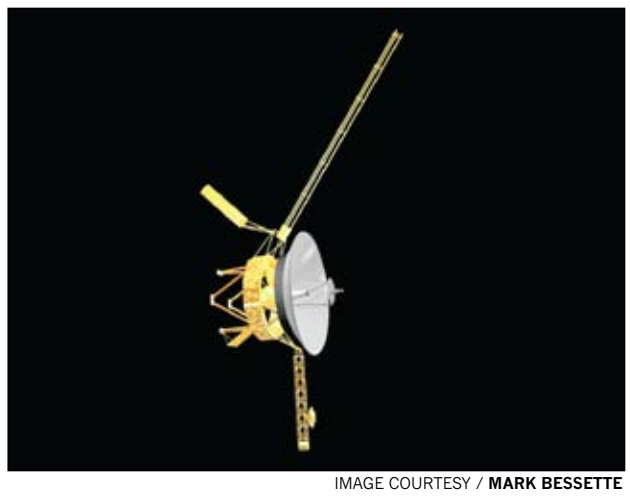


IMAGE COURTESY / **MARK BESSETTE**

More than 30 years after its launch, Voyager 2 continues to produce surprising revelations.

Voyager 2 is now 7.879 billion miles from Earth, traveling away at almost 35,000 miles per hour. Voyager 1 is 9.797 billion miles away, going more than 38,000 miles per hour.

The Plasma Science instrument was developed by the late Professor Herbert Bridge and Alan Lazarus, a senior research scientist in the Department of Physics and MIT's Kavli Institute for Astrophysics and Space Science. NASA has sponsored the work.

MIT creates oil-repelling materials

Many applications in aviation, more

Anne Trafton
News Office

MIT engineers have designed a class of material structures that can repel oils, a novel discovery that could have applications in aviation, space travel and hazardous waste cleanup. Such materials could be used to help protect parts of airplanes or rockets that are vulnerable to damage from being soaked in fuel, like rubber gaskets and o-rings.

"These are vulnerable points in many aerospace applications," said Robert Cohen, the St. Laurent Professor of Chemical Engineering and an author of a paper on the work that appeared in the Dec. 7 issue of Science.

"It would be nice if you could spill gasoline on a fabric or a gasket or other surface and find that instead of spreading, it just rolled off," Cohen said.

Creating a strongly oil-repelling, or "oleophobic," material has been challenging for scientists, and there are no natural examples of such a material.

"Nature has developed a lot of methods for waterproofing, but not so much oil-proofing," said Gareth McKinley, MIT School of Engineering Professor of Teaching Innovation in the Department of Mechanical Engineering and a member of the research team. "The conventional wisdom was that it couldn't be done on a large scale without very special lithographic processes."

The tendency of oils and other hydrocarbons to spread out over surfaces is due to their very low surface tension (a measure of the attraction between molecules of the same substance).

Water, on the other hand, has a very high surface tension and tends to form droplets. For example, beads of water appear on a freshly waxed car (however, over a period of time, oil and grease contaminate the surface and the repellency fades). That difference in surface tension also explains why water will roll off the feathers of a duck, but a duck coated in oil must be washed with soap to remove it.

PHOTO / **DONNA COVENEY**

From left, Gareth McKinley, Professor of Teaching Innovation in the Department of Mechanical Engineering, Robert Cohen, St. Laurent Professor of Chemical Engineering, Anish Tuteja, postdoc in chemical engineering, and Wonjae Choi, mechanical engineering graduate student. Seen here in the lab with lotus leaves, which naturally repel water, they have developed a class of material structures that repel oil and hydrocarbons.

The MIT team overcame the surface-tension problem by designing a type of material composed of specially prepared microfibers that essentially cushion droplets of liquid, allowing them to sit, intact, just above the material's surface.

When oil droplets land on the material, which resembles a thin fabric or tissue paper, they rest atop the fibers and pockets of air trapped between the fibers. The large contact angle between the droplet and the fibers prevents the liquid from touching the bottom of the surface and wetting it.

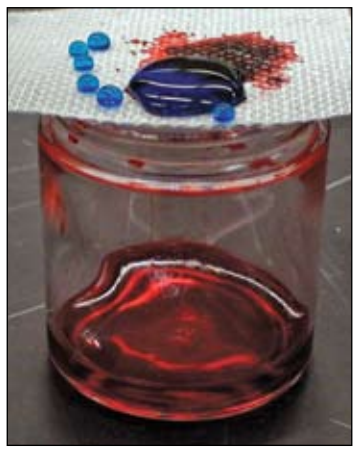


PHOTO COURTESY / **SCIENCE**

A steel mesh coated with a polymer containing a low concentration of a synthesized molecule called fluoroPOSS can repel water (dyed blue) but attracts the flammable fuel hexadecane (dyed red), allowing it to be used to separate the two substances.

The microfibers are a blend of a specially synthesized molecule called fluoroPOSS, which has an extremely low surface energy, and a common polymer. They can be readily deposited onto many types of surfaces, including metal, glass, plastic and even biological surfaces such as plant leaves, using a process known as electrospinning.

The researchers have also developed some dimensionless design parameters that can predict how stable the oleophobicity, or oil-resistance, between a particular liquid and a surface will be. These design equations are based on structural considerations, particularly the re-entrant nature (or concavity) of the surface roughness, and on three other factors: the liquid's surface tension, the spacing of the fibers and the contact angle between the liquid and a flat surface.

Using these relationships, the researchers can design fiber mats that are optimized to repel different hydrocarbons. They have already created a nonwoven fabric that can separate water and octane (jet fuel), which they believe could be useful for hazardous waste cleanup.

The Air Force, which funded the research and developed the fluoroPOSS molecules, is interested in using the new materials to protect components of airplanes and rockets from jet fuel.

Lead author is Anish Tuteja, a postdoctoral associate in MIT's Department of Chemical Engineering. Other MIT authors are Wonjae Choi and Minglin Ma, graduate students in chemical engineering, and Gregory Rutledge, professor of chemical engineering. Joseph Mabry and Sarah Mazzella of the Air Force Research Laboratory at Edwards Air Force Base are also authors on the paper.

Missing protein may be key to autism

Deborah Halber
News Office Correspondent

A missing brain protein may be one of the culprits behind autism and other brain disorders, according to researchers at MIT's Picower Institute for Learning and Memory.

The protein, called CASK, helps in the development of synapses, which neurons use to communicate with one another and which underlie our ability to learn and remember. Improperly formed synapses could lead to mental retardation, and mutations in genes encoding certain synaptic proteins are associated with autism.

In work published in the Dec. 6 issue of Neuron, Li-Huei Tsai, Picower Professor of Neuroscience at MIT, reported that she has uncovered an enzyme that is key to the activity of CASK.

Tsai studies a kinase (kinases are enzymes that change proteins) called Cdk5. While Cdk5's best-known role is to help new neurons form and migrate to their correct positions during brain development, "emerging evidence supports an important role for Cdk5 at the synapse," she said.

To gain a better understanding of how Cdk5 promotes synapse formation, Tsai's lab looked into how Cdk5 interacts with synapse-inducing proteins like CASK. A key scaffolding protein, CASK is one of the first proteins on the scene of a developing synapse.

Scaffolding proteins such as CASK are like site managers, supporting protein-to-protein interactions to ensure that the resulting architecture is sound. Mutations in the genes responsible for Cdk5 and CASK have been found in mental retardation patients.

"We found that Cdk5 is critical for recruiting CASK to do its job for developing synapses," Tsai said. "Without Cdk5, CASK was not in the right place at the right time and failed to interact with essential presynaptic components. This, in turn, led to problems with calcium influx." The flow of calcium in and out of neurons affects processes central to nervous system development and plasticity—its ability to change in response to experience.

Gene mutations and deletions in synaptic cell surface proteins and molecules called neurexins and neuroligins have been associated with autism. The problem with CASK recruitment investigated by the Tsai laboratory creates the same result as these genetic changes.

The Picower study also provides the first molecular explanation of how Cdk5, which also may go awry in neurodegenerative diseases such as Alzheimer's, promotes synapse development.

"There are still a lot of unknowns," said Tsai, who is also a Howard Hughes Medical Institute investigator. "Causes for psychiatric disorders are still very unclear, but accumulating evidence strongly suggests that alterations in the synaptogenesis program can lead to these serious diseases."

In addition to Tsai and Picower researcher Benjamin A. Samuels, co-authors are associated with Harvard Medical School, Johns Hopkins University School of Medicine, McLean Hospital in Belmont, Mass., and Academia Sinica in Taiwan.

This work is supported by the National Institute of Neurological Disorders and Stroke.

MIT corrects sickle-cell anemia in mice

Research involves reprogramming adult cells

Eric Bender
Whitehead Institute

MIT researchers have successfully treated mice with sickle-cell anemia in a process that begins by directly reprogramming their own cells to an embryonic-stem-cell-like state, without the use of eggs.

This is the first proof-of-principle of therapeutic application in mice of directly reprogrammed induced pluripotent stem (iPS) cells, which recently have been derived in mice as well as humans.

"This demonstrates that iPS cells have the same potential for therapy as embryonic stem cells, without the ethical and practical issues raised in creating embryonic stem cells," said MIT biology professor Rudolf Jaenisch, a member of the Whitehead Institute for Biomedical Research.

The research, reported Dec. 6 in Science online, was carried out in Jaenisch's laboratory. The iPS cells were derived using modifications of the approach originally discovered in 2006 by the Shinya Yamanaka laboratory at Kyoto University.

A disease of the blood marrow caused by a defect in a single gene, sickle-cell anemia is the most common inherited blood disorder in the United States, affecting more than 70,000 Americans and one in 500 African-Americans, according to the National Institutes of Health.

The scientists in Jaenisch's lab studied a therapeutic application of iPS cells with the sickle-cell anemia model mouse developed by the laboratory of Tim Townes of the University of Alabama at Birmingham. The mouse model had been designed to include relevant human genes involved in blood production, including the defective version of that gene.

To create the iPS cells, the scientists started with cells from the skin of the diseased mice, explained lead author Jacob Hanna, a postdoctoral researcher in the Jaenisch lab. These cells were modified by a standard lab technique employing retroviruses customized to insert genes into the cell's DNA. The inserted genes were Oct4, Sox2, Lif4 and c-Myc, known to act together as master regulators to keep cells in an embryonic-stem-cell-like state. iPS cells were selected based on their morphology and then verified to express gene markers specific to embryonic stem cells. To decrease or eliminate possible cancer in the treated mice, the c-Myc gene was removed by genetic manipulation from the iPS cells.

Next, the researchers followed a well-established protocol for differentiating embryonic stem cells into precursors of bone marrow adult stem cells, which can be transplanted into mice to generate normal blood cells. The scientists created such precursor cells from the iPS cells, replaced the defective blood-production gene in the precursor cells with a normal gene and injected the resulting cells back into the diseased mice.

The blood of treated mice was tested with standard analyses employed for human patients. The analyses showed that the disease was corrected, with measurements of blood and kidney functions similar to those of normal mice.

While iPS cells offer tremendous promise for regenerative medicine, scientists caution that major challenges must be overcome before medical applications can be considered. First among these is to find a better delivery system, since retroviruses bring other changes to the genome that are far too random to let loose in humans. "We need a delivery system that doesn't integrate itself into the genome," said Hanna. "Retroviruses can disrupt genes that should not be disrupted or activate genes that should not be activated."

Potential alternatives include other forms of viruses, synthesized versions of the proteins created by the four master regulator genes that are modified to enter the cell nucleus, and small molecules, Hanna says.

Despite the rapid progress being made with iPS cells, Jaenisch emphasized that this field is very young and that it's critical to continue full research on embryonic stem cells as well. "We wouldn't have known anything about iPS cells if we hadn't worked with embryonic stem cells," said Jaenisch. "For the foreseeable future, there will remain a continued need for embryonic stem cells as the crucial assessment tool for measuring the therapeutic potential of iPS cells."

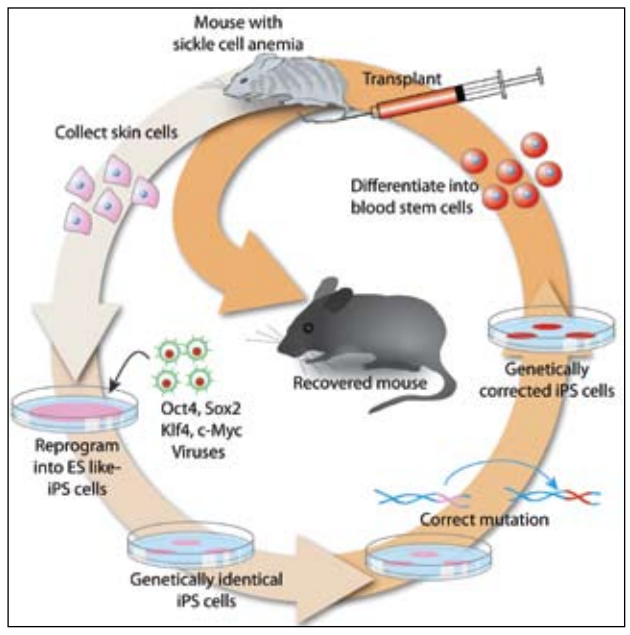


ILLUSTRATION / **TOM DiCESARE**

The cycle by which MIT/Whitehead scientists successfully treated mice with a human sickle-cell anemia disease trait, using a process that begins by directly reprogramming the mice's own cells to an embryonic-stem-cell-like state.

This work was funded in part the National Institutes of Health.

Laser beam 'fire hose' used to sort cells

System could enable new kinds of biological research

David Chandler
News Office

Separating particular kinds of cells from a sample could become faster, cheaper and easier thanks to a new system developed by MIT researchers that involves pushing up the cells with a laser beam "fire hose."

The system, which can sort up to 10,000 cells on a conventional glass microscope slide, could enable a variety of biological research projects that might not have been feasible before, its inventors say. It could also find applications in clinical testing and diagnosis, genetic screening and cloning research, all of which require the selection of cells with particular characteristics for further testing.

Joel Voldman, an associate professor in MIT's Department of Electrical Engineering and Computer Science, and Joseph Kovac, a graduate student in the department, developed the new system, which is featured as the cover story in the Dec. 15 issue of the journal Analytical Chemistry.

Present methods allow cells to be sorted based on whether or not they emit fluorescent light when mixed with a marker that responds to a particular protein or other compound. The new system allows more precise sorting, separating out cells based not just on the overall average fluorescent response of the whole cell but on responses that occur in specific parts of the cell, such as the nucleus. The system can also pick up responses that vary in how fast they begin or how long they last.

"We've been interested in looking at things inside the cell that either change over time or are in specific places," Voldman said. Separating out cells with such characteristics "can't be done with traditional cell sorting."

For example, if cells differ in how quickly they respond to a particular compound used in the fluorescent labeling, the new system would make it possible to "select out the ones that are faster or slower, and see what's different," said Voldman, who also has appointments in MIT's Research Laboratory of Electronics and the Microsystems Technology Laboratories.

"It seems like that should be easy, but it isn't," he said. There are other ways of accomplishing the same kind of cell separation, but they require complex and expensive equipment or are limited in the number of cells they can process.

The new system uses a simple transparent silicone layer bonded to a conventional glass microscope slide. Fabricated in the layer are a series of tiny cavities, or traps, in which cells settle out after being added to the slide in a solution. As many as 10,000 cells could be sorted on a single slide.

Looking through the microscope, either a technician or a computerized system can check each cell to determine whether it has fluorescence in the right area or at the right time to meet the selection criteria. If so, its position is noted by the computer. At the end of the selection process, all of the cells whose positions were recorded are levitated out of their traps using the pressure of a beam of targeted light from a low-cost laser. A flowing fluid then sweeps the selected cells off to a separate reservoir.

The laser levitation of the cells acts like "a fire hose pushing up a beach ball," Voldman said. But the laser method is gentle enough that the living cells remain viable after the process is complete, allowing further biological testing.

Voldman and Kovac are continuing to refine the system, working on making it easier to use and on improving its ability to keep samples sterile. Voldman said that unlike expensive separation techniques such as optical tweezers, the new system could cost only a few thousand dollars. As a result, it could be employed in a variety of biological research laboratories or clinical settings, not just in big, centralized testing facilities.

The research was funded by the National Institutes of Health and the Singapore-MIT Alliance; Kovac is supported by an ASEE National Defense Science and Engineering Graduate Fellowship.

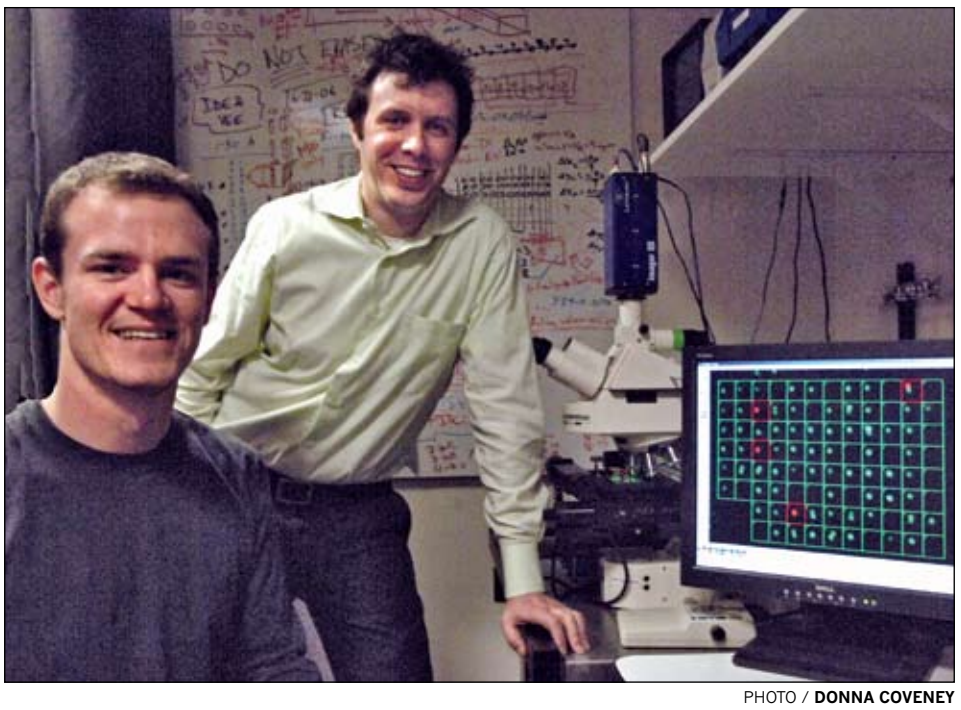


PHOTO / **DONNA COVENEY**

From left, graduate student Joseph Kovac and Joel Voldman, associate professor of electrical engineering and computer science, have developed an inexpensive and easy method for sorting cells for microscope examination, using microfluidics and a laser beam "firehose."

Heads or tails? Scientists ID gene key to regenerating flatworms

Cristin Carr
Whitehead Institute

When cut, a planarian flatworm can regenerate a new head, new tail or even entire new organisms from a tiny fragment of its body—a phenomenon that has puzzled researchers for more than 100 years.

Now, scientists in the lab of Peter Reddien, a member of the Whitehead Institute for Biomedical Research and an MIT assistant professor of biology, have discovered a gene required for proper decisions about head-versus-tail polarity in regenerating flatworms.

Their results, published in the Dec. 6 issue of Science online, could help explain how regenerating animals "know" what missing tissues to make.

"Evolution has selected for mechanisms that allow organisms to accomplish incredible feats of regeneration," and planaria offer a dramatic example, Reddien said. "By developing this model system to explore the molecular underpinnings of regeneration, we now have a better understanding of … the process."

The researchers used a technique called RNA interference to screen a group of genes known to be involved in animal development.

"We discovered that inhibiting the gene Smed-beta-catenin-1 caused animals to regenerate a head instead of a tail at the site of the wound," said Christian Petersen, Whitehead postdoctoral fellow and lead author on the paper. "This resulted in a worm that possessed two oppositely facing heads. Smed-beta-catenin-1 is the first gene found to be required for this regeneration polarity."

Genes very similar to Smed-beta-catenin-1 are found in animals ranging from jellyfish to humans, and they have been implicated in posterior tissue specification in frogs, sea urchins and many other animals.

See **GENES**
Page 6

PHOTO / **RUTH T. DAVIS**

Powering up

MIT's biggest array of solar panels (left) is expected to go into service this month, producing an estimated 50,000 kWhs annually in clean energy. That's equivalent to removing 65,000 pounds of carbon dioxide from the atmosphere, according to the Department of Facilities, which oversaw the project.

The installation on the roof of Building 57 (the Alumni Pool) is twice as large as all of MIT's other solar-panel installations—on buildings 14, W20 and N51—combined, said MIT Director of Utilities Randall Preston.

All of the energy produced by the array will feed into MIT's central electrical grid and will displace energy the Institute otherwise would have had to purchase. About a quarter of what is produced is meant to offset energy consumed by the new, efficient lighting system launched earlier this year atop the Great Dome, Preston said.

The installation cost approximately $365,000, around 40 percent of which came from a competitive grant awarded by the Massachusetts Technology Collaborative, a state agency that invests in renewable energy projects in the state. An MIT alum who wishes to remain anonymous also made a significant donation to the project.

Several other alumni played key roles: James (S.B. 1989) and Anita (S.B. 1990) Worden of Solectria Renewables significantly discounted the cost of the three 13kW inverters used in the project, while Richard Chleboski (S.B. 1987) of Evergreen Solar supplied the 216 Evergreen 180W solar panels used in constructing the array at a greatly reduced cost.

Finally, a small amount of funding came from the Utilities Budget within the Department of Facilities.

MITEI Energy Salon eyes opportunities

Google energy czar: 'Send us resumes!'

David Chandler
News Office

The challenges represented by energy—global warming, pollution, supply problems and security issues—also provide a wealth of exciting new opportunities for the United States, New England and MIT students and faculty.

That was the essence of the upbeat messages presented by panelists at last week's Energy Salon, sponsored by the MIT Energy Initiative (MITEI), which brought together representatives of energy-related businesses, from small local startups to giant global companies, along with researchers and students.

The marriage of industry and academia is "a critical piece of the solution to our energy problems," said Melanie Kenderdine, MITEI's associate director for strategic planning. Such interactions, she said, will help create "the next generation of energy innovators that we are so in need of."

"The most important resource for solving our energy problems isn't coal or oil or uranium, it's brainpower," said Richard Lester, director of the MIT Industrial Performance Center, who moderated the panel discussion at the MIT Faculty Club.

That's a resource that this region has in abundance. New England is working to "emerge as a global center of energy innovation," Lester said, and is well on its way: The region has more than 500 companies in the fields of renewable energy and efficiency, employing more than 14,000 people. Other regions "would give their eye teeth for what we have here," he said.

Kenan Sahin, CEO of the technology development firm Tiax LLC, addressed what he said were common myths about energy, especially the idea that energy is scarce. "Energy is abundant, it's everywhere. It's harnessing energy in a way that makes sense" that needs work, he said.

Many people focus on the beginning of the innovation process, he said—coming up with new ways of doing things. But that's actually the easy part, he said. "The heavy lifting is on the other side. Anybody can sit at a table and come up with an idea, and 15 years later it's still not available." The hard, unglamorous part is the implementation and maintenance of systems.

Robert Healy, Cambridge's city manager for the last 26 years, said local governments play a significant role both in creating a business environment that attracts new industries and in using their own purchasing power to help foster innovation. Cambridge, for example, has begun a $100 million program to improve energy efficiency in the city.

Ann Berwick, undersecretary of energy for Massachusetts, said the state is also taking the initiative to enhance the region's leadership in energy innovations. "Massachusetts has the brainpower to make the world our customer," she said. New legislation being finalized now should help to bring that about. Among other things, Gov. Deval Patrick has signed executive orders for various measures to reduce the commonwealth's greenhouse-gas emissions, including installing energy-efficient lighting, and increasing the installed base of photovoltaic panels by more than a hundredfold.

Dan Reicher, director of climate and energy initiatives for Google, said the company has made a serious commitment to not only improve its own energy use, but also to foster the development of innovative solutions that could be applied worldwide. The company has just announced a plan to invest in projects to bring the cost of renewable energy production down below the cost of comparable coal-burning facilities.

The company wants to build a gigawatt's worth of renewable energy plants within the next few years, Reicher said. "We face a simple economic reality: price matters," he said, so the company is focusing on making renewable solutions competitive in the marketplace.

Google hopes to help new energy companies cross the "valley of death" between an innovative prototype and wide-scale adoption that can bring about economies of scale, he said.

But the company is not doing this as charity, he stressed. "We think we can make money" by being a pioneer in new industries in solar-thermal, wind and geothermal energy, he said. Google will spend tens of millions of dollars in research and development, and hundreds of millions in building projects, to bring this about—and that represents an enormous opportunity for people with innovative ideas.

"We're looking for engineers and others to join us," Reicher said. "Send us resumes!"

HST faculty member wins BMW Science Award

Ali Khademhosseini has won first prize in the doctoral thesis category of the 2007 BMW Science Award competition. The award was presented to six young scientists, three in the doctoral and three in the bachelor's/master's thesis categories, in a Dec. 6 ceremony at the Deutsches Museum in Munich.

Khademhosseini, an assistant professor of medicine and health sciences and technology at the Harvard-MIT Division of Health Sciences and Technology, won for his 2005 dissertation, written under the supervision of Institute Professor Robert Langer. His research focused on miniaturizing tissue cultures with the help of microtechnology and nanotechnology.

Drawing on knowledge from the field of microsystems technology, Khademhosseini has succeeded in developing a new set of methods that allows scientists not only to miniaturize laboratory cell cultures, but also to control them with a high level of accuracy.

Micro-electromechanical systems, or MEMS for short, is the name given to the technology developed by the electronics industry that allows micro-switches, sensors and other control elements to be combined on a silicon chip. Khademhosseini has applied the principles of MEMS production processes to the field of biological research. His BioMEMS are miniaturized laboratories in microchip form, and enable him to monitor and control with great accuracy the micro-environment and growth conditions of cells.

"This approach allows us to research a large number of fundamental cell biology issues, and especially those that concern the complex construction of biological systems in tissue cultures," said Khademhosseini.

As this technology allows cell-growth conditions in the laboratory to be controlled very precisely, it might be used one day to ensure that stem cells become exactly the cell type required for a given therapeutic purpose.

The scientific award of the BMW Group is given out every two years and rewards outstanding graduate work produced by young academics worldwide. This year, the award-winning entries competed against a total of 241 submissions from 25 countries and 22 different fields for a 70,000 euro prize.

MIT, Chevron announce energy program

MIT and Chevron Corporation have announced an energy research program to develop remote, ultra-deepwater exploration and production technology.

The $5 million Chevron Remote and Ultra-deepwater Research Program will focus on developing the technologies required to access hydrocarbons in water depths up to and greater than 3,000 meters in a safe, cost-effective and environmentally friendly manner.

The program includes the sponsorship of two named fellowships—the Chevron Energy Fellows—and makes Chevron a Sustaining Member of the MIT Energy Initiative (MITEI), which was created to address global energy issues. The five-year program will also support MITEI's energy research seed fund to promote the development of a broad range of novel, innovative energy technologies and concepts across the Institute.

Ernest J. Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems and director of MITEI, said: "The need for affordable, sustainable energy is one of the greatest challenges of the 21st century. Conventional oil and gas supplies will play a critical role in meeting global energy demand for at least the next several decades, and advanced technologies are essential for producing these essential resources in environmentally sensitive ways."

"We look forward to working with MITEI both in the research effort and in developing engineering talent to deploy and operate the new technologies," said Don Paul, vice president and chief technology officer of Chevron Corporation.

GENES

Continued from Page 5

The researchers then went on to study the expression of a family of genes associated with regeneration. They found that different members of the Wnt gene family were active at different locations across the planarian's head-to-tail axis. These results suggest that Smed-beta-catenin-1 may be active in the tail region and inhibited in the head region by the regulated expression of these Wnt genes.

Additionally, the researchers found that Smed-beta-catenin-1 plays a role in ongoing cell replacement in planaria that have not been challenged to regenerate. When the gene was inhibited, these animal's tails began changing into heads.

The researchers hope that future work on regeneration polarity and Smed-beta-catenin-1 will yield a better understanding of the molecular mechanisms of regeneration.

DIGITALK: Where IT's at

This IAP, scope out IT

During IAP 2008, IS&T will sponsor several sessions to help you boost your computing IQ. Learn about the greening of information technology (IT) or how to secure sensitive data. Drop by the Adaptive Technology Open House, which will highlight magnification devices, Braille embossing, accessibility features in the Mac operating system, and alternative keyboard and pointing devices. If you're a programmer or system administrator, you may want to check out sessions on Mac OS X Leopard Server or ABAP, the SAP programming language. For a complete listing of IS&T offerings, visit student.mit.edu/iap/nsis.html.

IS&T launches wiki service

IS&T recently launched an enterprise wiki service for MIT. Wikis are web sites whose content can be edited by anyone who has permission; they enable online collaboration in a convenient, user-friendly and secure way. Wikipedia, the free encyclopedia at wikipedia.org, is the most famous example of a wiki.

The MIT Wiki Service offers simplified web-page editing and the ability to pull in content such as Google Maps. Integrated with MIT web certificates, Moira group management and Stellar class lists, the service features a wide range of permission options, including access for non-MIT users.

The iLabs Project, MIT Press and several courses are already using the service. If you're interested in setting up a wiki and would like to learn more, visit web.mit.edu/ist/topics/webpublishing/wiki.

MIT's DHL SmartShip

DHL is MIT's partner vendor for express shipments in the U.S. and abroad, with rates 30 to 40 percent lower than those for FedEx and UPS. MIT's DHL SmartShip web site adds convenience to the equation. You can create and print airbills online, including airbills for hazardous materials. You can also compare costs of shipping options, schedule pickups and track packages. The system uses your MIT certificate to authenticate you.

The first time you use SmartShip you'll need to set up a user profile. When you're ready to create an airbill, be sure to enter the correct address information and a valid MIT cost object. Note that DHL SmartShip is for MIT shipments only, not personal shipments.

At this time SmartShip does not work with Safari; Macintosh users can access the site with Firefox. On Windows, the recommended browser is Internet Explorer.

To use SmartShip, go to web.mit.edu/ecat/dhl. Be sure to check out the tips, including working with pop-up windows. If you have questions about the service, contact Catelin Matos in Procurement at cmatos@mit.edu. For technical help, contact the Computing Help Desk at computing-help@mit.edu.

Sleep mode saves energy

Today's personal computers come with advanced power management. These energy-saving features—standard in Windows and Macintosh operating systems—place inactive monitors and computers into a low-power usage "sleep" mode. A simple touch of the mouse or keyboard "wakes" the computer and monitor in seconds.

It's simple to customize these settings on your desktop or laptop. For instructions, see web.mit.edu/ist/initiatives/it-energy/pcconfig.html. For more guidelines about saving energy on personal computers, see the IT-Energy@MIT Initiative web page at web.mit.edu/ist/initiatives/it-energy.

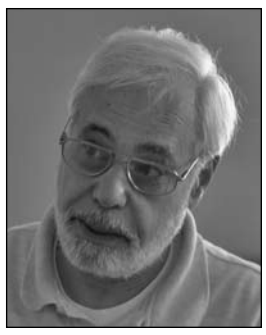
Note: Check with your local IT support provider before changing any configurations on your machine to avoid disrupting important services such as TSM backup. If you are unable to change your energy settings, they have likely been restricted by your local IT support.

Digitalk is compiled by Information Services and Technology.

IAP poetry course to mark 10th year

Pleasures of Poetry, the IAP literature course that offers poetry scholars and fans a daily hour-long reading and discussion session throughout January, celebrates its 10th year in 2008.

MIT literature and humanities faculty, staff and others select the poems and moderate the very wide-ranging discussions in a seminar setting. The course meets weekdays, 1:00 p.m. to 2:00 p.m., in 14E-304 from Jan. 7 to Feb. 1, 2008. All sessions are free and open to the public.



David Thorburn

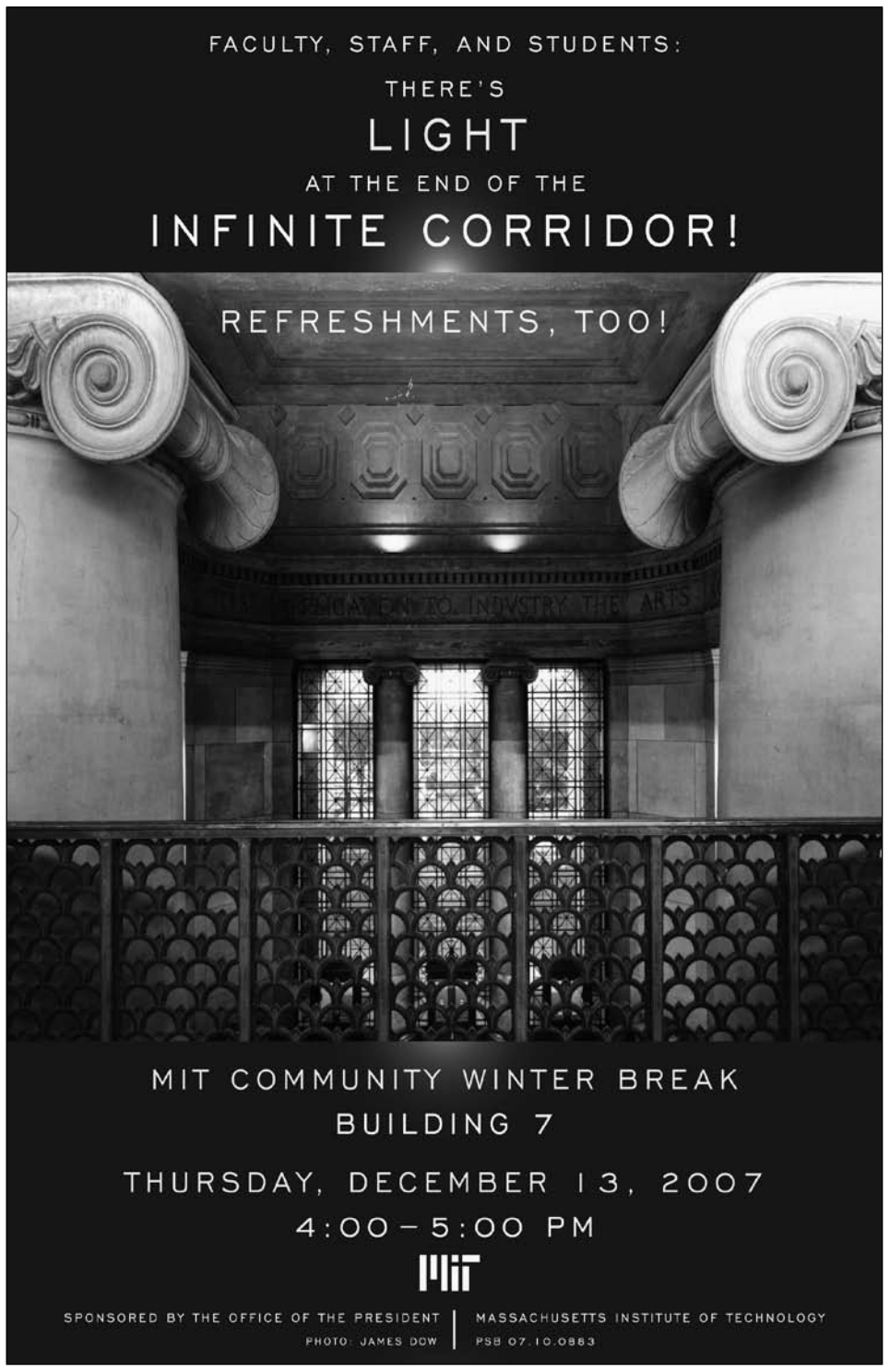
As in previous years, Pleasures of Poetry offers an eclectic mix of poetry by classic and contemporary figures including John Milton, Alfred, Lord Tennyson, and William Wordsworth, as well as Brenda Marie Osbey, Venus Khoury-Ghata and Grace Paley.

Literature Professor David Thorburn, director of the MIT Communications Forum, is the series' founder and organizer.

"I'm always surprised and inspired by the diversity and aesthetic energy of the poems our moderators choose," Thorburn said. "We're all volunteers, and each discussion leader selects poems that are personal favorites. This year there is a good selection of canonical English poems, as well as several provocative, unexpected texts. Our audiences are always a wonderful mix of students, faculty and staff from all parts of the Institute. I love the core message this activity sends every January: Poetry thrives at MIT."

For more information or to receive a packet of the poems, please e-mail Julie Saunders at juliec@mit.edu.

–Sarah H. Wright



ARTS

Continued from Page 1

new book "Sacred Games," the Boston jazz saxophonist and composer Charlie Kohlhase performing with the Festival Jazz Ensemble and the Shakespeare Ensemble's performance of "Titus Andronicus." There are also the ongoing public art tours, exhibitions at the List Visual Arts Center and the newly expanded MIT Museum, and many other cultural and art opportunities.

In addition to the messaging service and the revamped arts calendar, an arts blog, ARTALK, will soon be available through the popular MIT admissions web site. The blog will focus on the active arts scene at MIT as students, faculty and staff will discuss exhibitions or concerts they have attended, courses they are enrolled in, plays they have acted in or any other art-related activities or ideas worth blogging about.

"It's about getting the MIT perspective out there," said freshman Ken Haggerty, student coordinator of the arts blog and editor of Rune. "There are so many art events to go to and classes to take, and I'm hoping ARTALK will show not only how strong our art community is but also a distinctively MIT interpretation of the arts."

Lori Gross, director of arts initiatives and adviser to the associate provost, explained that the communications changes are part of a strategic push to emphasize the role of the arts at the Institute.

> *More and more of what we want to do online is now available through phones.*
>
> **Sonya Huang**
> MIT graduate student

At the same time as they advance the communication of arts information at MIT, Associate Provost Philip S. Khoury, Gross and other MIT arts proponents are examining the role of the arts at the Institute. A new mission statement, drafted this fall by the Creative Arts Council's communications subcommittee, seeks to position the essential role of the arts at MIT:

The arts at MIT are rooted in risk-taking and problem-solving, connecting creativity across boundaries and shaping a lifetime of exploration and discovery. The languages and processes of the arts, the mind and hand, menus et manus, are essential to rethinking the challenges of the 21st century to build a better society.

Look for the arts blog beginning in January. To learn more about the arts at MIT, go to web.mit.edu/arts.

'Wondrous Life' tops critics' fiction lists

"The Brief Wondrous Life of Oscar Wao," by Junot Díaz, associate professor in writing and humanistic studies, has been named best novel of the year by critics at Time and New York magazines, topping their influential "must-read" lists.

Time described the book as a "massive, heaving, sparking tragicomedy," while New York hailed its "miraculous balance" of comic-book plots and "honest, messy realism."

Díaz's novel was also cited among the best novels of 2007 by critics and reviewers at The Village Voice, The Washington Post, the Los Angeles Times and Publishers' Weekly.

A poll of more than 100 critics and authors also cited "Wondrous Life" as best fiction of the year. Initiated by the National Book Critics Circle, the poll surveyed new releases in fiction, nonfiction and poetry.

A round of critical praise greeted "Wondrous Life" when it was published in September: Book critic Michiko Kakutani of The New York Times described "Wondrous Life" as both a comic portrait of a lovesick second-generation Dominican geek and a harrowing meditation on public and private history.

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.

FOR RENT

Arlington: 2BR, 2BA, sunny 6th floor corner unit. Newly updated kitchen, bath, laundry, exercise room, function room. Heated garage. Bus 77, 79 to Harvard, Alewife Sta. $1600/mo. Avail. now. Call 339-368-1588 or 617-258-7372.

Milton: exceptional private home for rent. 10 rms: 5BR/2BA, eat-in kitchen, 2-car garage with playground, next to the Blue Hill reservation. Walk to parks, trails, subway, commuter rail and shops. $2900/mo. Call 617-785-6476 or e-mail feng@psfc.mit.edu.

FOR SALE

Lowrey Spinet Piano, approx. 10 yrs. old. Blond mahogany wood, good condition. $500 Call Ken or Gen at 978-250-1387.

1998 Camry LE in good condition. 203,000 miles w/oil changed every 3,500 miles; passes inspections easily. No major mechanical problems. $1,200 or best offer. Contact Dave at 781-981-4204.

Perfect Gift: MIT rocker (still in box). $200. Will deliver to MIT. Call Terry at 603-887-8231.

Just in time for the holidays! For sale at MIT Furniture Exchange. Pool table in great condition: $250. Kettler Fitnesscenter classic with additional accessories: $150. Contact Judy at fx@mit.edu.

PHOTO / **DONNA COVENEY**

Mechanical engineering graduate student Barry Kudrowitz, who teaches a toy product design course at MIT, began his design life building an Epcot theme park out of LEGOs. Here he is shown with some of his more recent creations.

Toy soldier: At play with Barry Kudrowitz, MIT toy designer

Sarah H. Wright
News Office

'Tis always the season for Barry Kudrowitz to think about toys.

A doctoral student in mechanical engineering, Kudrowitz specializes in toys: He plays with them; he designs them; and he pioneered MIT's first course in toy design, now in its third year.

Kudrowitz often gets asked to name his favorite toy, especially at this time of year: Who wouldn't want to know what might top an MIT toy expert's wish list?

"The toys I love usually fit into one of three categories: Toys that allow me to create freely; toys that are humorous, weird, gross or random; and toys that are elegantly designed and simple, like magnets," he said.

Kudrowitz, whose MIT office is lined with toy projects and toy parts, began his design life building an Epcot theme park out of LEGOs for childhood friends. He has already worked with big-name toy companies like Nerf and its owner, Hasbro.

He has also written extensively on toys and play: His 2006 MIT master's thesis explored new concepts for projectile toys, and his undergraduate thesis, completing his 2004 bachelor of science degree from the University of Central Florida, offered alternative forms of extreme thrill rides.

His Florida roots did much to inspire him, Kudrowitz said: He grew up near 20 theme parks—including eight major ones such as Epcot, Magic Kingdom and Universal—and to this day, theme parks are his favorite form of play.

"Storytelling is an important element in toy design, and I try to incorporate it into the toy class. Some theme-park attractions and interactive shows are the ultimate form of storytelling. They put you inside the story," he said.

Children get inside the story when they play with toys, Kudrowitz noted, but adults need more of a nudge, if they've lost the ability to immerse themselves in a fantasy world.

"Theme-park attractions get us to suspend our disbelief. The most serious of adults will flinch at the 100-foot dinosaur that swings down to eat you; they'll squirm when the 'rats' crawl around by your feet or cheer when you get rescued by the superhero," he said.

For Kudrowitz, suspension of disbelief—getting grown-ups to stop making sense—is a toy- and play-specialist's dream. So his doctoral dissertation focuses on design for entertainment.

"I'd like to research adult play; it seems to be an area that is not very well developed. Adults needs play, too. I want more options than poker and Scrabble," he commented.

Kudrowitz has worked on immersing people in play as a 2005 member of an MIT product design class and in a 2006 externship with 5-Wits, a Boston-based interactive entertainment company.

In the externship, the class worked on 5-Wits' Boston adventure, Tomb, which immerses adventurers in a dark Egyptian maze. In the design class, Kudrowitz worked on a 5-Wits show at the International Spy Museum in Washington, D.C., an interactive adventure in which participant-spies race to save the world from nuclear madness.

Kudrowitz and his team developed new special effects and plot elements for the show, Operation Spy. They also designed and prototyped an elevator simulator that features Kudrowitz's favorite inside-the-story experience.

Now part of the exhibit, their elevator is a stationary steel-grated room whose walls "scroll" up and down to make it appear to move and whose floor pulsates, thanks to an attached industrial vibrator. "With light and sound it seems very realistic," said Kudrowitz.

A scale model of the elevator sits on Kudrowitz's desk. "Basically, you're in a cage that shakes," he says, holding it up.

The little elevator is a case in point. By itself, it's got a dollhouse appeal. In Kudrowitz's hand, it's a story and it's a toy.

"A great toy is something that you always have out on the desk. It's something you can't wait to show the next person who walks into the room," he said.