Volume 52, Number 20
Wednesday, March 19, 2008

TechTalk
SERVING THE MIT COMMUNITY

Floating a big idea

MIT demonstrates pre-Columbian use of rafts to transport goods

David Chandler
News Office

Oceangoing sailing rafts plied the waters of the equatorial Pacific long before Europeans arrived in the Americas, and carried tradegoods for thousands of miles all the way from modern-day Chile to western Mexico, according to new findings by MIT researchers in the Department of Materials Science and Engineering. Details of how the ancient trading system worked more than 1,000 years ago were reconstructed largely through the efforts of former MIT undergraduate student Leslie Dewan, working with Professor of Archeology and Ancient Technology Dorothy Hosler, of the Center for Materials Research in Archaeology and Ethnology (CMRAE). The findings are being reported in the Spring 2008 issue of the Journal of Anthropological Research.

The new work supports earlier evidence documented by Hosler that the two great centers of pre-European civilization in the Americas—the Andes region and Mesoamerica—had been in contact with each other and had longstanding trading relationships. That conclusion was based on an analysis

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Professor of Archeology and Ancient Technology Dorothy Hosler, back left on the raft, helps row a raft built by four of her students in 2004. Leslie Dewan, standing, recently worked with Hosler to show how similar rafts carried goods through the Americas before the arrival of the Europeans.
PHOTO / **DONNA COVENEY**

PHOTO / **DONNA COVENEY**

Erik Demaine, left, the Esther and Harold Edgerton Associate Professor of Electrical Engineering, and his father, CSAIL visiting scientist Martin Demaine, model a couple of their sculptures in a Museum of Modern Art show titled 'Design and the Elastic Mind,' which runs until early May.

MIT@ MoMA ... and beyond

The art world turns to the Institute for its artists and creativity

Sarah H. Wright
News Office

MIT artists, designers and architects are filling some of New York's most prominent and competitive exhibition spaces this year with works that disrupt traditional distinctions among art, technology and performance.

Right now, four groups of MIT designers have works on exhibit at the prestigious Museum of Modern Art. A fifth will exhibit there this summer. The Whitney Biennial, renowned for distilling the best of the global cutting-edge in art, includes works by two MIT affiliates. The list goes on, with one-person MIT shows in smaller venues.

It all adds up to a new, dramatic presence on the global arts stage for MIT. Long a leader in applying technology to the world's problems,

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MIT TAKES MANHATTAN

Larry Sass and other Institute-affiliated artists have shows coming up: Find out where they'll be.

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Seven MIT research teams win Deshpande grants

Awarded $500K in total

The Deshpande Center for Technological Innovation at MIT today announced it is awarding $500,000 in grants to seven MIT research teams currently working on early stage discoveries. These projects have the potential to make a significant impact on our quality of life by revolutionizing disease therapies, micromanufacturing, wireless communications, web searching, semiconductors, drug discovery and hearing for the impaired.

Acting as a catalyst for innovation and entrepreneurship, the Deshpande Center awards both Ignition Grants and Innovation Grants each spring and fall that fund proof-of-concept explorations and validation for emerging technologies. "Providing funding and support to early stage research projects helps accelerate their transition from MIT labs to the marketplace and thus to our daily lives," said Leon Sandler, the center's executive director. "The 'innovation ecosystem' in Boston and beyond has been an immense support in this endeavor, too."

The spring 2008 grant recipients are:

- **A New Architecture for Highly Efficient Broadband RF Transceivers: Joel Dawson**. Very energy-efficient, high data rate transmitters for broadband wireless communications that will increase battery life in handsets and reduce heat generation in

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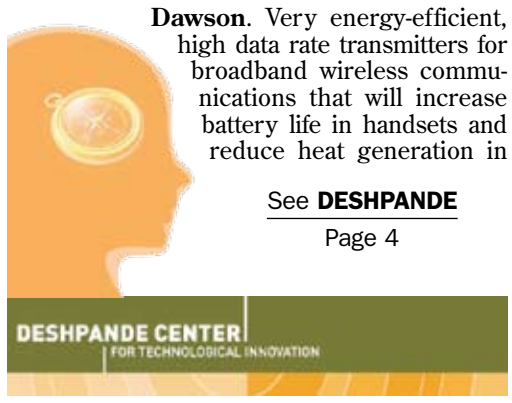

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A 'WONDROUS' HONOR
Junot Diaz wins top novel prize for his work 'The Brief Wondrous Life of Oscar Wao.'
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Book critics honor Díaz with top novel prize

Sarah H. Wright
News Office

MIT professor Junot Díaz has won the National Book Critics Circle 2007 award for fiction for his first novel, "The Brief Wondrous Life of Oscar Wao."

"I'm proud that the invented lives of a Dominican family could reach into so many hearts—proof positive that the particular is the universal," Díaz told the MIT News Office in an e-mail from Rome, where he is on a one-year fellowship in literature.

Junot Díaz

"I definitely could not have finished this novel without the support of my chair, James Paradis; my mentor, Kenneth Manning; and my former dean, Philip Khoury—and of course my wonderful, brilliant kooky students," added Díaz, who came to MIT in 2003 and is an associate professor in the Program in Writing and Humanistic Studies.

Paradis, Robert M. Metcalfe Professor of Writing and Humanistic Studies and head of the Program in Writing and Humanistic Studies, said the award indicates that Díaz's novel had resonated with a broad audience.

"He has appealed to a whole cross-section of critics and that's a very gratifying thing. We're thrilled that he won it. It's well-deserved—he's a writer for our times," Paradis said, adding that Díaz was an "excellent fit" with MIT.

"He's a terrific teacher and he's interested in a lot of the things MIT students are—computer games, popular culture, science fiction, for example—but also interested by serious writers like Faulkner," Paradis said.

"Oscar Wao" received glowing reviews when it was published by Riverhead Press in September 2007. At the time, Time magazine called Díaz's novel "astoundingly great," while book critic Michiko Kakutani of The New York Times said "Oscar Wao" had established Díaz as one of contemporary fiction's most distinctive and irresistible new voices.

Time and New York Magazine selected "Oscar Wao" as the best novel of 2007.

Díaz is also the author of a 1996 short story collection, "Drown." He has published work in The New Yorker, The Paris Review and Best American Short Stories.

Díaz was born in the Dominican Republic and moved to New Jersey with his parents when he was six. He received his BA from Rutgers and an MFA from Cornell.

Founded in 1974, the National Book Critics Circle has about 500 members. Past winners of the group's best novel award include E.L. Doctorow, John Updike and Toni Morrison.

No Tech Talk next week

Because of Spring Break, there will be no Tech Talk on Wednesday, March 26. The next Tech Talk will be published on April 2. For ongoing MIT news updates through the break, please go to the News Office web site, web.mit.edu/newsoffice/.

OBITUARIES

Jin Au Kong, renowned expert on electromagnetic waves, 65

Professor Jin Au Kong, an internationally renowned expert on electromagnetic waves who served on the faculty of the Department of Electrical Engineering and Computer Science for nearly 40 years, died unexpectedly last week of complications from pneumonia. He was 65.

Kong, who joined the MIT faculty in 1969, was chair of Area IV on Energy and Electromagnetic Systems in the Department of Electrical Engineering and Computer Science, and leader of the Research Laboratory of Electronics (RLE) Center for Electromagnetic Theory and Applications.

Jin Au Kong

Kong earned international acclaim for his work in electromagnetic wave propagation, radiation, scattering, inverse scattering and its applications in microwave remote sensing, geophysical exploration, and electromagnetic transmission and coupling in microelectronic integrated circuits. Recent research also included groundbreaking work on metamaterials, a new class of composites that exhibit extraordinary properties not readily observed in nature, and which show promise for a variety of novel optical and microwave applications.

Kong was unusually devoted to the generations of MIT students who learned and conducted research in his laboratories. In 1993, in a faculty profile interview in "RLE Currents," Kong was asked what advice he had for MIT students interested in electromagnetism. "You must be able to think on your feet. No one knows better than you about the problem you're working on," he answered. "Most important of all, do not restrict yourself to a narrow topic. Be prepared and open-minded in making contributions to seemingly unrelated topics. Cross-fertilization is an intellectually rewarding exercise."

He was awarded honorary doctorates by the University of Nantes and the University of Paris X-Nanterre, France, in 2006. At that time, RLE Director Jeffrey H. Shapiro, Julius A. Stratton Professor of Electrical Engineering, said, "Professor Kong has been one of the world leaders in his field for decades and continues to make fundamental contributions and advances in electromagnetic theory and applications. In addition, he has a remarkable degree of commitment to the enterprise of scholarship worldwide and to promoting excellence at MIT and beyond."

Kong was also president of The Electromagnetics Academy and dean of the Electromagnetics Academy at Zhejiang University. Over the years, he also served as a consultant to the New York Port Authority, Raytheon, Hughes Aircraft, Lockheed Missiles and Space, MIT's Lincoln Lab and Schlumberger-Doll Research. He served as a visiting scientist at the Lunar Science Institute in Houston, a visiting professor at the University of Houston, and a high-level consultant to the United Nations. Kong was the primary organizer of the Progress in Electromagnetics Research Symposium (PIERS), a key discussion forum for electromagnetic research. He was also editor-in-chief for the Wiley series on remote sensing, the Journal of Electromagnetic Waves and Applications (JEWA). Among his numerous awards are the S.T. Li Prize and the IEEE Geoscience and Remote Sensing Society's Distinguished Achievement Award (2000) and the IEEE Electromagnetics Award (2004). A fellow of IEEE and the Optical Society of America, he published more than 30 books on electromagnetic and more than 700 research papers and book chapters.

Born in Kiangsu, China, on Dec. 27, 1942, Kong was a seventy-fourth generation descendant of Chinese philosopher K'ung-Futzu, or Confucius. He received a BS in 1962 from the National Taiwan University in Taipei, Taiwan, and an MS in 1962 from the National Chiao Tung University in Hsinchu, Taiwan. He came to the United States in 1965 and obtained a PhD from Syracuse University, where he continued as a postdoctoral research engineer until 1969.

Kong passed away early Wednesday morning, March 12. He was in the hospital fighting a severe case of pneumonia before his health suddenly declined due to complications from his illness. He passed away peacefully, surrounded by his family. Kong leaves a wife, Wen Yuan Kong, lecturer in the Department of Mathematics at the University of Massachusetts, Boston, and their two children, Shing SB '94 and David SB '01, SM '04. David will also be receiving a PhD in Media, Arts and Sciences this year from MIT.

A public memorial service celebrating Kong's life and accomplishments will be held Saturday, March 22, at Douglass Funeral Home in Lexington, Mass. The visitation period will run from 1 p.m. to 3 p.m., followed by a memorial service from 3 p.m. to 5 p.m. A collection of pictures, videos and stories commemorating Kong will be on display during the memorial service; those who would like to add to this memorabilia may do so by sending submissions to ProfessorJAKong@gmail.com by Thursday, March 20.

In lieu of flowers, contributions to the Jin Au Kong Memorial Fund may be sent to 72 Hillcrest Ave., Lexington, MA 02420.

AWARDS & HONORS

Dean for Student Life **Larry G. Benedict** has been honored as a 2008 Pillar of the Profession by the National Association of Student Personnel Administrators Foundation.

The award, which was presented to Benedict at the annual NASPA Conference on Monday, March 10, honors members of the profession who are individuals of professional distinction, have served in leadership roles in NASPA and are recognized by colleagues, friends, students or student organizations for extraordinary service.

Dean Benedict will retire in June 2008, after three decades of work in higher education. He came to MIT as dean for student life in 2000 and has been instrumental in transforming the way the Institute approaches student life on campus.

With more than 11,000 members at 1,400 campuses, and representing 29 countries, NASPA is the largest professional association for student affairs administrators, faculty and graduate students.

Steven Tannenbaum, the Underwood-Prescott Professor of Toxicology in the Department of Biological Engineering and professor of chemistry, has been awarded the AACR-CICR Award for Outstanding Achievement in Chemistry in Cancer Research.

The award, established by the American Association for Cancer Research Chemistry in Cancer Research Working Group, honors novel and significant chemistry research that has led to important contributions to cancer research.

Tannenbaum's research has "advanced our knowledge of chemical carcinogenesis, the molecular epidemiology of cancer, and more recently, anti-cancer drug development and evaluation," according to the AACR. He will receive the award at the AACR annual meeting April 12-16 in San Diego; he will give an award lecture on Sunday, April 13.

Nelson Uhan, a PhD student at the Operations Research Center, won the annual George Nicholson Student Paper Competition, which is held annually to identify and honor outstanding student-written papers in the field of operations research and the management sciences.

NEWS YOU CAN USE

MIT's Lost and Found goes online

MIT has put the power of the Internet behind its Lost and Found, giving community members a chance to report lost property online and also view a list of items turned in to MIT Police.

Sergeant Cheryl Vossmer said the posting of lost and found data at http://web.mit.edu/cp/www/lost_found.htm has helped the process of returning items to their rightful owners. But several valuable items—including at least five Brass Rats—are still waiting to be claimed, she said.

The central Lost and Found is located at MIT Police Headquarters, Building W89, 301 Vassar St. Found items can be delivered to MIT Police Headquarters or to one of the police substations located in the basement of the Stata Center, Building 32-070-C, or the Student Center, W20-020C, between 9 a.m. and 2 p.m., Monday through Thursday. Community members who are unable to deliver items to any of these locations should call the MIT Police at 617-253-9753 and notify the officer to have the item picked up.

Anyone claiming lost and found property at the MIT Police must show positive identification such as an MIT ID card or a driver's license.

Found items are held for a minimum of 30 days; if unclaimed, they are eventually donated to a charitable organization.

Faculty meeting today

The monthly faculty meeting will be held today in the Stata Center, 32-141, from 3:30 p.m. until 5:30 p.m. The following items will be on the agenda:

- A vote to establish a permanent exploratory subject option for sophomores
- A vote for a Pass/D/Fail option for graduate students
- A discussion on tuition and financial aid for '08-'09
- A proposal to allow double majors
- A proposal to make the SB program in comparative media studies permanent
- A memorial resolution in honor of Professor J. Mark Schuster
- Remarks from the president
- Questions for the president, provost and chancellor

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MIT aims to search for Earth-like planets with Google's help

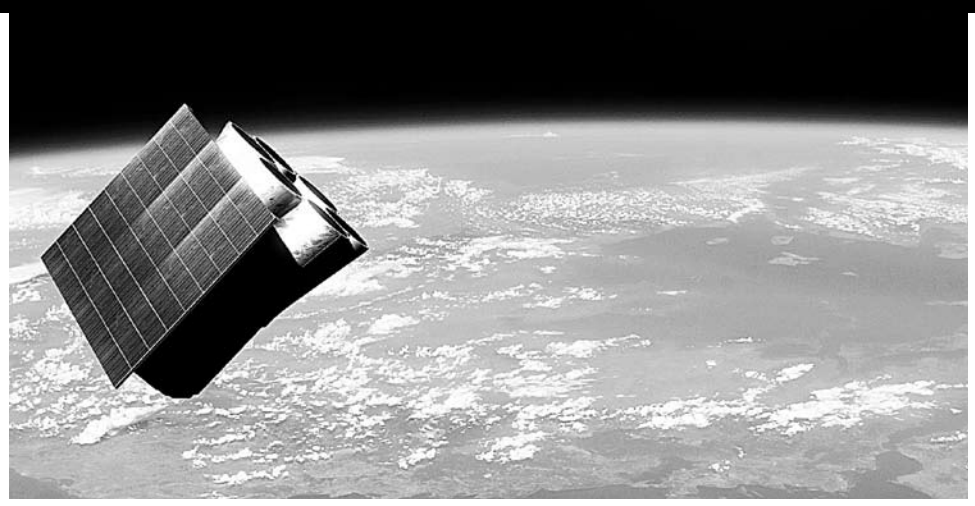


IMAGE / **COURTESY OF THE TESS TEAM**

An artist's representation of a proposed satellite that would be used to view distant planets. A planet is transiting a star in the background.

David Chandler
News Office

MIT scientists are designing a satellite-based observatory that they say could for the first time provide a sensitive survey of the entire sky to search for planets outside the solar system that appear to cross in front of bright stars. The system could rapidly discover hundreds of planets similar to the Earth.

Google, the Internet search powerhouse that in recent years has expanded to include mapping of the stars as well as the surfaces of the moon and Mars and which has an ongoing collaboration with NASA's Ames Research Center, provided a small seed grant to fund development of the wide-field digital cameras needed for the satellite. Because of the huge amount of data that will be generated by the satellite, Google has an interest in working on the development of ways of sifting through that data to find useful information.

Dubbed the Transiting Exoplanet Survey Satellite (TESS), the satellite could potentially be launched in 2012. "Decades, or even centuries after the TESS survey is completed, the new planetary systems it discovers will continue to be studied because they are both nearby and bright," says George R. Ricker, senior research scientist at the Kavli Institute for Astrophysics and Space Research at MIT and leader of the project. "In fact, when starships transporting colonists first depart the solar system, they may well be headed toward a TESS-discovered planet as their new home."

Most of the more than 200 extrasolar planets discovered so far have been much larger than Earth, similar in size to the solar system's giant planets (ranging from Jupiter to Neptune), or even larger. But to search for planets where there's a possibility of finding signs of living organisms, astronomers are much more interested in those that are similar to our own world.

Most searches so far depend on the gravitational attraction that planets exert on their stars in order to detect them, and therefore are best at finding large planets that orbit close to their stars. TESS, however, would search for stars whose orbits as seen from Earth carry them directly in front of the star, obscuring a tiny amount of starlight. Some ground-based searches have used this method and found about 20 planets so far, but a space-based search could detect much smaller, Earth-sized planets, as well as those with larger orbits.

This transit-detection method, by measuring the exact amount of light obscured by the planet, can pinpoint the planet's size. When combined with spectroscopic follow-up observations, it can determine the planet's temperature, probe the chemistry of its atmosphere, and perhaps even find signs of life, such as the presence of oxygen in the air.

The satellite will be equipped with six high-resolution, wide-field digital cameras, which are now under development. Two years after launch, the cameras—which have a total resolution of 192 megapixels—will cover the whole sky, getting precise brightness measurements of about two million stars in total.

Statistically, since the orientation of orbits is random, about one star out of a thousand will have its planets' orbits oriented perpendicular to Earth so that the planets will regularly cross in front of it, which is called a planetary transit. So, out of the two million stars observed, the new observatory should be able to find more than a thousand planetary systems within two years.

George Ricker

In fact, if a new estimate based on recent observations of dusty disks is confirmed, there might even be up to 10 times as many such planets.

Because the satellite will be repeatedly taking detailed pictures of the entire sky, the amount of data collected will be enormous. As a result, only selected portions will actually be transmitted back to Earth. But the remaining data will be stored on the satellite for about three months, so if astronomers want to check images in response to an unexpected event, such as a gamma-ray burst or supernova explosion, "they can send us the coordinates [of that event] and we could send them the information," Ricker says.

The team is still trying to secure the full funding to build, launch and operate the satellite, once the design work is completed this year. The Harvard-Smithsonian Center for Astrophysics and the Origins of Life Initiative, as well as the privately funded Las Cumbres Observatory Global Telescope Network, are already scientific partners with MIT on the TESS program.

Regardless of the funding for the satellite, the same wide-field cameras being developed for TESS could also be used for a planned ground-based search for dark matter in the universe—the invisible, unknown material that astronomers believe is more prevalent in space than the ordinary matter that we can see. Some of the unknown dark-matter particles must constantly be striking the Earth, and the plan is to train a bank of cameras inside tanks of fluid deep underground, to detect flashes of light produced by the impacts of these dark particles. Ricker's Kavli group is participating with MIT physics professor Peter Fisher's team in this new physics research initiative.

The electronic detectors for the new cameras are being developed in collaboration with MIT's Lincoln Laboratory. The lab's expertise in building large, highly sensitive detectors is a significant factor in making possible these unique cameras, which have no moving parts at all. If all goes well and funding is secured, the satellite could be launched in 2012 with NASA support, or even earlier with a private sponsor.

Ricker's MIT colleagues on the TESS project include Kavli Institute research scientist Roland Vanderspek, professors Sara Seager, Josh Winn, Adam Burgasser, Jim Elliot, Jacqueline Hewitt and several others.

MIT in the world

Bringing a bit of MIT to Africa

David Chandler
News Office

The west African country of Cameroon is one of the few to have been colonized by both England and France, and as a result English and French are both official languages of the independent nation today. But the French-speaking eastern and central regions dominate, accounting for about 80 percent of the nation's population of 18 million people.

MIT sophomore Edison Achelengwa, a student in electrical engineering and computer science, comes from the English-speaking minority in Cameroon, and spent his first year of college in the French-speaking University of Yaounde, in the nation's capital. Like many Cameroonians, he speaks both French and English, as well as a couple of the local languages.

This year, with a grant from the Public Service Center, he returned to his home country during IAP to work on installing MIT's OpenCourseWare on computers in that school as well as the University of Buea, the country's only English-speaking university. Though Open CourseWare is available through the Internet, most African universities, including these two, do not have Internet connections, so students would have to go out to an Internet café to access the material. By installing it on a local server, however, all 1,800 courses of the material became available to every computer on campus through a local-area network.

Getting the installation done proved to be more complicated than expected, and Achelengwa says he learned a great deal that he thinks will help him to make more progress on his next visit.

"It was a difficult experience," he says. Despite the fact that he had made arrangements in advance with faculty members at the two universities, he soon discovered that wasn't enough. Though the faculty had assured him that they would have a workstation prepared for him to install the courseware, "most of the administrators didn't know about it," he says, and getting approval from them to go ahead turned out to be difficult. "Knocking on doors, trying to explain what I was trying to do wasn't easy," he says.

In the end, after showing various faculty members and administrators a 10-minute video he had prepared to demonstrate how the system worked, he finally received the needed go-ahead to install the hard drive he had brought with him containing the OpenCourseWare material. Now, "it will become readily accessible" to the students there, he says, and the system is currently being evaluated by the school.

He had hoped to bring some computers to the school as well, but found out that the shipping costs outweighed the benefits of the donated hardware.

"The experience showed me a whole new, different face of my country," Achelengwa says. "A lot of Cameroonians are thirsty for knowledge, and they hold MIT in high esteem."

But the bureaucratic obstacles that delayed his work also taught him valuable lessons. "You can really be a blessing to people," he says, "but if you want to get something done, you really have to hit the right spot. Sometimes you have to go to the top."

Achelengwa hopes to return to Cameroon this summer to make MIT's OpenCourseWare available to other institutions around the country, and to evaluate its use in the two universities where he already installed it.

Achelengwa advises people who attempt such projects in developing countries to be persistent and not let difficulties deter them. "You can't always expect people to welcome you with open arms, even if you're doing something for them," he says. "Doing the right thing is never a bed of roses."

OCW, Elsevier offer free content from thousands of journals

In a move to encourage open education, MIT OpenCourseWare (OCW) and Elsevier have agreed to make available figures and text selections from any of the publisher's more than 2,000 journal titles for use on OCW.

As a result of this landmark agreement announced this month, select Elsevier content can now be included within the open-access OCW course materials to be freely downloaded, used and shared under a Creative Commons license. The Elsevier content includes up to three figures (including tables and illustrations) per individual article (or 10 per journal volume) and up to 100 words from a single text extract (or 300 words from a series of extracts).

"This is a great example of how publishers and institutions can work together to support the academic community, in this case by making it easier to use copyright works for academic purposes," said Mark Seeley, general counsel, Elsevier.

Elsevier publishes prestigious journals within the science and health fields, including Journal of Biomechanics, Cell, Journal of Structural Biology, Biomaterials, Polymer, and Planetary & Space Sciences. The full list is available at http://www.elsevier.com.

The agreement will significantly increase the richness of OCW materials, since many of the illustrations reduce the amount of time that professors, their staff and OCW staff would have otherwise spent searching and obtaining permissions for individual quotes and figures.

Cecilia d'Oliveira, acting executive director of OCW, said, "We hear from thousands of students, educators, and self-learners every day about how OCW materials have helped changed their lives. Offering additional resources to these people will make an even greater impact on open learning and education. We hope this agreement will inspire other publishers to join in these efforts to unlock knowledge and empower people around the world."

MIT Research DIGEST

Study sees mental link between drug price, effectiveness

A higher-priced medication with a brand name might work better than a generic version—even if the pills are exactly the same—simply because the patient thinks the expensive prescription should work better, according to a recently published MIT study.

The study—conducted by researchers including graduate student Rebecca Waber and Dan Ariely, the Alfred P. Sloan Professor of Behavioral Economics at MIT—involved 82 volunteers who were given identical placebos that were supposed to be a new pain medication. But the volunteers were told the pills had different costs, with some getting pills supposedly costing 10 cents, and some getting $2.50 pills.

Results of the study, which appeared in the March 5 issue of the Journal of the American Medical Association, showed that those who were told the pill cost more reported feeling less pain from a series of electrical shocks to the wrist. Those told the pill only cost 10 cents reported feeling more pain on average.

The results may impact how generic medication and brand-name medication are marketed, packaged and distributed, and help explain "the popularity of high-cost medical therapies over inexpensive, widely available alternatives," according to the study.

A tangled web: CEE researchers unravel the secrets of spider silk's strength

The strength of a biological material like spider silk lies in the specific geometric configuration of structural proteins, which have small clusters of weak hydrogen bonds that work cooperatively to resist force and dissipate energy, researchers in Civil and Environmental Engineering have revealed.

This structure makes the lightweight natural material as strong as steel, even though the "glue" of hydrogen bonds that hold spider silk together at the molecular level is 100 to 1,000 times weaker than the powerful glue of steel's metallic bonds or even Kevlar's covalent bonds.

Based on theoretical modeling and large-scale atomistic simulations implemented on supercomputers, this new understanding of exactly how a protein's configuration enhances a material's strength could help engineers create new materials that mimic spider silk's lightweight robustness. It could also impact research on muscle tissue and amyloid fibers found in brain tissue.

"Our hope is that by understanding the mechanics of materials at the atomistic level, we will be able to one day create a guiding principle that will direct the synthesis of new materials," said Professor Markus Buehler, lead researcher on the work.

In a paper published in the Feb. 13 issue of Nano Letters, Buehler and graduate student Sinan Keten describe how they used atomistic modeling to demonstrate that the clusters of three or four hydrogen bonds that bind together stacks of short beta strands in a structural protein rupture simultaneously rather than sequentially when placed under mechanical stress. This allows the protein to withstand more force than if its beta strands had only one or two bonds. Oddly enough, the small clusters also withstand more energy than longer beta strands with many more hydrogen bonds.

MIT researchers demonstrate protective role of microRNA

Genetic snippets linked to cancer are also key to embryonic cell development

Anne Trafton
News Office

Snippets of genetic material that have been linked to cancer also play a critical role in normal embryonic development in mice, according to a new paper from MIT cancer biologists.

The work, reported in the March 7 issue of Cell, shows that a family of microRNAs—short strands of genetic material—protect mouse cells during development and allow them to grow normally. But that protective role could backfire: The researchers theorize that when these microRNAs become overactive, they can help keep alive cancer cells that should otherwise die—providing another reason to target microRNAs as a treatment for cancer.

Discovered only a decade ago, microRNAs bind to messenger RNAs (mRNAs), preventing them from delivering protein assembly instructions, thereby inhibiting gene expression. The details of how microRNAs act are not yet fully understood.

"The scientific community is busy trying to understand what specific biological functions these microRNAs affect," said Andrea Ventura, lead author of the paper and postdoctoral associate in the Koch Institute for Integrative Cancer Research at MIT (formerly known as the Center for Cancer Research).

Ventura—who works in the laboratory of Tyler Jacks, director of the Koch Institute—and his colleagues studied the function of a family of microRNAs known as the miR-17~92 cluster.

Previous research has shown that the miR-17~92 cluster is overactive in some cancers, especially those of the lungs and B cells.

To better understand these microRNAs' role in cancer, the researchers decided to study their normal function. Knocking out microRNA genes and observing the effects can offer clues into how microRNA helps promote cancer when overexpressed.

They found that when miR-17~92 was knocked out in mice, the animals died soon after birth, apparently because their lungs were too small. Also, their B cells, a type of immune cell, died in an early stage of cell development.

This suggests that miR-17~92 is critical to the normal development of lung cells and B cells. In B cells, these microRNAs are likely acting to promote cell survival by suppressing a gene that induces cell death, said Ventura.

"Understanding why these things are happening provides important insight into how microRNAs affect tumorigenesis," he said.

The researchers theorize that when miR-17~92 becomes overactive in cancer cells, it allows cells that should undergo programmed cell death to survive.

Blocking microRNAs that have become overactive holds promise as a potential cancer treatment. Research is now being done on molecules that prevent microRNAs from binding to their target mRNA.

More work needs to be done to make these inhibitors into stable and deliverable drugs, but Ventura said it's possible it could be done in the near future.

The exact genes targeted by miR-17~92 are not known, but one strong suspect is a gene called Bim, which promotes cell death. However, a single microRNA can have many targets, so it's likely there are other genes involved.

The researchers also studied the effects of knocking out two other microRNA clusters that are closely related to miR-17~92 but located elsewhere in the genome.

They found that if the other two microRNA clusters are knocked out but miR-17~92 remains intact, the mice develop normally. However, if miR-17~92 and one of these similar clusters are removed, the mice die before birth, suggesting there is some kind of synergistic effect between these microRNA families.

Other MIT authors of the paper are Amanda Young, graduate student in biology; Monte Winslow, postdoctoral fellow in the Center for Cancer Research (CCR); Laura Lintault, staff affiliate in the CCR; Alex Meissner, faculty member at the Broad Institute of MIT and Harvard; Jamie Newman, graduate student in biology; Denise Crowley, staff affiliate at the CCR; Rudolf Jaenisch, professor of biology and member of the Whitehead Institute for Biomedical Research; Phillip Sharp, MIT Institute Professor; and Jacks, who is also a professor of biology.

The research was funded by the National Institutes of Health and the National Cancer Institute.

PHOTO / **DONNA COVENEY**

Researchers in MIT cancer researcher Tyler Jacks' lab have demonstrated the role of a family of microRNAs in normal embryonic development. Amanda Young, a graduate student of biology, shows a film to, from left, postdoc Monte Winslow, research technician Laura Lintault and postdoc Andrea Ventura.

DESHPANDE

Continued from Page 1

base stations.

- **Rapid Multiplexed Analysis for Molecular Diagnostics: Patrick Doyle.** A new method to perform multitarget bioassays using micro-particles that could enable clinical bedside diagnostics and easier, less-costly diagnosis of disease (renewal from spring 2007 grant round).
- **Digital Ear Canal Scanner: Douglas Hart.** An in-ear, 3-D digital scanner for custom-fitting hearing aids, resulting in better hearing for hearing-aid users.
- **Developing Novel Strategies to Arrest Biofilms: Susan Lindquist.** The development of novel therapeutic strategies to combat difficult-to-treat bacterial biofilm infections.
- **Gallium Nitride High-Electron Mobility Transistors: Tomás Palacios.** A new approach to the fabrication technology of gallium nitride semiconductors to reduce the cost and improve the performance of electronic products (renewal from spring 2007 grant round).
- **A Three-Dimensional Lithographic Microfabrication System: Peter So.** A 3-D, two-photon microfabrication system to rapidly build high-resolution microscale structures.
- **Integrating the Deep Web with the Shallow Web: Michael Stonebraker.** This project will provide sophisticated search capability for the "deep web" of pages dynamically generated from data entered into forms.

The Ignition and Innovation grants help recipients assess and reduce the technical and market risks associated with their innovations.

In addition to financial support, the Deshpande Center's network of entrepreneurs, venture capitalists and academic and legal experts helps recipients assess the commercial potential of their innovations and make decisions that accelerate progress toward the development of business plans or licensing strategies.

The Deshpande Center is part of the MIT School of Engineering and was established through an initial $20 million gift from Jaishree Deshpande and Desh Deshpande, the cofounder and chair of Sycamore Networks.

The Deshpande Center has provided approximately $8,700,000 in grants to 75 MIT research projects since 2002. Fourteen projects have spun out of the center as independent start-ups, having collectively raised more than $100 million in outside financing from investors.

MIT faculty interested in securing a Deshpande Center Ignition or Innovation Grant should submit a preproposal in May 2008 for the fall 2008 funding round. For more information on how to submit a pre-proposal, see: http://web.mit.edu/deshpandecenter/instructions.html.

Eyes on the stars, even under cloudy skies

David Chandler
News Office

PHOTO / **DONNA COVENEY**

Earth, Atmospheric and Planetary Sciences Professor Richard Binzel, and graduate student Cristina Thomas, are doing remote observing of asteroids using a NASA IRTF telescope in Hawaii that they are controlling from MIT. They are assisted by Paul Sears (on TV screen), a research associate in Hawaii.

Graduate student Cristina Thomas has been making observations of asteroids using a large NASA telescope in Hawaii, at least once a month for more than three years now. Doing this kind of astronomical research has traditionally required a lot of time and money for travel, but Thomas usually can get to the telescope just by walking down the hall.

Like dozens of students in Professor Richard Binzel's astronomy classes, Thomas gets to operate one of the world's leading infrared telescopes, perched 14,000 feet above sea level on the summit of Hawaii's extinct volcano Mauna Kea, without ever leaving the MIT campus.

NASA's Infrared Telescope Facility (IRTF), a three-meter telescope fitted with a variety of electronic cameras and spectrographs, is one of just a few in the world's prime astronomical locations that has been set up so that it can be controlled from anywhere in the world through a high-speed Internet connection. Astronomers anywhere can sit for hours in a convenient office and control the scope's motions with the click of a mouse, while watching the images it is capturing right on their computer monitors—just as they would do if they were on the mountaintop.

Actually controlling the huge scope is a complex bit of choreography, an interplay between a technician at the observatory in Hawaii, the student sitting in MIT's Green building and automated software that handles the finest-level autoguidance system.

Over a teleconferencing hookup, Dave, the technician in Hawaii, says the system is ready to go. Thomas clicks the "go" button on her monitor with a left-click of her mouse, and the display shows a black-and-white image of the star field. Thomas drags-and-drops a green box, using the mouse, so it is centered on the pinprick of light that is the target of this observing run—a tiny, faint asteroid. At that point, the autoguider takes over and keeps the object centered in the field.

Except that occasionally it doesn't. A brief blurring of the light because of air turbulence, or a wisp of cloud passing in front of the speck of light, has caused the autoguider to lose track. Thomas has to manually restart the process, and the autoguider takes over again.

This slow, tedious process can go on for 12 hours, starting at about midnight and running until noon (these are the nighttime hours in Hawaii, because of the difference in time zones). It may not be glamorous work, but it's a remarkable privilege for these students to be getting much time on one of the world's major telescopes.

In this case, their work may even help to save this planet from the risk of a devastating impact by a wayward chunk of space rock—the kind of disaster that the dinosaurs never saw coming, 65 million years ago. If an asteroid is ever found on a collision course with Earth, the best way of responding to the threat may depend on knowing what type of asteroid it is—whether it's a solid chunk of metal, or a crumbly mass of rocky debris.

Binzel and his students have been studying the composition of asteroids by training the IRTF telescope (and others) on them one by one, using spectrographs attached to those scopes to split the light into a spectrum that can reveal details of the object's composition. It's slow and tedious work but somebody's got to do it, for the sake of the planet's future.

Binzel, who has been working on getting spectra of asteroids for more than two decades, has secured regular observing time on the Hawaiian telescope that adds up to about one full night per month. Usually Binzel runs some of the observations himself, but his students get to do most of it, building up an impressive base of experience that can form the basis of an original thesis. Each night, they might manage to check off 20 asteroids from their list of potential targets.

Other students at Boston University, Harvard and other institutions also get to spend some time using the telescope every year, Binzel says, using similar control rooms set up on their campuses. In fact, it's possible to display the real-time images from any computer with a high-speed Internet connection. For example, Binzel was recently in Paris controlling the telescope from a similar setup and was able to send live images of a storm on Jupiter to an astronomer who was giving a talk at a conference in Athens.

Surprisingly few telescopes are equipped for this kind of remote observing, Binzel says. To share the benefits of the rare privilege, Binzel invites students in every class he teaches to take part in the observations, and dozens of them have taken advantage of the opportunity over the last few years.

The setup works best for observing programs like his, where the same types of objects are observed over and over, month after month, Binzel says. "If you're doing something new every time, there's a good reason to be there at the observatory, in case you need to adjust the experiment," he says.

For those students who are involved in a serious observing project—such as Thomas' thesis project on asteroid compositions—bINZEL feels it's important to give them a chance to go to the observatory at least once. "It gives them a chance to see the entire operation," he says, so they can better understand what's going on when they later control the scope from on campus.

"It's an incredibly useful tool" for teaching astronomy, he says. "But you have to apply it correctly."

Author-illustrator Macaulay to speak at MIT April 1

Sarah H. Wright
News Office

David Macaulay, the acclaimed illustrator and author whose books, especially "The Way Things Work," animate the overlap between art and engineering, will discuss how he works in a free public lecture, "Finding Ideas, Making Books and Visualizing Our World," to be held at 6:30 p.m. Tuesday, April 1, in Kirsch Auditorium.

"Macaulay's work resonates with MIT's ethos of innovation and advancing knowledge. His work cuts across many disciplines; his visit will appeal to people across our community," said Deborah Fitzgerald, Kenan Sahin Dean of the School of Humanities, Arts, and Social Sciences.

Macaulay, 61, has dissected the building methods used in cathedrals in the Middle Ages, in New England mills and in Turkish mosques, down to each nut and bolt. He has illustrated a major new book on human anatomy, "The Way We Work," to be published later this year.

Winner of a 2006 MacArthur "genius" Fellowship, Macaulay has received the Bradford Washburn Award, presented by Boston's Museum of Science to an outstanding contributor to science, the Caldecott Medal, an American Institute of Architects Medal, and the Boston Globe-Horn Book Award, among many other awards.

Macaulay's lecture is hosted by the Program in Writing and Humanistic Studies and the Graduate Program in Science Writing and sponsored by the School of Humanities, Arts, and Social Sciences (SHASS), the School of Engineering, the School of Science and the School of Architecture and Planning.

In anticipation of his MIT talk, Macaulay described his way of working as not quite mens et manus (mind and hand), but one that ping-pongs between the two.

"My projects begin as idea fragments that may be drawn, literally and figuratively, from an experience, visual image or text. The first physical manifestation appears either in sketchbooks or on really cheap tracing paper and is always a combination of often-indistinguishable words and scribbles," he wrote in an e-mail from Vermont, where he lives.

RAFTS

Continued from Page 1

of very similar metalworking technology used in the two regions for items such as silver and copper tiaras, bands, bells and tweezers, as well as evidence of trade in highly prized spondylus-shell beads.

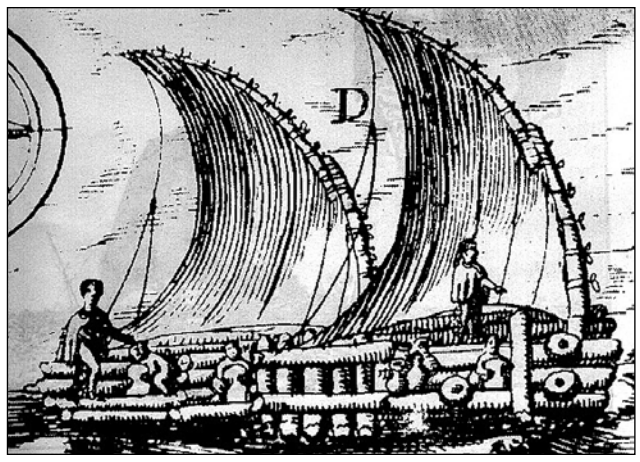
Early Spanish, Portuguese and Dutch accounts of the Andean civilization include descriptions and even drawings of the large oceangoing rafts, but provided little information about their routes or the nature of the goods they carried.

In order to gain a better understanding of the rafts and their possible uses, Dewan and other students in Hosler's class built a small-scale replica of one of the rafts to study its seaworthiness and handling, and they tested it in the Charles River in 2004. Later, Dewan did a detailed computer analysis of the size, weight and cargo capacity of the rafts to arrive at a better understanding of their use for trade along the Pacific coast.

"It's a nontrivial engineering problem to get one of these to work properly," explained Dewan, who graduated last year with a double major in nuclear engineering and mechanical engineering. Although the early sketches give a general sense of the construction, it took careful study with a computerized engineering design program to work out details of dimensions, materials, sail size and configuration, and the arrangement of centerboards. These boards were used in place of a keel to prevent the craft from being blown to the side, and also provided a steering mechanism by selectively raising and lowering different boards from among two rows of them arranged on each side of the craft.

Although much of the raft design may have seemed familiar to the Europeans, some details were unique, such as masts made from flexible wood so that they could be curved downward to adjust the sails to the strength of the wind, the centerboards used as a steering mechanism, and the use of balsa wood, which is indigenous to Ecuador.

Dewan also analyzed the materials used for the construction, including the lightweight balsa wood used for the hull. Besides having to study the aerodynamics and hydrodynamics of the craft and the properties of the wood, cloth and rope used for the rafts and their rigging, she also ended up delving into some biology. It turns out that one crucial question in determining the longevity of such rafts had to do with shipworms—how quickly and under what conditions would they devour the rafts? And were shipworms always present along that Pacific coast, or were they introduced by the European explorers?



An early 17th-century sketch of a raft by the Dutch envoy Joris von Spilbergen in 'Speculum Orientalis Occidentalis que Indiae Navigation.'

Shipworms are molluscs that can be the width of a quarter and a yard long. "Because balsa wood is so soft, and doesn't have silicates in it like most wood, they are able to just devour it very quickly," Dewan said. "It turns into something like cottage cheese in a short time."

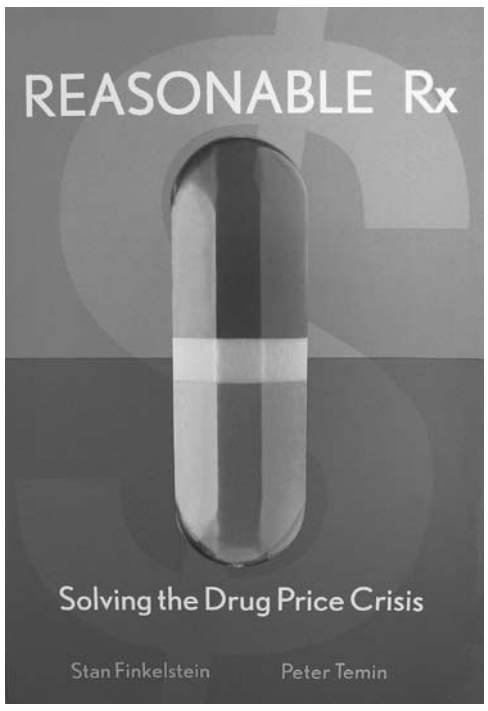
That may be why earlier attempts to replicate the ancient rafts had failed, Dewan said. After construction, those replicas were allowed to sit near shore for weeks before the test voyages. "That's where the shipworms live," Dewan said. "One way to avoid that is to minimize the amount of time spent in harbor."

Dewan and Hosler did a simulation of the amount of time it would take for shipworms to eat one of the rafts and concluded that with proper precautions, it would be possible to make two round-trip voyages from Peru to western Mexico before the raft would need replacing.

The voyages likely took six to eight weeks, and the trade winds only permit the voyages during certain seasons of the year, so the travelers probably stayed at their destination for six months to a year each trip, Dewan and Hosler concluded. That would have been enough time to transfer the detailed knowledge of specific metalworking techniques that Hosler had found in her earlier research.

While Hosler's earlier work had shown a strong likelihood that there had been contact between the Andean and Mexican civilizations, it took the details of this new engineering analysis to establish that maritime trade between the two regions could indeed have taken place using the balsa rafts. "We showed from an engineering standpoint that this trip was feasible," Dewan said. Her analysis showed that the ancient rafts likely had a cargo capacity of 10 to 30 tons—about the same capacity as the barges on the Erie canal that were once a mainstay of trade in the northeastern United States.

Hosler said the analysis is "the first paper of its kind" to use modern engineering analysis to determine design parameters and constraints of an ancient watercraft and thus prove the feasibility of a particular kind of ancient trade in the New World. And for Dewan, it was an exciting departure from her primary academic work. "I just loved working on this project," she said, "being able to apply the mechanical engineering principles I've learned to a project like this, that seems pretty far outside the scope" of her work in nuclear engineering.



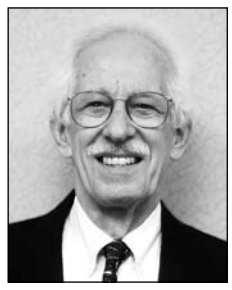
Solving the drug price crisis

Institute experts' new book 'Reasonable Rx' looks to solve prescription pricing problems

Sarah H. Wright
News Office

The mounting U.S. drug price crisis can be contained and eventually reversed by separating drug discovery from drug marketing and by establishing a nonprofit company to oversee funding for new medicines, according to two MIT experts on the pharmaceutical industry.

Stan Finkelstein, MD, senior research scientist in MIT's Engineering Systems Division, and Peter Temin, Elisha Gray II Professor of Economics, present their research and detail their proposal in their new book, "Reasonable Rx: Solving the Drug Price Crisis," published by Financial Times Press.


Peter Temin

Finkelstein and Temin address immediate national problems—the rising cost of available medicines, the high cost of innovation and the 'blockbuster' method of selecting drugs for development—and predict worsening new ones, unless bold steps are taken.

"Drug prices in the United States are higher than anywhere else in the world. Right now, the revenues from those drugs finance research and development of new drugs. We propose to reduce prices, not at the expense of innovation, but by changing the way innovation is financed," said Temin, also the author of "Taking Your Medicine: Drug Regulation in the U.S."

"Nationally, if we keep the current structure, in 50 years only hedge-fund managers will be able to afford prescription drugs. Drug development will focus on therapies for those small groups of people who can pay a thousand dollars a pill. With income distribution widening and insurance carriers already refusing some coverage, this would be a disaster," Temin said.

"Prescription drugs have been left out of previous efforts to reform the delivery of health care. New initiatives to expand coverage must include a plan to reduce the high cost of drugs," Finkelstein added.

The book, which draws on the researchers' expertise in the realms of medicine and economics, proposes eliminating the linkage between drug prices and the cost of drug discovery while financing innovation and addressing the needs of society.

Their first bold step is conceptual, recognizing that we all have a critical stake in the products of pharmaceutical research.

Next, drawing on recent history, they propose dividing drug companies into drug discovery/development firms and drug marketing/distribution firms, just as electric utility firms were separated into generation and distribution companies in the 1990s.

Following the utility model, Finkelstein and Temin propose establishing an independent, public, nonprofit Drug Development Corporation (DDC), which would act as an intermediary between the two new industry segments—just as the electric grid acts as an intermediary between energy generators and distributors.

The DDC also would serve as a mechanism for prioritizing drugs for development, noted Finkelstein.

"It is a two-level program in which scientists and other experts would recommend to decision-makers which kinds of drugs to fund the most. This would insulate development decisions from the political winds," he said.

Finkelstein and Temin's plan would also insulate drug development from the blockbuster mentality, which drives companies to invest in discovering a billion-dollar drug to offset their costs.


Stan Finkelstein

An example of the blockbuster mentality is developing a new drug for hypertension, one that varies only slightly from those already on the market but can bring in huge profits if aggressively marketed.

For Finkelstein, a physician, and Temin, an economist, societal needs for medicines are swiftly extending beyond national boundaries: Diseases affecting the developing world—afflicting people too poor to make drug development attractive for businesses—will soon affect health inside the United States.

"Global travel and climate change both require that U.S. drug development and innovation policy rethink the way drugs are developed, and for whom. Air travel, migrations, a global workforce—all these mean unusual diseases could become usual here," Temin noted.

Climate change also may affect which drugs their proposed DDC would select for funding.

"Especially in the southern states, tropical diseases are likely to increase with global warming, and people will need treatments for them. In our plan, the DDC would encourage research in advance of the market—and, we hope, in advance of disaster," he said.

> *We propose to reduce prices, not at the expense of innovation, but by changing the way innovation is financed.*
>
> **Peter Temin, Elisha Gray II Professor of Economics**

MIT tests unique approach to fusion power

Mimicking Earth's magnetic field in a giant thermos bottle

David Chandler
News Office

An MIT team has successfully tested a novel reactor that could chart a new path toward nuclear fusion, which could become a safe, reliable and nearly limitless source of energy.

After 10 years of design, construction and testing, the reactor achieved full operation for the first time last November. Some of the equipment used to monitor its performance wasn't working then, so another test run scheduled for this week is expected to produce data needed for the first formal report on the experimental results.

Fusion—the process that provides the sun's energy—occurs when two types of atoms fuse, creating a different element (typically helium) and releasing energy. The reactions can only occur at extremely high temperatures and pressures. Because the material is too hot to be contained by any material, fusion reactors work by holding the electrically charged gas, called plasma, in place with strong magnetic fields which keep it from ever touching the walls of the device.

The new reactor, called the Levitated Dipole Experiment, or LDX, reproduces the conditions necessary for fusion by imitating the kind of magnetic field that surrounds the planets Earth and Jupiter. A joint project by MIT and Columbia University, it consists of a supercooled, superconducting magnet about the size and shape of a large truck tire. When the reactor is in operation, this half-ton magnet is levitated inside a huge vacuum chamber, using another powerful magnet above the chamber to hold it aloft.

The advantage of the levitating system is that it requires no internal supporting structure, which would interfere with the magnetic field lines surrounding the donut-shaped magnet, explains Jay Kesner of MIT's Plasma Science and Fusion Center, joint director of LDX with Michael Mauel of Columbia. That allows the hot, dense electrically charged gas, or plasma, inside the reactor to flow along those magnetic field lines without bumping into any obstacles that would disrupt it (and the fusion process).

To produce a sustained fusion reaction the right kinds of materials must be confined under enormous, pressure, temperature and density. The "fuel" is typically a mix of deuterium and tritium (known as a D-T cycle), which are two isotopes of hydrogen, the simplest atom. A normal hydrogen atom contains just one proton and one electron, but deuterium adds one neutron, and tritium has two neutrons. So far, numerous experimental reactors using different methods have managed to produce some fusion reactions, but none has yet achieved the elusive goal of "breakeven," in which a reactor produces as much energy as it consumes. To be a practical power source, of course, will require it to put out more than it consumes.

If that can be achieved, many people think it could provide an abundant source of energy with no carbon emissions. The deuterium fuel can be obtained from seawater and there is a virtually limitless supply.

Most fusion experiments have been conducted inside donut-shaped (toroidal) chambers surrounded by magnets, a design that originated in the Soviet Union and is called by the Russian name Tokamak. MIT also operates the most powerful Tokamak reactor in the United States, the Alcator C-mod, which is located in the same building as the new LDX reactor. Tokamaks require a large number of magnets around the wall of the torus, and all of them must be working properly to keep the plasma confined and make fusion possible.

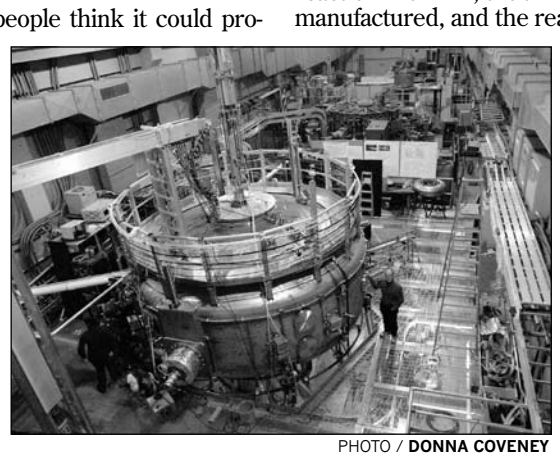


PHOTO / **DONNA COVENEY**

Senior research scientist Jay Kesner stands by the now-operational LDX fusion reactor, in which an experiment is about to be run.

The new approach to fusion being tested in the LDX is the first to use the simplest kind of magnet, a dipole—one that has just two magnetic poles, known as north and south, just like the magnetic fields of Earth and Jupiter. Tokamaks and other fusion reactor designs use much more complex, multi-poled magnetic fields to confine the hot plasma.

Unlike the Tokamak design, in which the magnetic field must be narrowed to squeeze the hot plasma to greater density, in a dipole field the plasma naturally gets condensed, Kesner explains. Vibrations actually increase the density, whereas in a Tokamak any turbulence tends to spread out the hot plasma.

The renowned physicist Richard Feynman once compared confining a plasma inside the magnetic field in a Tokamak to "trying to hold Jell-O with rubber bands," says LDX chief experimentalist Darren Garnier of Columbia. "It's the difference between pulling and pushing." Whereas the Tokamak's magnetic field tries to push the plasma in from the outside, "we have the field lines on the inside, pulling on the plasma," which is inherently more stable, he says.

Another potential advantage of the LDX approach is that it could use a more advanced fuel cycle, known as D-D, with only deuterium. Although it's easier to get a self-sustaining reaction with D-T, tritium doesn't exist naturally and must be manufactured, and the reaction produces energetic neutrons that damage the structure. The D-D approach would avoid these problems.

The LDX magnet has coils made of superconducting niobium-tin alloy, which loses all electrical resistance when cooled below about 15 degrees Kelvin; in the device, it is cooled to 4 degrees Kelvin—4 degrees above absolute zero, or minus 269 degrees Celsius, a temperature that can only be achieved by surrounding the coils with liquid helium. This is the only superconducting magnet currently used in any U.S. fusion reactor.

When in full operation, the frigid magnet, contained in a double-walled vessel that is essentially a large thermos bottle, is surrounded by plasma heated to millions of degrees Celsius. Garnier says that in full operation, the system is quite literally a snowball in hell.

Besides providing data that might someday lead to a practical fusion reactor, the experimental device could provide important lessons about how planetary magnetic fields work, which is still poorly understood. So the experiment is of great interest to planetary physicists as well as to energy researchers.

Keeping the huge magnet levitated to just the right height requires a feedback system that constantly monitors its position, using eight laser beams, and then adjusts the power of the lifting magnet accordingly. "That was tricky to develop," Garnier says, and in early experiments "we did drop it a couple of times." Fortunately, they had designed the structure with a spring-mounted lifter under the magnet, used to lift it into its starting position, that could absorb the falling weight without damage.

The work is funded by the U.S. Department of Energy.

Folding art and science

MIT students showcase origami at annual exhibit

Patrick Gillooly
News Office

At MIT, origami is more than just art—it's a blend of the ancient Japanese paper-folding tradition with scientific principles that make it possible. There's no place that is more apparent this month than at the Weisner Student Art Gallery, where entries in the annual student origami contest are on display.

Now in its sixth year, the competition blends the ancient art with its mathematical and scientific background, according to one of the competition's judges, Professor Erik Demaine.

"What's great about an exhibit like this is you get to appreciate science from a purely visual point of view," said Demaine, the Esther & Harold Edgerton Associate Professor in the Department of Electrical Engineering and Computer Science. "It is one way of expressing the beauty of science."

Demaine said the competition gives students the opportunity to branch out and see realistic applications of work they do in class.

"They get to experience the blending of (art and science)," he said. "Not just do their science, not just do their art."

Demaine, who studies origami mathematically and algorithmically, judged the competition alongside graduate student Brian Chan; MIT alumni Elsa Chen SB '89, Anne LaVin SB '85 and Jeannine Moseley PhD '85; and Martin Demaine, a visiting scientist in CSAIL.

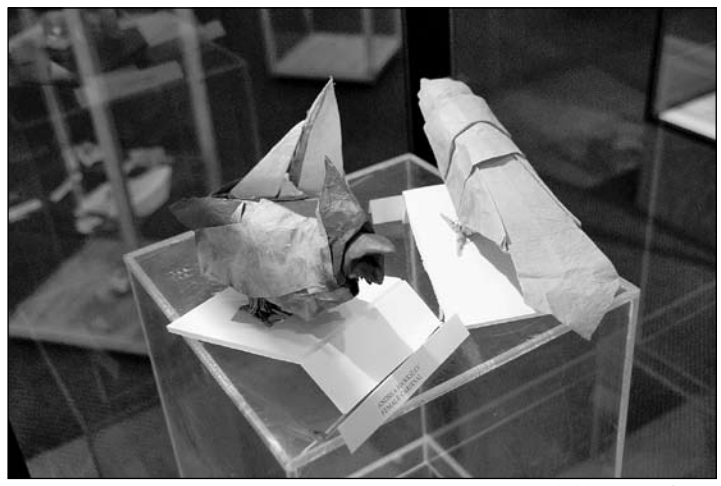
About a dozen-plus entries are now on display—and will be 24 hours a day through March 31.

The students participating in the competitions included both undergraduate and graduate students—and offered a wide variety of takes on origami, from the intricate to the intriguing.

"Female Cardinal," an original design by EECS graduate student Andrea Hawksley, employed a technique where Hawksley affixed one piece of red paper to the back of a piece of brown paper to achieve the color scheme needed for her bird, Demaine said. Other artwork used creative—though unconventional—paper, including one made out of a schematic printout of an MIT building.

The top winner, "Butterfly" by Jason Ku, a senior in mechanical engineering, was folded precisely "so that the legs come out at the right place … the antennae come out at the right place," Demaine said.

The competition was cosponsored by the Office of the Arts/Student & Artist-in-Residence Programs and the MIT Japan program. For more information, visit http://web.mit.edu/spair/origami.html.



PHOTOS / **BRIAN CHAN**

ABOVE: 'Female Cardinal' by EECS graduate student Andrea Hawksley

BELOW: 'Modular #2' by junior Xiao Xiao

The winners of this year's competition were:

- **Best Original Design:** "Butterfly," by Jason Ku '09
- **Best Technical Folding:** "Faerie," an original design by Jason Ku
- **Best MIT Themed:** "Beaver #3," an original design by graduate student Andrea Hawksley
- **Best Use of Paper:** "Female Cardinal," an original design by Andrea Hawksley
- **Best Color Change:** "Sailboat," an original design by Andrea Hawksley
- **Best New Take on a Traditional Technique:** "Connected Cranes (brown)," by Pei Lin Ren '11
- **Best Miniature:** "Crane on Snowflake," by Pei Lin Ren '11
- **Best Modular:** "#3," folded by Xiao Xiao '09
- **Honorable Mention, Modular:** "Colliding Suns," a double icosahedron by graduate student Joel Lewis
- **Best Simple Model:** "Green Heart," by graduate student Yuan Gong

HR@Your Service

Three things you should know about your benefits

#1: MIT has a backup child-care and elder-care program.

Maybe this has happened to you. Your child's day-care center is closed on a holiday that you have to work. You can't reschedule an important meeting that day and your backup provider is busy. Help is on the way! All benefits-eligible MIT employees and postdoc fellows can access backup childcare referrals through Parents in a Pinch Inc. This program provides referrals to screened and trained in-home caregivers when temporary care is needed to cover the work time of the employee. Childcare providers are available to come to your home, office or other meeting place.

In addition, backup elder care providers are also offered. Screened and trained backup elder providers can offer companionship, meal preparation, light housekeeping, prompts for medications or can accompany an elder to a doctor's appointment. Elder-care providers are available to come to your home or the elder's. They are also available to provide for spouses, partners, relatives—or you. And you can also get help with long-distance elder-care arrangements.

MIT participants can request up to 10 child-care and/or elder-care referrals annually and do not pay any registration or placement fees, only the caregiver fee, which is $15 per hour. For elder care only, participants reimburse the round-trip transportation costs of $0.50 per mile, up to a maximum of $20 per day. Care is available on short notice at any time, day or night, any day of the week, but you need to preregister for this service through the Center for Work, Family and Personal Life; you may complete the preregistration form online through links on the Center's web site: hrweb.mit.edu/worklife. Please contact the Center at 617-253-1592 or e-mail worklife@mit.edu for additional assistance.

#2: There is an amendment to the Family Medical Leave Act (FMLA).

On Jan. 28, President George W. Bush signed the National Defense Authorization Act, which amends the FMLA to provide broader leave protections to families of members of the armed services. This act has expanded FMLA leave to care for an ill or injured service member. Under the act, the spouse, son, daughter, parent or next of kin of a covered service member may take up to 26 weeks of unpaid leave in a single 12-month period to care for the service member. This leave is not in addition to the 12 weeks of FMLA leave.

To access the required forms for all FMLA leaves, go to http://web.mit.edu/hr/fmla/index.html and click on the Leave Related Forms tab to download the Medical Certification and Leave Request forms. E-mail the Disabilities Services and Medical Leaves Office for more information at hr-dsmlo@mit.edu or call 617-253-4572.

#3: Your vesting has changed. Effective Jan. 1, 2008, you are now vested in your MIT Basic Retirement Plan after you have been employed by MIT for three full years—it was previously five years. The MIT Basic Retirement Plan is a defined-benefit plan, which means it provides you with a benefit payable as lifetime monthly income at retirement. MIT pays the full cost of the plan and you are enrolled automatically. E-mail retirement@mit.edu for any questions. In the next couple of weeks you will receive your plan statements in the mail. These statements are being printed this year due to feedback received from the MIT community.

MARK YOUR CALENDAR: On June 12, Human Resources and the Working Group on Support Staff Issues will co-host "Your Professional Development Toolkit," a half-day program open to all support staff. This will be held in conjunction with the annual Support Staff Appreciation Lunch. Look for details in the April 30 edition of HR@Your Service.

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

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.

HELP WANTED

Speak Ukrainian? Seeking grad student or faculty/staff member to translate web page information related to medical regulatory guidelines from Ukrainian into English. This is a paying one-time project. Contact pjsiska@mit.edu for details.

HOUSING

Ocean front summer cabin, Mount Desert Island, ME: 2BD/1BA w/living/kitchen area; picture windows, deck overlooking water; stairway to beach. Mins from Acadia National Park, Bar Harbor. $1,000/week June-Sept. Steve at 253-5757 or chorover@mit.edu.

Brokaw to deliver Compton lecture April 2

Tom Brokaw, former anchor and managing editor of NBC Nightly News, will deliver a 2008 Compton lecture titled "Life Is Not Virtual" at 3:30 p.m. Wednesday, April 2, in Kirsch Auditorium.

An internationally respected journalist, Brokaw served as the NBC anchor for 21 years. He was the NBC White House correspondent during the Watergate scandal, advancing to lead NBC's coverage of primaries, national conventions and election nights in 1984, 1988 and 1992. Brokaw, 68, is the author of "The Greatest Generation" (1998) and "A Long Way from Home" (2002).

The Karl Taylor Compton Lecture Series was established in 1957 to honor the late Karl Taylor Compton, who served as president of MIT from 1930 to 1948 and chairman of the Corporation from 1948 to 1954. The purpose of the lectureship is to give the MIT community direct contact with the important ideas of our times and with people who have contributed much to modern thought.

This event in the series is sponsored by the MIT Information Center and the Office of the President.

PHOTO / **PATSY SAMPSON**

Markus Zahn, left, the Thomas and Gerd Perkins Professor of Electrical Engineering and director of the VI-A Internship Program, signs an agreement March 14 with Hsiao-Wuen Hon, managing director of Microsoft Research Asia. The agreement will send EECS students to the Beijing-based facility—dubbed 'the world's hottest computer lab' by Technology Review magazine—as part of the MIT EECS VI-A M.Eng. Thesis Program. The program, which has existed since 1916, matches industry mentors with EECS students who have demonstrated excellent academic preparation and motivation to provide practical work experience combined with a funded Masters of Engineering thesis.

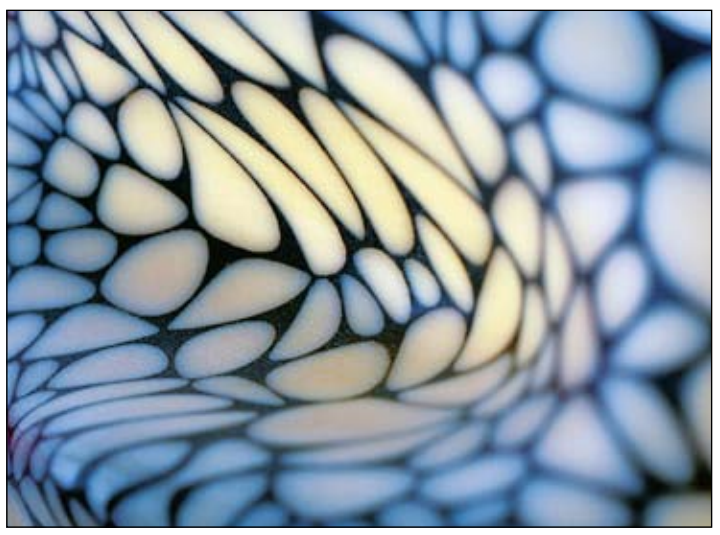
PHOTO / **DONNA COVENEY**

Larry Sass, assistant professor of architecture, is making a digitally fabricated replica of a 'shotgun' house typical of New Orleans. Here he works with laser-cut ornaments to go on the façade of the building.

ART & ECHNOLOGY

PHOTOS / **NERI OXMAN**

ABOVE AND BELOW: Three works from Neri Oxman's 'Natural Artifice' exhibit at MoMA. Oxman's model are made of materials including plaster-resin composites, CNC (computer numerically controlled) milled wood laminations, flexible and rigid acrylic composites and 3-D printed nylon.



MoMA

Continued from Page 1

MIT artists and designers are devising new genres, setting new standards for the way video, digital and other technologies foster innovations in the arts.

"Some of the most important things happen at the intersection of art, design and technology, and MIT is where it all comes together," says Adele Naude Santos, dean of the School of Architecture and Planning. "Now we're on the world stage, with faculty showing their work in many countries. And it's not just art for art's sake. Like everyone else at MIT, our artists and designers are working on the critical social issues of our times."

Two upcoming MIT exhibits in New York plumb such critical issues as housing and lending—one, a multimedia installation called "Red Lines," will show at the Institute next fall. Recently, MIT faculty in visual arts, music and theater have received critical acclaim for bold works that blend technology with traditional arts practice to explore social or political issues.

"Ten years ago, the words 'art' and 'technology' meant two very different—if not opposite—things. That is certainly not the case today," said Professor Mark Jarzombek, associate dean of the School of Architecture and Planning.

"At MIT, numerous scientists, engineers, students, architects and artists are working in the complex interface between art and technology. This is one of the prime growth areas of research, both in physical and conceptual terms, for the coming decade," he added.

MIT may indeed be benefiting from a sharper focus on technology by leading art institutions, but Lori Gross, director of arts initiatives and adviser to the associate provost, notes that art has traditionally played a central role over the years in fostering risk-taking and problem-solving at MIT.

"The arts at MIT encourage the crossing of traditional boundaries to invent new fields of research and to create the skills and media needed to serve society and its future challenges," she said.

MIT takes Manhattan

The Museum of Modern Art's current exhibit, "Design and the Elastic Mind," features origami, architecture and design by MIT faculty and graduate students. The show runs through May 12.

Part of the exhibit is New York Talk Exchange, a project by Carlo Ratti and his colleagues in the MIT Media Lab's Sense*able* City Lab, which illustrates the volumes of long-distance telephone and IP (Internet Protocol) data flowing between New York and cities around the world.

"It is like showing how the heart of New York connects with the global network of cities," said Ratti, director of the Sense*able* City Lab and associate professor of the practice of urban technologies. The network looks like delicate fireworks. To see, go to http://senseable.mit.edu/nyte.

MoMA commissioned Neri Oxman, graduate student in architecture and planning, to design four pieces for "Design and the Elastic Mind."

Oxman's research uses advanced digital applications in architectural and design practices. Some of Oxman's images look like weirdly stretched animal skins; others look like slinky vases.

Hugh Herr, associate professor in media arts and sciences, presents a prototype of his ankle-foot prosthesis, in "Design and the Elastic Mind."

Composed of titanium, aluminum, carbon composite and polyurethane and manufactured by iWalk Inc., the ankle was designed by Herr and the MIT Media Lab's Biomechatronix Group, including Jeff Weber, research engineer, and Bruce Deffenbaugh, technical associate

The MoMA design exhibit also features three curved origami sculptures by MIT's pioneering origami team: Erik Demaine, Esther and Harold E. Edgerton Associate Professor of electrical engineering and computer science, and Martin Demaine, Angelika and Barton Weller Artist-in-Residence in electrical engineering and computer science.

The Demaine works, titled "Computational Origami," are made of elephant-hide paper and look like double-mobius strips or small, mad free-form freeways.

Larry Sass, assistant professor of architecture, is one of five architects commissioned by MoMA to construct prefabricated homes in a vacant lot on 53rd Street, next to the museum for its summer exhibit, "Home Delivery: Fabricating the Modern Dwelling," starting in July.

Sass' design is based on a reinterpretation of New Orleans' "shotgun" houses—narrow, one-floor structures—using recycled plywood and friction-fit components, all put together with rubber mallets.

The Whitney Biennial, held at the Whitney Museum of American Art through June 1, ranks among the international art world's most renowned exhibitions. Curators scour the world for cutting-edge works in all media.

This year, two affiliates from the Center for Advanced Visual Studies (CAVS) represent MIT at the Biennial:

David Reinfurt, web, identity and publications designer for CAVS and a CAVS research affiliate, participates in the Biennial as a member of Dexter Sinister, a graphic design partnership and publishing workshop that prints books in very limited, "just in time" runs for occasional sale at their store.

Joe Zane, CAVS artistic production coordinator, worked with Michael Smith, 2005-2006 CAVS fellow, in producing the video, "Portal Excursion," a segment of Smith's 30-year work, "Mike's World." Fictional Mike, a hapless Everyman, is the subject of video, installation and performance works on display at the Biennial.

Upcoming MIT shows:

- **Damon Rich**, former CAVS fellow and founder and creative director of the Center for Urban Pedagogy, presented "Red Lines, Death Vows, Foreclosures, and Risk Structures" at the New York Architecture League on Jan. 17. "Red Lines" is a multimedia installation of photography, models, digital animation and video, which explores where the money for building and repairing buildings comes from, the social history of home finance and what leads to the abandonment of buildings. It goes on view at the MIT Museum's Compton Gallery in September.
- **Marisa Jahn**, visiting artist in the Media Lab's Tangible Media Group, will present "Commuter Cookout," a project with Steve Shada, at the ISE Cultural Foundation in New York, on March 7. "Commuter Cookout" is a cookbook and stainless-steel cooking set that enables urban commuters to cook food using the heat of auto engines. Driving times determine the menu—from eggs (a short hop to the dry cleaner) to a stew (a long ride to Logan Airport).
- **Antonio Muntadas**, visiting professor of art in the visual arts program, has a one-person show at the Kent Gallery in Chelsea opening on May 1. He's preparing the seventh installment of his project, "Political Advertisement Project 1952-2008," to coincide with this year's election. Muntadas and Marshall Reese have been aggregating found footage of election campaigns since 1984; their work has been showcased every four years in such New York venues as Artist Space, NYPL and Lincoln Center.