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TechTalk
SERVING THE MIT COMMUNITY

MIT marks OpenCourseWare milestone

Thomas Friedman to give keynote address

At an event hosted by President Hockfield this afternoon, the MIT community will celebrate a major milestone for the Institute's open publication of course content, OpenCourseWare (OCW). The event marks the publication of core teaching materials—including syllabi, lecture notes, assignments and exams—from virtually all MIT courses, 1,800 in total. The site includes voluntary contributions from 90 percent of faculty and more than 2,600 members of the MIT community.

JOIN THE CELEBRATION

The OCW Milestone Celebration will be simulcast to the Bartos Theatre and Whitaker 111 starting at 2 p.m.

A webcast of the event will be available through the MIT home page.

"OCW demonstrates MIT's commitment to openness and to improving education on a global level," President Susan Hockfield said of the achievement. "The site embodies the generosity and dedication of our faculty."

New York Times columnist Thomas Friedman will give the keynote address at the event, which will include a panel on the future of OCW and education with MIT President Emeritus Charles Vest, former Xerox chief scientist John Seely Brown and the chair of India's National Knowledge Commission, Dr. Sam Pitroda. Hockfield will also announce a new OpenCourseWare initiative for secondary education at the event (see inset on page 3).

First announced in 2001, OpenCourseWare (http://ocw.mit.edu) has grown from a 50-course pilot to a site that includes virtually the entire MIT undergraduate and graduate curriculum. Materials are pub-

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IMAGE / **STEVE CARSON**

As this graphic shows, millions of visitors have accessed online content from 1,800 available courses—evidence that OCW is delivering on the promise of open sharing of knowledge.

Way cool: Researchers jump-start old field with new approach

David Chandler
News Office

Breathing new life into an old idea, MIT Institute Professor Mildred S. Dresselhaus and co-workers are developing innovative materials for controlling temperatures that could lead to substantial energy savings by allowing more-efficient car engines, photovoltaic cells and electronic devices.

Novel thermoelectric materials have already resulted in a new consumer product: a simple, efficient way of cooling car seats in hot climates. The devices, similar to the more-familiar car seat heaters, provide comfort directly to the individual rather than cooling the entire car, saving on air conditioning and energy costs.

The research is based on the principle of thermoelectric cooling and heating, which was first discovered in the early 19th century and was advanced into some practical applications in the 1960s by MIT professor (and former president) Paul Gray, among others.

Dresselhaus and colleagues are now applying nanotechnology and other cutting-edge technologies to the field. She described her work toward better thermoelectric materials on Nov. 26 in an invited

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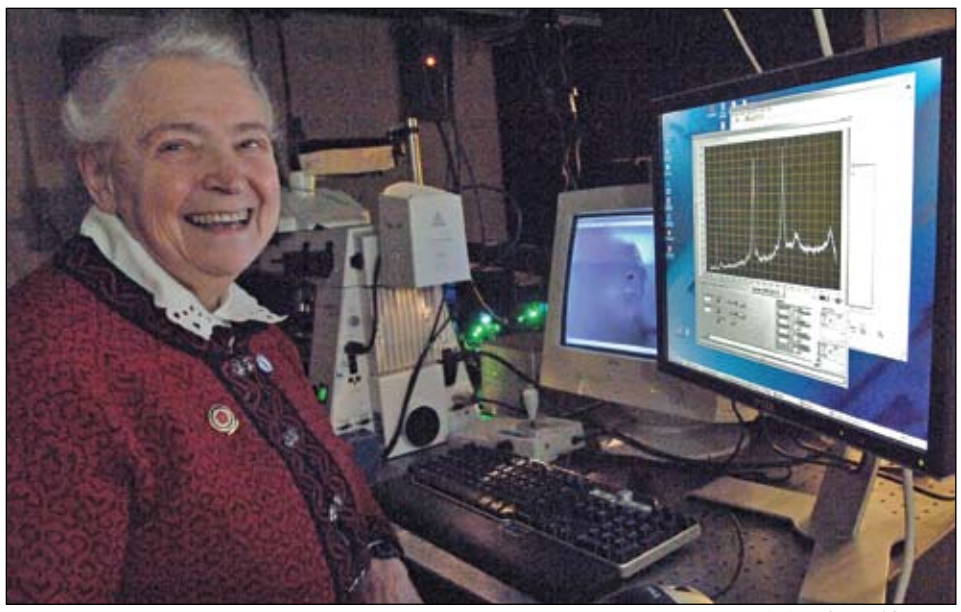

PHOTO / **DONNA COVENEY**

MIT Institute Professor Mildred Dresselhaus in the spectroscopy lab.

A wish come true

MIT helps fulfill leukemia patient's dream

Jessica Holmes
News Office

"When I grow up, I want to be a scientist." How many MIT students uttered these words when they were children? Juliana Bach, a 7-year-old from Miami, discovered her passion for science at a young age. On Tuesday, Nov. 13, in conjunction with the Make-A-Wish Foundation, MIT made her wish to be a scientist come true.

As Juliana worked in the lab, she looked like a miniature scientist, wearing a white lab coat with her name stitched across the back. With her earnest demeanor and straight posture, Juliana exhibited all the characteristics of an eager science student. The only indications of her young age were the pink pants peeking out from below her lab coat, the high ponytail swinging atop her head and her tiny, infectious giggle. What her physical appearance and positive demeanor hid, however, was the fact that Juliana is battling leukemia.

Juliana's parents approached the Make-A-Wish Foundation about her desire to be a scientist and were promptly directed to MIT, which was delighted to host her. Juliana's requests while at MIT were that she be allowed to experiment with chemical reactions, discover how liquids change color, find out why there are different colors of sand and make "goop."

Juliana first met with Heidi Nepf, director of the Environmental Fluid Mechanics Lab and professor of civil and environmental engineering. Nepf worked with Juliana to demonstrate aspects of how water moves in rivers, lakes and the coastal zone. The experiments were all based on previous or current research in Nepf's laboratory, but scaled down in size and concept to be understandable to a 7-year-old.

"She looks at Heidi with awe, like she's Santa Claus," said Juliana's father, Charles Julian. He said Juliana has been doing her

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PHOTO / **DONNA COVENEY**

Seven-year-old Juliana Bach uses drops of dye and floating beads to study the pattern of water movement in a shallow basin. Juliana conducted the experiment as part of her dream-come-true to be a "scientist for a day," enabled by the Make-A-Wish Foundation and MIT. Heidi Nepf, rear, a professor of civil and environmental engineering, came up with a number of experiments for Juliana to do.

OBITUARIES

Simon Foner, 82, experimental physicist

Simon Foner, experimental physicist in magnetism and superconductivity, died Oct. 2 in Cambridge, Mass. He was 82.

Born Aug. 13, 1925, in Pittsburgh, Simon took a position as staff physicist at the MIT Lincoln Laboratory in 1953, where he developed the idea for and eventually patented the vibrating sample magnetometer. His name will forever be associated with that versatile and widely used method for magnetism measurements.

Simon Foner

In 1961, he became one of the founding staff members of what would become the Francis Bitter National Magnet Laboratory (FSNML). Until 1977 he was a project leader for the FBNML, later becoming its chief scientist. He served for two years as associate director of the lab and, after 1982, was a senior research scientist affiliated with the MIT physics department.

During his tenure, FBNML was a pioneer in high-field pulsed magnet technology; Simon's advances in this area underpin much of the currently used modern pulsed field magnet technology.

Foner's honors included fellowship in AAAS, IEEE (winning the Millennium Medal in 2000) and the American Physical Society (APS). He was honored for his invention of the vibrating sample magnetometer in 1999 by winning the Joseph F. Keithley Award on the occasion of the 100th anniversary of the founding of the APS. Foner was chosen Distinguished Lecturer for the IEEE Magnetics Society in 1995-97.

In addition to his wife, Brenda, he is survived by two sons, Joel and Leonard Foner; two grandsons; two brothers and three sisters.

Ronald G. Sandholm, 76, Lincoln Labs engineer

Ronald G. Sandholm, longtime engineer at MIT's Lincoln Laboratory, died Aug. 11. He was 76.

A native of Worcester and a resident of Westfield, Sandholm retired in 1996 after more than 40 years at the Institute.

He was a principal engineer in the development of the airborne Traffic Collision Avoidance System (TCAS), now adopted worldwide. The author of more than 80 reports on missile defense, air traffic control and airplane collision avoidance, he worked with radar experts nationally and internationally to coordinate standards for TCAS.

He is survived by his wife, Luise, three children, three stepchildren and eight grandchildren.

MIT senior wins Rhodes Scholarship

Melis Anahtar, an MIT senior who aspires to become a physician-scientist, has been awarded a Rhodes Scholarship to study at Oxford University.

Anahtar, of Bethesda, Md., is a mechanical engineering major with a minor in biomedical engineering, following a pre-med program with a perfect academic record. According to the Office of the Provost, Anahtar is the 38th MIT student to win a Rhodes Scholarship.

"A stellar student, Anahtar strives to broaden biological technology with innovative research while also helping her community," said Linn Hobbs, professor of materials science and of nuclear engineering, and chair of the MIT Foreign Scholarships Committee. "MIT is extremely proud of her as a scientist, student and as a person."

"I am positive that Melis will not only impress Oxford but also make a lasting impression on their community, just as she has done at MIT," said Kimberly Benard, program advisor for distinguished fellowships.

Anahtar's undergraduate research has included work in Department of Biology Professor Jianzhu Chen's lab and work in Department of Mechanical Engineering Professor Ian Hunter's Bioinstrumentation Laboratory.

She also held summer internships at the National Institute of Standards and Technology and at the National Institutes of Health's National Human Genome Research Institute. Her senior thesis is on the use of microelectromechanical devices in tissue engineering, in the laboratory of Sangeeta Bhatia, an associate professor in MIT's Department of Electrical Engineering and Computer Science and the Harvard-MIT Division of Health Sciences and Technology.

Before coming to MIT, Anahtar worked as a medical research intern at Massachusetts General Hospital and at Harvard Medical School's Bioelectromechanical Systems Resource Center, where she designed a microfluidic device for testing blood. She co-authored a 2004 refereed journal paper on this work, which also led to her selection as a finalist in the Intel Science Talent Search.

Anahtar has also undertaken leadership roles in the Institute community. She is editor-in-chief of the MIT Undergraduate Research Journal, where MIT undergraduate researchers share their results with the wider scientific community. Her other community roles include serving as vice president of the Biomedical Engineering Society, volunteering for the Science Club for Girls and writing a popular MIT admissions blog.

On her blog, www.mitadmissions.org/Melis.shtml, Anahtar noted that her first house was across the street from a nuclear reactor and that her current house faces the National Institutes of Health.

"Perhaps my love for science and engineering was inevitable," she wrote.

In 2007, Anahtar was named one of Glamour magazine's Top 10 College Women.

Anahtar plans to study integrated immunology and global health science at Oxford and to enter an M.D.-Ph.D. program in the United States after her Rhodes Scholarship.

Rhodes Scholarships, first awarded in 1904, are a legacy of Cecil Rhodes, the 1881 Oxford University alumnus and founder of the DeBeers diamond mining company.

AWARDS AND HONORS

Harry Tuller

Ed Boyden

Nancy Kanwisher

Harry Tuller, professor of ceramics and electronic materials, received the Edward Orton Jr. Memorial Award at the Materials Science and Technology 2007 Conference and Exhibition for scholarly attainments in the ceramic or related field, where he also presented a plenary lecture. Professor Tuller is the director of the Crystal Physics and Electroceramics Laboratory in the Department of Materials Science and Engineering.

The Society for Neuroscience presented **Ed Boyden**, Benesse Career Development Professor and head of the MIT Media Lab's Neuroengineering and Neuromedia Group, with a research award for innovation in neuroscience, supported by Astellas USA Foundation. This award honors imaginative, innovative research that will advance novel ideas and has the potential to lead to significant breakthroughs in the understanding of the brain and nervous system and related diseases.

Boyden received a New Innovator Award from the NIH earlier this semester.

In honor of her seminal findings in vision and brain research, **Nancy Kanwisher**, Ellen Swallow Richards Professor of Cognitive Neuroscience, has been named the recipient of the 2007 Golden Brain Award by the Minerva Foundation. The award, now in its 23rd year, was presented to Kanwisher during the 37th annual meeting of the Society for Neuroscience.

"We have enlarged our current understanding of how the brain handles complex visual stimuli from work done by Nancy Kanwisher," said Elwin Marg, professor emeritus of vision sciences at the University of California, Berkeley and co-founder of the Minerva Foundation.

Krystyn J. Van Vliet and **Kiran Kedlaya** have received 2006 Presidential Early Career Awards for Scientists and Engineers, the nation's highest honor for professionals at the outset of their independent scientific research careers. Van Vliet, Thomas Lord Assistant Professor of Materials Science and Engineering, was nominated for the award by the Department of Defense, while Kedlaya, associate professor of mathematics, was nominated by the National Science Foundation.

The Presidential Early Career Awards for Scientists and Engineers, established in 1996, honors the most promising researchers in the nation within their fields. Nine federal departments and agencies annually nominate scientists and engineers who are at the start of their independent careers and whose work shows exceptional promise for leadership at the frontiers of scientific knowledge. Participating agencies award these talented scientists and engineers with up to five years of funding to further their research in support of critical government missions.

The Center for Integration of Medicine and Innovative Technology (CIMIT) and the MIT School of Engineering has named three MIT graduate students as MIT-CIMIT Medical Engineering Fellows. **Faisal Kashif**, a Ph.D. candidate in electrical engineering and computer science, and **Benjamin Rapoport**, an M.D./Ph.D. candidate in the Harvard-MIT Division of Health Sciences and Technology, are this year's new fellows. **Olumuyiwa "Muyiwa" Ogunnika**, a Ph.D. candidate in electrical engineering and computer science who received the first MIT-CIMIT Medical Engineering Fellowship last year, continues as a fellow for a second year. Intended to support research in medical science and health care, the fellowships will advance developments in assessing neuromuscular diseases, biomedical monitoring and thought-controlled prosthetic limbs.

"The MIT-CIMIT Fellowships provide important support to select graduate students who work in innovative areas of health care research," said Dean Subra Suresh of the MIT School of Engineering. "Since medicine and health care are among the most critical issues that we all face, having this new source of funding is invaluable in furthering this crucial work."

The American Association of Physics Teachers (AAPT) announced that the Oersted Medal has been awarded to **Mildred S. Dresselhaus**, MIT Institute Professor of Physics and Electrical Engineering, in recognition of her outstanding, widespread and lasting impact on the teaching of physics.

Ken Heller, chair of the AAPT Awards committee, said, "Dr. Dresselhaus is a dynamo in her support of physics in all of its aspects. Her research is on the cutting edge of materials physics."

The Oersted Medal will be presented at a ceremonial session of the AAPT winter meeting in Baltimore, Md. Following the presentation, Dresselhaus will deliver her keynote address, "Expanding the Audience for Physics Education."

WISH

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own science experiments for as long as he can remember, mixing together kitchen items such as salt and water and experimenting with chemistry sets to test acids and bases.

Professor Philip Gschwend of the Department of Civil and Environmental Engineering was the second MIT professor to work with Juliana. They researched whether the lakes in Florida, Michigan and Massachusetts might be sensitive to pollution from acid rain, and what the associated risks for the animals and plants living in them might be. In their second experiment, they created a material, or "goop," that might be a useful substitute for rubber.

"I enjoyed preparing for Juliana's visit, and I used my own daughters, ages six and eight, to test each of the experiments in advance. In fact, this was an essential step, because not everything worked as smoothly as I initially thought," said Nepf. "Juliana seemed to enjoy her visit tremendously. Her curiosity and enthusiasm reminded me of how fun research really is."

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PHOTO / **DONNA COVENEY**

Leaving a permanent impression

While falling leaves have long been a sign of impermanence, one leaf has left an imprint in a cement sidewalk at the corner of Massachusetts Ave. and Vassar St.

OCW

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lished under an open license that encourages reuse, redistribution and modification for noncommercial purposes.

Associate Dean of Engineering Dick Yue chaired the committee that first proposed OCW. "The idea is simple," he said in a recent interview: "just to publish our teaching material, our course content online and make it widely available to everyone who can use it, for free."

An estimated 35 million individuals have accessed OCW materials since its launch, 60 percent of them from outside the United States. Nearly 600 courses have been translated into languages including Chinese, Spanish, Portuguese and Thai. MIT has also provided more than 120 local copies of the site to universities in bandwidth-constrained regions such as sub-Saharan Africa.

OpenCourseWare also sparked a global movement that now includes more than 160 universities from around the world that together have published an estimated 5,000 courses. Along with leading universities from the United States, China, Japan and Spain, the OpenCourseWare Consortium (http://ocwconsortium.org) now includes schools from Africa, Australia, Europe, Latin America and Southeast Asia.

OpenCourseWare was proposed by a committee studying lifelong learning in the summer of 2000, and support for the program has been provided by the William and Flora Hewlett Foundation, the Andrew W. Mellon Foundation and the Ab Initio Corporation. The site has also been supported by more than 300 site users and alumni, including Jon Gruber, Larry Birenbaum and Abhay Parekh.

Yue said the committee had hoped the project would have broad impact, but that the use of the OCW site and the spread of the movement have far exceeded initial expectations.

"The dream was that OpenCourseWare would be a broad-based movement that would impact knowledge, information and education worldwide," Yue said. "I think it's coming to fruition even as we speak."

MIT launches web site for high school students

MIT President Susan Hockfield announced the launch of a new web site, Highlights for High School, that will provide resources to improve science, technology, engineering and math (STEM) instruction at the high school level.

The web site builds on the success of MIT's revolutionary OpenCourseWare initiative and is designed to inspire the next generation of engineers and scientists and to be a valuable tool for high school teachers.

"Strength in K-12 math and science will be increasingly important for America if the nation is to continue to lead the innovation economy," Hockfield said.

"Highlights for High School will provide students and teachers with innovative tools to supplement their math and science studies," she added. "We hope it will inspire students to reach beyond their required classwork to explore more advanced material through OCW and also might encourage them to pursue careers in science and engineering."

Highlights for High School features more than 2,600 video and audio clips, animations, lecture notes and assignments taken from actual MIT courses, and categorizes them to match the Advanced Placement physics, biology and calculus curricula. Demonstrations, simulations and animations give educators engaging ways to present STEM concepts, while videos illustrate MIT's hands-on approach to the teaching of these subjects.

Thomas Magnanti, former dean of the School of Engineering at MIT, chaired the committee that developed the site. "As has been well documented, the U.S. needs to invest more in secondary education, particularly in STEM fields. MIT, as a leading institution of science and technology, has an obligation to help address the issue," he said.

Highlights for High School represents MIT's first step in adapting the successful OpenCourseWare model to secondary education. The web site organizes the course materials currently featured on OCW—including syllabi, lecture notes, assignments and exams—into a format that is more accessible to high school students and teachers.

An estimated 10,000 U.S. high school instructors and 5,000 U.S. high school students already visit MIT OpenCourseWare each month, and MIT expects Highlights for High School to make MIT's course materials even more useful to these audiences.

Highlights for High School continues MIT's tradition of supporting science, technology and engineering instruction at the secondary level. One of the most prominent previous efforts was the Physical Science Study Committee, a program begun in 1956 as a collaboration between MIT physics professors and high school physics teachers, which dramatically changed the way physics was taught in high schools. MIT has more than 40 K-12 outreach programs, including the Edgerton Center, MIT's Minority Introduction to Engineering and Science and MIT's Educational Studies Program.

With Highlights for High School in place, a broader plan proposed for a secondary education program—OCW SE—may include creating a teacher-in-residence program to develop new open curricula with high school educators and organizing an MIT secondary-education mentor corps.

LuperFoy to direct UPOP

Susann LuperFoy, a scientist whose research has focused on artificial intelligence, has been named executive director of the Undergraduate Practice Opportunities Program (UPOP), effective Nov. 5, the School of Engineering announced this month.

LuperFoy has worked in academic, government and industry sectors from early-stage start-ups to large public corporations. Within the domain of artificial intelligence, she has researched spoken dialog, natural language processing and intelligent tutoring systems.

Following a postdoctoral research stint interpreting telephony in Kyoto, Japan, she taught artificial intelligence and linguistics for eight years at Georgetown University, where she guided graduate research in automated spoken dialog systems, machine translation, natural language processing, computational pragmatics and acoustic phonetics.

She has authored and edited more than 30 publications and delivered more than 40 invited lectures and technical tutorials on research and applied artificial intelligence topics. She has organized several workshops, special interest groups and standards committees and has served on the technical boards of five Cambridge start-ups.

During Akamai's start-up years she directed the growth of an engineering department that delivered analysis tools to Akamai's customers, among others. Most recently she has worked with surgeons and instructors on the use of intelligent tutoring technology for simulation-based training.

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talk at the annual meeting of the Materials Research Society in Boston.

Thermoelectric devices are based on the fact that when certain materials are heated, they generate a significant electrical voltage. Conversely, when a voltage is applied to them, they become hotter on one side and colder on the other. The process works with a variety of materials and especially well with semiconductors—the materials from which computer chips are made. But it always had one big drawback: It is very inefficient.

The fundamental problem in creating efficient thermoelectric materials is that they need to be very good at conducting electricity, but not heat. That way, one end of the apparatus can get hot while the other remains cold, instead of the material quickly equalizing the temperature. In most materials, electrical and thermal conductivity go hand in hand. So researchers had to find ways of modifying materials to separate the two properties.

The key to making it more practical, Dresselhaus explained, was in creating engineered semiconductor materials in which tiny patterns have been created to alter the materials' behavior. This might include embedding nanoscale particles or wires in a matrix of another material. These nanoscale structures—just a few billionths of a meter across—interfere with the flow of heat, while allowing electricity to flow freely. "Making a nanostructure allows you to independently control these qualities," Dresselhaus said.

She and her MIT collaborators started working on these developments in the 1990s and soon drew interest from the U.S. Navy because of the potential for making quieter submarines (power generation and air conditioning are some of the noisiest functions on existing subs). "From that research, we came up with a lot of new materials that nobody had looked into," Dresselhaus said.

After some early work conducted with Ted Harman of MIT Lincoln Labs, Harman, Dresselhaus and her student Lyndon Hicks published an experimental paper on the new materials in the mid-1990s. "People saw that paper and the field started," she said. "Now there are conferences devoted to it."

Her work in finding new thermoelectric materials, including a collaboration with Warren and Townley Rohsenow Professor of Mechanical Engineering Gang Chen, invigorated the field, and now there are real applications like seat coolers in cars. Last year, a small company in California sold a million of the units worldwide.

Other Potential Applications

The same principle can be used to design cooling systems that could be built right into microchips, reducing or eliminating the need for separate cooling systems and improving their efficiency.

The technology could also be used in cars to make the engines themselves more efficient. In conventional cars, about 80 percent of the fuel's energy is wasted as heat. Thermoelectric systems could perhaps be used to generate electricity directly from this wasted heat. Because the amount of fuel used for transportation is such a huge part of the world's energy use, even a small percentage improvement in efficiency can have a great impact, Dresselhaus explains. "It's very practical," she says, "and the car companies are getting interested."

The same materials might also play a role in improving the efficiency of photovoltaic cells, harnessing some of the sun's heat as well as its light to make electricity. The key will be finding materials that have the right properties but are not too expensive to produce.

Dresselhaus and colleagues are continuing to probe the thermoelectric properties of a variety of semiconductor materials and nanostructures such as superlattices and quantum dots. Her research on thermoelectric materials is presently sponsored by NASA.

Prenatal arsenic exposure affects genes

Research could lead to test for screening populations for the poison

David Chandler
News Office

The children of mothers whose water supplies were contaminated with arsenic during their pregnancies harbored gene expression changes that may lead to cancer and other diseases later in life, MIT researchers reported in a new study. In addition to establishing the potential harmful effects of these prenatal exposures, the study also provides a possible method for screening populations to detect signs of arsenic contamination.

This is the first time evidence of such genome-wide changes resulting from prenatal exposure has ever been documented from any environmental contaminant. It suggests that even when water supplies are cleaned up and the children never experience any direct exposure to the pollutant, they may suffer lasting damage.

The research was published in the Nov. 23 issue of PLoS Genetics (published by the Public Library of Science).

The evidence comes from studies of 32 mothers and their children in a province of Thailand that experienced heavy arsenic contamination from tin mining. Similar levels of arsenic are also found in many other regions, including the U.S. southwest.

The research was led by Mathuros Ruchirawat, director of the Laboratory of Environmental Toxicology of the Chulabhorn Research Institute (CRI) in Thailand, and Leona D. Samson, director of MIT's Center for Environmental Health Sciences (CEHS) and the American Cancer Society Professor in the Departments of Biological Engineering and Biology at MIT. The first author of the study was Rebecca C. Fry, a research scientist at CEHS. Co-authors included Panida Navasumrit of the CRI and Chandni Valiathan, graduate student at MIT's Computational and Systems Biology Initiative.

The team analyzed blood that had been collected from umbilical cords at birth. The exposure of mothers to arsenic during their pregnancy was independently determined by analyzing toenail clippings—the most reliable way of detecting past arsenic exposure.

The team found a collection of about 450 genes whose expression had been turned on or turned off in babies who had been exposed to arsenic while in the womb. That is, these genes had either become significantly more active (in most cases) or less active than in unexposed babies.

"We were looking to see whether we could have figured out that these babies were exposed in utero" just by using the gene expression screening on the stored blood samples, Samson said. "The answer was a resounding yes."

Further, the team found that a subset of just 11 of these genes could be used as a highly reliable test for determining whether babies had been born to mothers exposed to arsenic during pregnancy. Since blood samples are already taken routinely for medical tests, this may provide an easier way of screening for such exposure.

The gene expression changes the group found in the exposed children are mostly associated with inflammation, which can lead to increased cancer risk. Recognizing the damaging effects of the arsenic exposure, "the government has provided alternative water sources" to the affected villages, Fry said, which means that following these children as they grow older (they are now toddlers) has the potential to show how long-lasting the effects of the prenatal exposure may be. However, she adds, this may be complicated by the fact that many people are still using the local water for cooking.

It's not yet clear how long the changes may last. "We will be testing whether these gene expression changes have persisted in these children," Fry said.

This is the first time such a response to prenatal arsenic exposure has been found in humans. But it is not entirely unexpected, Samson explains, because "in mice, when mothers are transiently exposed to arsenic in the drinking water, their progeny, in their adult life, are much more cancer-prone."

Further research could include studies of possible ways of reversing or mitigating the damage, perhaps through dietary changes, nutritional supplements or drug treatments to counteract the gene expression changes.

Also, the group plans to do follow-up studies in different locations and with larger groups of subjects to confirm the value of the 11 "marker" genes as a reliable indicator of arsenic exposure. The researchers also aim to determine whether the gene expression changes are specific to arsenic.

This study is an example of the CEHS's efforts to promote collaborative interdisciplinary research into global environmental health issues, specifically in the developing world.

This research was funded by the National Institutes of Environmental Health Sciences and the Chulabhorn Research Institute.

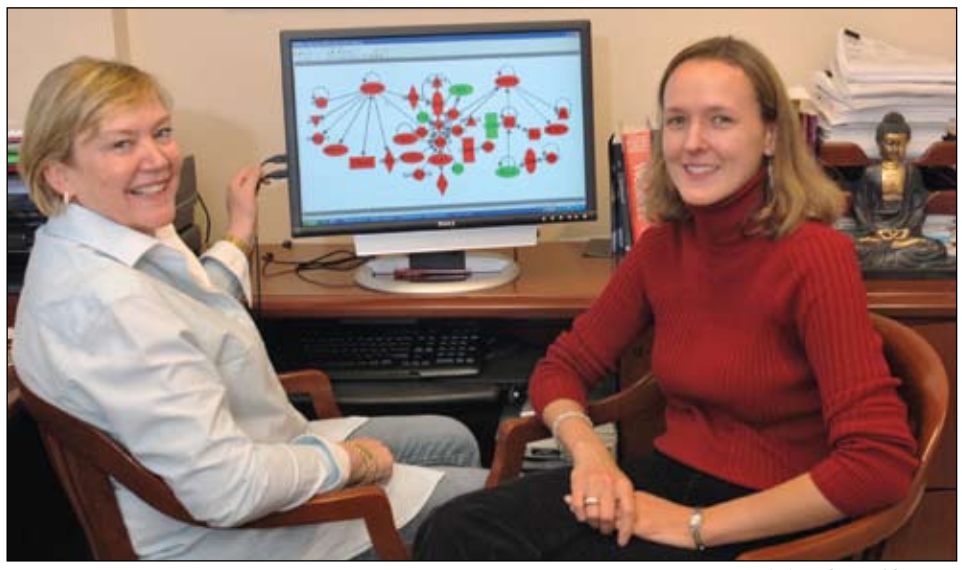

PHOTO / **DONNA COVENEY**

Leona Samson, left, and Rebecca Fry have found that prenatal exposure to arsenic leads to alarming changes in the activity of genes of newborn babies. Samson is the director of MIT's Center for Environmental Health Sciences (CEHS) and the American Cancer Society Professor in the Departments of Biological Engineering and Biology. Fry is assistant scientific director of CEHS.

Scientists decode genomes of tuberculosis microbes

Work could aid research on drug-resistant TB

Nicole Davis
Broad Institute

An international collaboration led by researchers in the U.S. and South Africa announced Nov. 20 the first genome sequence of an extensively drug resistant (XDR) strain of the bacterium Mycobacterium tuberculosis, one linked to more than 50 deaths in a recent tuberculosis outbreak in KwaZulu-Natal, South Africa.

As part of this work, genomes of multidrug-resistant (MDR) and drug-sensitive isolates were also decoded. Initial comparisons of the genome sequences reveal that the drug-resistant and drug-sensitive microbes differ at only a few dozen locations along the four-million-letter DNA code, revealing some known drug resistance genes as well as some additional genes that may also be important to the spread of TB.

The researchers have taken an unusual step of immediately sharing both the genome sequence and their initial analysis far in advance of submitting a scientific paper, in order to accelerate work on drug-resistant TB by researchers around the world.

"Tuberculosis is a major threat to global public health

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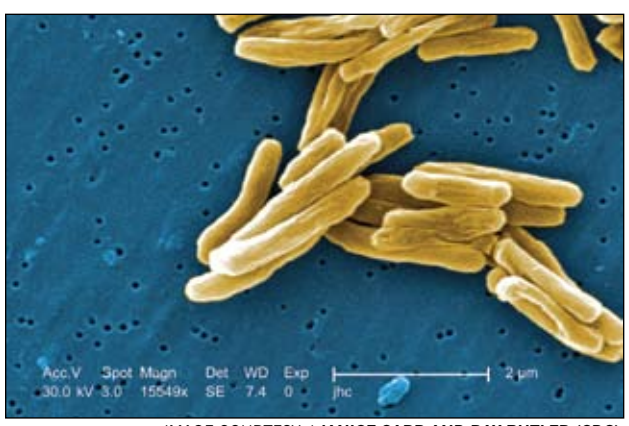


IMAGE COURTESY / **JANICE CARR AND RAY BUTLER (CDC)**

Researchers have sequenced the genome of a potent strain of the tuberculosis bacterium. This image from the U.S. Centers for Disease Control shows a culture of tuberculosis bacteria.

Compound 'cocktail' improves brain function in rodents

Treatment is undergoing a clinical study in Alzheimer's patients

Anne Trafton
News Office

MIT researchers have shown that a cocktail containing three compounds normally in the bloodstream promotes growth of new brain connections and improves cognitive function in rodents. The treatment is now being tested in Alzheimer's patients and could hold promise for other brain diseases and injuries.

The mixture, which includes a type of omega-3 fatty acid, is part of a new approach to attacking Alzheimer's. That approach focuses on correcting the loss of synapses, or connections between neurons, which characterizes the disease.

For the past 30 years, researchers have tried targeting the clumps of misfolded proteins, known as amyloid beta plaques, found in the brains of Alzheimer's patients. However, that approach has not yielded any effective treatments for the disease, which affects an estimated four million to five million Americans.

"It's been very frustrating," said Richard Wurtman, the Cecil H. Green Distinguished Professor of Neuropharmacology and senior author of a paper on the new work published in the November issue of Brain Research. "Nobody has demonstrated that if you prevent formation of the amyloid, people get better."

In December, a group of Alzheimer's researchers, including Wurtman, will participate in a symposium with the goal of developing a public policy to promote new approaches to Alzheimer's research. Organizers of the symposium believe that the current system of dementia research is "broken" and needs to be fixed.

Alzheimer's researchers agree that the cognitive decline seen in Alzheimer's patients is caused by loss of brain synapses. Wurtman and others theorize that restoring some of those synapses could provide an effective treatment, analogous to giving L-dopa to Parkinson's patients. Such treatments don't cure the disease but can restore significant brain function, said Wurtman.

Synapses, where information is passed between neurons, play a critical role in learning and memory. Messages travel from a presynaptic neuron to a postsynaptic cell.

In the Brain Research paper, the MIT team reported that rodents given a cocktail of DHA (a type of omega-3 fatty acid), uridine and choline showed a greatly increased concentration of dendritic spines, which receive messages in the postsynaptic neuron. That indicates that synapse regeneration has occurred, which is unusual, Wurtman said.

Synapse regrowth could also prove an effective treatment for other brain diseases, such as Parkinson's, or for brain injuries, he said.

The researchers found that rodents who received the treatment performed much better on tests of cognitive ability (specifically, navigating a water maze). Sarah Holguin, an MIT graduate student in brain and cognitive sciences, presented those results at the Society for Neuroscience annual meeting earlier this month.

Some of the rats in the studies received all three compounds and some received only one. The improvements in synapse growth and cognitive ability were greatest in the rats given all three.

Omega-3 fatty acids are not produced in the body but are found in a variety of sources, including fish, eggs, flaxseed and meat from grass-fed animals. Choline can be synthesized in the body and obtained through the diet; it is found in meats, nuts and eggs. Uridine cannot be obtained from food sources, but is a component of human breast milk and can be produced in the body.

The cocktail of compounds is now in clinical studies in Europe.

Other authors of the Brain Research paper were Toshimasa Sakamoto, the first author and a research affiliate in the Department of Brain and Cognitive Sciences (BCS), and Mehmet Cansev, a BCS postdoctoral associate.

The research was funded by the National Institutes of Health and the Center for Brain Sciences and Metabolism Charitable Trust.

‘Micro’ livers could aid drug screening

Elizabeth Dougherty
Harvard-MIT Division of
Health Sciences and Technology

MIT researchers have devised a novel way to create tiny colonies of living human liver cells that model the full-sized organ. The work could allow better screening of new drugs that are potentially harmful to the liver and reduce the costs associated with their development.

Liver toxicity is one of the main reasons pharmaceutical companies pull drugs off the market. These dangerous drugs slip through approval processes due in part to the shortcomings of liver toxicity tests. Existing tests rely on liver cells from rats, which do not always respond to toxins the way human cells do. Or they rely on dying human cells that survive for only a few days in the lab.

Sangeeta Bhatia

The new technology arranges human liver cells into tiny colonies only 500 micrometers (millionths of a meter) in diameter that act much like a real liver and survive for up to six weeks.

Sangeeta Bhatia, associate professor in the Harvard-MIT Division of Health Sciences and Technology (HST) and MIT’s Department of Electrical Engineering and Computer Science, and HST postdoctoral associate Salman Khetani described their model liver tissue and its behavior in the Nov. 18 online issue of Nature Biotechnology.

To build these model livers, Khetani used micropatterning technology—the same technology used to place tiny copper wires on computer chips—to precisely arrange human liver cells and other supporting cells on a plate. Khetani adapted this method from Bhatia’s early work as an HST graduate student building micropatterned co-cultures of rat liver cells and supporting cells.

Such precisely arranged cells result in what Bhatia called a “high-fidelity tissue model” because it so closely mimics the behavior of a human liver. For example, each model “organ” secretes the blood protein albumin, synthesizes urea and produces the enzymes necessary to break down drugs and toxins.

To predict how close their model tissue is to real liver tissue, which has more than 500 different functions, they also evaluated its gene expression profiles, measures of the levels of gene activation in the tissues. They found that these profiles are very similar to those of fresh liver cells, “giving us confidence that other [liver] functions are preserved,” said Khetani.

For drug-testing purposes, this affinity to the human liver allows each colony to provide a window into the human liver’s response to a drug without having to expose human patients to the drug in a clinical trial, said Bhatia.

Further, because the engineered tissue lives for so long, it has the potential to make new types of toxicity tests possible. For instance, it opens the door to testing the effects of long-term drug use akin to taking one pill a day over multiple weeks. It also will allow more extensive testing of drug-drug interactions.

In addition to being a good biological model, the engineered tissue is designed to be seamlessly integrated into an industrial pharmaceutical science setting.

To mass-produce plates of the miniature liver models, Khetani relied on a technique called soft lithography. This technique fashions a reusable micropatterned rubber stencil from a silicon master. Each stencil contains an array of 24 wells, and each well contains a matrix of 37 tiny holes. Khetani “peels and sticks” the stencil onto plates and places the liver cells into the holes, patterning more than 888 miniature model livers across the microwells in a matter of minutes.

In tests of drugs with a range of well-known toxicity levels, assays (chemical detection tests) on the miniature liver models showed the expected levels of toxicity. “Our platform was able to predict the relative toxicity of these drugs as seen in the clinic,” said Khetani. For instance, troglitazone, a drug withdrawn from the market by the FDA due to liver toxicity, showed toxicity levels much higher than its FDA-approved analogues, Rosiglitazone and Pioglitazone.

The model uses a fraction of the costly human liver cells used in other test platforms and can be assembled using frozen cells. Moreover, the expanded toxicity-testing capabilities have the potential to allow drug developers to identify toxicity earlier in the development process, thereby avoiding the expense of investing in formulas that are bound to fail.

A start-up company called Hepregen has licensed the technology and is working to introduce it into the pharmaceutical marketplace.

“My hope is that this new model will make drugs safer, cheaper and better labeled,” said Bhatia.

The work was funded by the National Science Foundation, the National Institutes of Health’s National Institute of Diabetes and Digestive and Kidney Diseases, the MIT Deshpande Center, and the David and Lucile Packard Foundation.

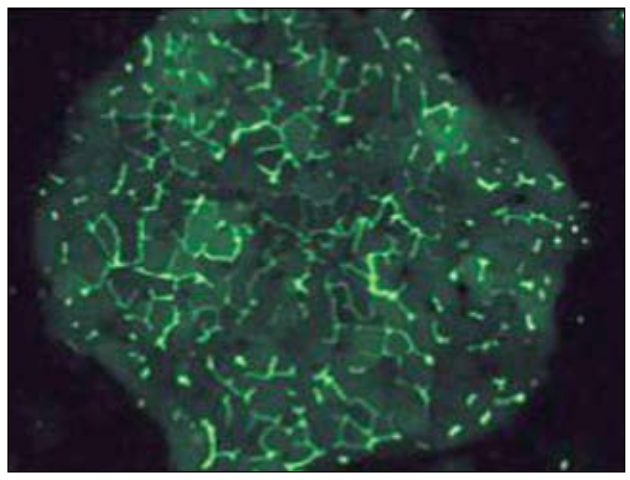
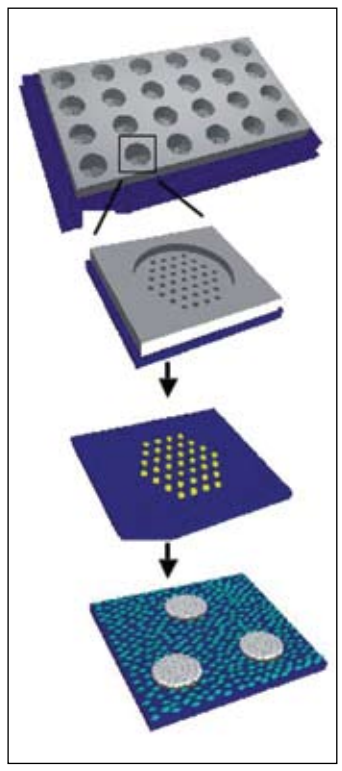


IMAGE COURTESY / **SANGEETA BHATIA**

Liver cells in the micropatterned co-culture form tube-like structures (shown here in green) that resemble bile capillaries found in a human liver.



MIT researchers use micropatterned stencils to build miniature model livers. Each stencil contains an array of wells. Each well contains a hexagonal matrix of 37 holes, each one 500 micrometers in diameter. Using the stencil, they form islands by placing approximately 300 liver cells into each hole and surrounding each with a sea of supporting cells, including collagen and other proteins.

IMAGE COURTESY / **SANGEETA BHATIA**

MIT develops folding electric scooter

David Chandler
News Office

It’s energy efficient, it’s clean, compact and simple, and above all, it’s very cool.

All of these factors could be significant in getting people to adopt a lightweight, electrically powered scooter designed by William J. Mitchell, the Alexander W. Dreyfoos Professor of Architecture and Media Arts and Sciences, and several of his students in the Smart Cities Group, in collaboration with SYM, a major scooter manufacturer in Taiwan, and ITRI, Taiwan’s Industrial Technology Research Institute. A prototype of the new design was a hit at the Milan Auto Show, where it was unveiled earlier this month.

Motor scooters are a very popular form of transportation in Asian and European cities, Mitchell said, because they provide convenient, inexpensive transportation. But conventional scooters, using inefficient two-stroke gas engines, are also a source of local air pollution. The new design “was all about providing a clean, green, silent electric scooter that would provide, even better, the same kind of urban mobility,” he said.

As an added bonus, the simplicity of the electric design, which eliminates the powertrain by putting motors directly inside each of the two wheels, made it possible to design the scooter so that it could be folded up to about half its size, making it even easier to store in crowded urban environments.

“In very dense urban areas where scooter parking is a big issue, the small size is a big advantage. It makes it possible to park it in narrow streets and alleys,” Mitchell said. When folded, it can also be easily wheeled along like a trolley suitcase, its approximate size, making it easy to take along on trains or even indoors.

The simplified design could bring down production costs significantly, he said. “A typical gas scooter has about 1,000 parts, but ours only has 150.”

Mitchell and his team envision the scooters being provided in racks at convenience stores, train stations and other city locations as one-way rentals.

Users would swipe a credit card to remove a scooter from the rack (which would also charge its batteries), unfold it for the trip and then fold it up again to deposit at another rack at the destination.

The viability of the one-way-rental business model has been demonstrated in Paris, Mitchell said, where a company has recently begun a similar service with 1,000 bicycles.

The design of the scooter is also important in getting the new concept adopted. “People want to look cool,” Mitchell said, and the folding scooter was highly praised at the Milan show, where vehicle design is especially prized.

The team now plans to further develop the prototype to come up with two different production models. One will be a refinement of the folding scooter introduced in Milan, and the other will be an even simpler model, without the folding capability, to be produced for regions where low cost is most important and space restrictions are not as crucial.

The whole design project was accomplished in eight months, “from a blank sheet to a built concept,” Mitchell said. The multigenerational, cross-disciplinary team included a core of four graduate students along with several others who made contributions, and students from the Undergraduate Research Opportunities Program. “They don’t know what’s ‘impossible,’” said Mitchell of the students, “so they just go out and do it.”

IMAGE COURTESY / **SMART CITIES GROUP**

Above, the lightweight electric scooter, developed by the Smart Cities Group in collaboration with groups in Taiwan, folds nearly in half, allowing for convenient storage. An artist’s rendering (below) shows how the low-cost scooter would provide a convenient and efficient mode of transportation in urban environments such as downtown Milan.

IMAGE COURTESY / **MICHAEL CHIA-LIANG LIN, SMART CITIES GROUP**

MIT commercial property index posts first drop since '03

Housing woes, credit crunch may be spreading

Greg Frost
News Office

Prices for commercial real estate posted their first quarterly drop in four years, according to an index produced by the MIT Center for Real Estate (MIT/CRE) that appears to show U.S. housing woes spreading into the commercial property market.

The MIT quarterly transaction-based index (TBI) released earlier this month showed that the value of U.S. commercial real estate owned by big pension funds fell 2.5 percent in the third quarter of 2007.

MIT/CRE Director David Geltner said the drop may not only spell the end of a five-year rally that saw commercial property prices effectively double, but it may also signal that weakness in the housing market is spilling over into commercial real estate, a sector made up of privately held income-producing buildings such as shopping malls, office towers and apartment complexes.

"The fall in our index is the first solid, quantitative evidence that the subprime mortgage debacle, which hit the broader capital markets in August, may be spreading to the commercial property markets," Geltner said.

Geltner has estimated the total market value of U.S. commercial real estate to be around $8 trillion, a portion of which is not traded by professional investors. The so-called "institutional" commercial property market is probably between $3 and $5 trillion, and the annual dollar volume of trading of such property is at least $350 billion, he said.

The TBI decline in the third quarter of 2007 marks its first quarterly downturn since the third quarter of 2003, when prices fell 2.4 percent. The last time prices fell more than in the third quarter of 2007 was in the fourth quarter of 2001 (following 9/11), when they fell 3.9 percent.

Against a backdrop of more than a year's worth of housing price declines and an international credit crunch that erupted over the summer, analysts have been seeking clues about whether other markets and sectors of the economy—including commercial real estate—would be impacted.

By way of comparison, one widely used barometer of U.S. housing, the S&P/Case-Shiller price index for 20 metro areas, peaked in mid-2006 and had fallen by 4.2 percent by August 2007. But in the four quarters since the housing price peak, the TBI showed commercial prices continuing to increase—by almost 20 percent.

The TBI receives transaction price data from the National Council of Real Estate Investment Fiduciaries (NCREIF). Launched in February 2006 and covering the period since 1984, the index of commercial real estate prices is updated quarterly and published on the MIT/CRE's website, web.mit.edu/cre.

The TBI is based on transaction prices of properties sold each quarter from the property database that underlies the NCREIF Property Index (NPI) and also makes use of the appraisal information for more than 6,000 NCREIF properties. Such an index—national, quarterly, transaction-based and by property type—had not been previously constructed prior to MIT's development in 2006. NCREIF encouraged development of the index, citing the need for better tools for research and decision-making in the industry.

The TBI was the first tool released by the Center for Real Estate's new Commercial Real Estate Data Laboratory (CREDL). CREDL, which has added further tools since the TBI, is designed to be "a real go-to site," according to CREDL co-director Henry Pollakowski, comparable to the University of Chicago's Center for Research in Security Prices, which tracks stock performance.

PHOTO COURTESY / **STOCK.XCHNG**

The four-year rally in U.S. commercial real estate may be coming to an end, according to an index produced by the MIT Center for Real Estate.

MIT study shows families do more than care–they are caregivers

Laurie Pass
MIT Workplace Center

Despite the lack of formal training and monetary compensation, families have become a part of the geriatric health care workforce, researchers at the MIT Workplace Center at the Sloan School of Management have concluded in a new report.

"We call family caregivers a 'shadow workforce' because the care they are providing is largely unseen and unrecognized, especially inside health care institutions," said Ann Bookman, executive director of the MIT Workplace Center.

This point is underscored in the report, "Caring for the Caregivers," which was prepared for the Massachusetts Executive Office of Elder Affairs. The report presented 10 recommendations for improving resources for elder caregivers in Massachusetts, such as expanding support services, training and wellness programs for caregivers, and making elder care information more accessible so that families can get help before a crisis arises.

Bookman said some 700,000 Massachusetts residents are involved in caring for elders and disabled family members, and it is estimated that they spend 697 million hours a year providing care at an annual market value of $6,914,000.

"A significant shift in cultural attitudes toward aging and elder care is needed if the work of family caregivers is to become fully visible and fully valued," she said.

The MIT research also challenges the common assumption that family caregivers provide care only in private homes. "What we observed is that families are playing an important role in hospitals, in rehabilitation facilities and nursing homes and in outpatient settings as well," Bookman said.

One of the key issues identified by caregivers in the MIT study was the lack of basic information about how to find elder care services and caregiver support.

"Just the word 'caregiver' is a problem because most people don't think of themselves as caregivers until they are at a crisis point," said Joan Butler, executive director of Minuteman Senior Services in Burlington, Mass., and contributor to the MIT report.

"You don't need to have 24/7 kind of involvement to be considered a caregiver," Butler said. "In fact, if there's any older person in your life that you're concerned about, and you're starting to ratchet up your contact with them and your concern, then you're a caregiver. And there's lots of support out there."

The MIT Workplace Center was founded in 2001 and is funded by the Alfred P. Sloan Foundation to address the current mismatch between existing workplace policies and practices and the changing work force. The Center's goal is to stimulate change on the level of private sector workplaces, community-based family care agencies and public policy.

TB

Continued from Page 1

that demands new approaches to disease diagnosis and treatment," said Megan Murray, one of the project's principal investigators and an associate member of the Broad Institute of MIT and Harvard and an associate professor at the Harvard School of Public Health. "By looking at the genomes of different strains, we can learn how the tuberculosis microbe outwits current drugs and how new drugs might be designed."

"Genome information is a powerful tool for understanding the biology of infectious disease, such as tuberculosis," said Eric Lander, professor of biology and founding director of the Broad Institute. "It is important that genomic data be made immediately available, particularly to researchers in areas most heavily burdened by disease."

Globally, tuberculosis is a major cause of infectious disease deaths. Nearly two billion people, comprising roughly one third of the world's population, are thought to carry M. tuberculosis, the culprit bacterium. Major obstacles to controlling the disease stem from the microbe's ability to evade current treatments, which typically require prolonged use by patients and are often not curative. Adding to the problem, inefficient diagnostic methods for TB make it difficult for doctors to determine whether an individual harbors a drug-resistant strain, often delaying proper therapy.

To shed light on the genetic changes that mediate drug resistance, the international team of scientists undertook a large-scale effort to sequence the genomes of drug-sensitive MDR and XDR TB isolates of a strain responsible for the current XDR TB epidemic in KwaZulu-Natal, South Africa.

The draft genome sequences of the various TB strains each cover roughly 95 percent of the M. tuberculosis genome. Comparing the DNA sequences in these regions allows the researchers to pinpoint the key differences among them, shedding light on the genetic factors that contribute to TB drug resistance. Strikingly, comparisons of the draft sequences reveal surprisingly few genetic differences among the drug-sensitive MDR and XDR strains: There are only a few dozen small DNA changes.

"These results also lay the groundwork for the development of a rapid diagnostic test for TB," said Murray. "Such a test would enable more-rapid and accurate diagnoses and help to prevent the spread of TB—especially the most virulent strains."

U.K.'s Stern eyes economic and policy responses to climate change

Deborah Halber
News Office Correspondent

As difficult as adapting to climate change will be for rich countries, developing countries will be much more deeply affected, British government adviser Nicholas Stern told an MIT Energy Initiative (MITEI) colloquium Monday, Nov. 19.

Although climate change poses severe risks to the economies and societies of the planet, the risk can be radically reduced with strong and timely action on a global scale, Stern said. A global deal involving India, China and other developing countries will be key, he said, but pushing them too far too fast may backfire.

Policy instruments such as price hikes, tax increases and cap-and-trade schemes, in which companies buy and sell permits to emit carbon, will need to be a key part of an emission-limiting global deal, he said. But fixing the carbon price alone won't work, Stern said, and technology will have to play an important role.

Stern served as adviser to the British government on the economics of climate change and development, and reported to the prime minister from 2003 to 2007. He headed the Stern Review on the Economics of Climate Change.

From an economist's point of view, he said, climate change represents a market failure: one person's action affects the livelihood of others, but the original actor bears none of the costs. Climate change is "the greatest example of market failure the world has ever seen because of the magnitude of the consequences and the fact that we're all involved," Stern said.

Stern said his economic and policy analysis is dictated by the scientific premise that human emissions of greenhouse gases are generating climate change that, if unaddressed, will lead to an increase in global temperatures that would cause massive migrations of people away from the equator, plus storms, floods and droughts. In all, those changes would "make much of the world hard to live in," he said.

The carbon dioxide in the earth's atmosphere is measured in parts per million (ppm). Current concentration levels average approximately 430 ppm and are steadily rising, Stern said. At 800 ppm, scientists predict a 50-50 chance of an annual temperature boost of 5 degrees Celsius, accompanied by severe global consequences.

"We have to be clear that at 750 or more ppm, we're going to live in a world that is extremely uncomfortable and very dangerous," he said.

The cost to slow the trend would be somewhere between 1 and 2 percent of gross domestic product—a bargain, Stern said, given the cost of inaction. "Most people are willing to take 2 percent of GDP to avoid the scale of damages," he said. "The cost of action is much less than the cost of inaction."

HR @ Your Service

New Manager Training

What prepares someone to be a manager? How do leaders become more effective? Can individuals learn to initiate change in their own work life? These are some of the questions addressed in HR's leadership and management development programs for MIT employees.

While it is true that some people are natural managers and leaders, the reality is that most of us are not—and need specific training to take on these roles. MIT's professional development classes support this; they are often oversubscribed because so many employees want to develop these skills.

Although HR offers several classes for managers, it has been many years since there was a comprehensive program that puts in one place what new managers need to know. On Dec. 14, a pilot of the New Manager Training Program at MIT will start. It has been clear for a while that the MIT community needed this; now, with resources and the help of leadership, it is a reality.

The overall goal of this new program is to prepare prospective managers for core responsibilities in managing individuals. The formation of the curriculum was collaborative, involving people from across the Institute. As with most new training, this program is being piloted to see how effectively it works and if it meets the needs of the participants. The pilot will involve 16 people from academic and administrative areas who are new to managing.

There will be a significant focus on using the material back "on the job," with nine three-hour sessions covering topics such as constructive communication, laws and policies, and managing employee development. Participants will learn through a blend of classroom activities and the web and will be able to apply their learning through their homework assignments.

This new program features interdisciplinary content, which evolved using input by the Training Alignment Team, a cross-functional group represented by departments on campus who provide Institute-wide, work-related training activities.

A spring pilot for experienced managers will aim to develop strengths in managing individuals and leading their teams.

With the addition of these two new programs, a continuum of leadership and management development programs at MIT now exists—training that provides skills and experiences that reflect different phases in a career.

It begins with "Everyday Leadership," a class for individuals who want to develop their ability to initiate and implement change in their work lives. This class is not intended to help people manage others, but to learn how they can take initiative, change their daily work and develop their own leadership skills. At the other end is "Leader to Leader (L2L)," focused on developing the effectiveness of MIT leaders in leading an organization within the Institute. L2L fellows (visit web.mit.edu/hr/oed/l2l/class.html to see this year's fellows) partner with senior leaders and MIT faculty, and leadership skills are developed within the context of MIT's culture and aligned to the strategic needs of the Institute. The foundation of this program is the individual development plan that each fellow creates. This 12-month program has proven to be a career-transforming experience—and in some cases has a life-changing impact.

Employees who participate in these classes need support when they return to their jobs. The managers of these employees play a critical role in helping their staff integrate what they have learned and apply it to their positions. It is then a win-win for everyone.

For more information, visit web.mit.edu/sapwebss/PS1/training_home.shtml.

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

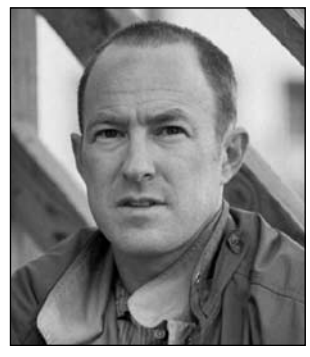
Faculty, alumna win United States Artists grants

Sarah H. Wright
News Office

Three current MIT faculty members and an MIT alumna have been named 2007 fellows by United States Artists (USA), a new organization that supports a diverse array of American artists in visual, literary, performing, design, media, and crafts and traditional arts.

Don Byron

Nader Tehrani



Evan Ziporyn

Among this year's 50 USA fellows are **Don Byron**, Martin Luther King Jr. Visiting Professor, **Maggie Orth** (S.M. 1993, Ph.D. 2001), **Nader Tehrani**, associate professor of architecture, and **Evan Ziporyn**, Kenan Sahin Distinguished Professor of Music.

Clarinetist and composer Byron is well known for his artful blends of Motown funk, experimental chamber music, klezmer, German lieder, and various forms of jazz, rock and hip-hop in his work and performance. The artistic director of jazz at the Brooklyn Academy of Music from 1996 to 1999, he has performed and been recorded with ensembles such as the Bang on a Can All-Stars and Kronos Quartet. He was named jazz artist of the year by Downbeat magazine in 1992 and received a Grammy Award nomination in 2004.

Orth creates smart textiles, a combination of textiles and computers. A pioneer of electronic textiles, interactive fashions, wearable computing and interface design, Orth designs two-dimensional fabric works that hang on the wall like paintings and change color when prompted by a viewer's touch.

Tehrani and Monica Ponce de Leon founded the Boston-based architecture firm Office dA in 1991. Office dA's work ranges in scale from furniture to urban design, with a focus on architecture, and the partners have designed and built projects around the world. Their rigorous approach to architecture employs both traditional and digital techniques of design and assembly, and their work is characterized by beautifully detailed building skins and powerful interior spaces.

Ziporyn combines Western traditions with Indonesian gamelan, resulting in a cross-cultural musical experience in his work. He also plays the clarinet, bass clarinet and soprano saxophone and is a member of the Bang on a Can All-Stars. In 1993 he founded Gamelan Galak Tika, a 30-member ensemble made up of MIT students, staff and community members who study and perform traditional and modern Balinese music.

–Material from unitedstatesartists.org was used in this article.

MISTI launches exchange program with Israel

MIT International Science and Technology Initiatives (MISTI) will expand its portfolio of eight countries (China, France, Germany, India, Italy, Japan, Mexico and Spain) with the launch of a new internship and research exchange program with Israel.

MISTI funds intensive, tailored, hands-on professional internships abroad with leading companies, research labs and universities for students at all academic levels and postdoctoral researchers. MISTI also supports workshops, conferences, symposia and lectures for MIT students and faculty with international corporations, government agencies and nongovernmental organizations, and assists MIT faculty with cross-border research collaboration.

"MISTI-Israel will serve as a lighthouse program—a bridge between the U.S. and Israel that will be the first of its kind at a major university," said Jake Seid (S.B., M.Eng., 1998) of Lightspeed Venture Partners, who is a member of the founding team.

The program will help initiate and strengthen research collaborations in critical areas such as stem cell research and tissue engineering, high-resolution microscopy and nanotechnology, and will allow a broad cross section of MIT students to build a meaningful understanding of Israel and deep local relationships.

Professor Christine Ortiz of the Department of Materials Science and Engineering, who will serve as faculty director of the new MISTI-Israel Program, said, "The quality of ongoing science and engineering education and research enterprise both in industry and academia in Israel is world-class; students who spend time in Israel via MISTI will receive both an outstanding technological and cultural life-changing experience."

Students who participate in MISTI-Israel may be placed in universities such as the Technion-Israel Institute of Technology (Haifa), the Weizmann Institute of Science (Rehovot), Tel Aviv University and the Hebrew University of Jerusalem, and a variety of leading-edge companies.

Students selected for 2008 internships must take a course on campus about Israel and cultural training before going abroad. They will have all expenses paid in addition to receiving a stipend. An informational session for MISTI-Israel will be held at 5 p.m. on Thursday, Nov. 29, in 6-104 (pizza will be served). Students who would like to apply to the program should send Ortiz (cortiz@mit.edu) a curriculum vitae, a letter of recommendation and a statement of preferred research area. General questions on MISTI-Israel may also be directed to Ortiz via e-mail.

NEWS YOU CAN USE

PLAZmA calls for entries

The School of Architecture and Planning is seeking submissions for its PLAZmA Digital Gallery, an electronic showcase of SA+P work and events displayed on nine large monitors set up in the school's public areas in Buildings 5, 7, 9, 10, W31, N52 and E15, the MIT Media Lab.

PLAZmA content runs continuously throughout the day, seven days a week. Past shows have featured samples of award-winning student artwork; images from an urban planning practicum in India; images from exhibits in MIT campus galleries; and images from a symposium on adaptive technologies.

Content is aimed at the interests of the SA+P community and includes faculty and student work, current research and fieldwork, material from school publications and galleries, and a calendar of upcoming events.

The school is seeking presentations created specifically for PLAZmA, as well as collections of stills and videos that come from research and schoolwork. Of particular interest is content that highlights collaborations among the School of Architecture's five divisions, with other departments at MIT, and with public and private institutions in the United States and abroad. Those who might be interested in curating PLAZmA shows on themes of their own choosing should also submit ideas.

For information on how to submit content and tips on what makes a good PLAZmA show, visit sap.mit.edu/resources/galleries/plazma_digital_gallery/.

Campus Dining hosts 5 percent day

Eat, drink and be giving—again! MIT Campus Dining will host the second annual "5% Day" on Wednesday, Nov. 28.

From 8 a.m. to 8 p.m., 5 percent of all sales conducted in all Campus Dining retail locations will be donated to the MIT Community Service Fund as part of Community Giving at MIT. Catering and residential dining rooms are excluded.

Last year this event raised more than $1,800 for the MIT Community Service Fund, providing financial assistance to support MIT student, faculty and staff volunteers in community service projects.

For information about dining locations or to view menus, visit web.mit.edu/dining. For information about this event, contact Anne Wilson, marketing specialist for Campus Dining, at awwilson@mit.edu.

For information about the MIT Community Service Fund, visit web.mit.edu/csf or contact Emily Paramore at 617-253-1988 or paramore@mit.edu. Visit web.mit.edu/communitygiving to learn more about Community Giving at MIT or to make an online donation.

Benefits Open Enrollment

Don't forget to choose your selections for this year's Benefits Open Enrollment by Nov. 30 at 4 p.m. All benefits-eligible staff can enroll or make changes to their medical and dental coverage, enroll in Flexible Spending Accounts, and review all benefits at MIT. For more information, visit http://hrweb.mit.edu/benefits/ or e-mail benefits-www@mit.edu. To enroll, visit web.mit.edu/sapwebss/PS1/benefits_home.shtml.

PHOTO / **KRISTOF ERKILETIAN**

The MIT Dance Theater Ensemble's production of "Madness at Mokuba" features giant robots (such as the one portrayed here by Kristof Erkiletian) among its many characters.

Anime takes the stage

Japanese animation-inspired play features live-action heroes, villains

Sarah H. Wright
News Office

The excitement and eccentricities of anime will be brought to life this week when members of the MIT community perform "Live Action Anime 2007: Madness at Mokuba," a play directed and co-written by MIT professors.

Anime (pronounced "ah-nee-may") refers to Japanese animated films and television shows in which characters are often drawn with large eyes and spiky hair and presented as ultraviolent and possessed of quirky sexuality. Anime is a global media phenomenon, embracing children's shows and toys like Pokémon as well as fine arts genres including such films as Paprika.

The MIT Dance Theater Ensemble's production of "Madness at Mokuba" is part homage to anime history, part commentary on the plight of undocumented workers in the United States, and 100 percent tribute to anime creators and fans worldwide. The original production features giant robots, a Japanese schoolgirl, a lovelorn otaku, a master-less samurai, evil media magnates and a vengeful death-god, all of whom battle for truth, justice and the anime way.

The story begins in bitter conflict and intensifies from there: As two teams rev up for the finals of the giant robot contest at the Mokuba Institute of Technology, a strange disease called Virtigo sweeps the school and causes unpredictable reality slippages.

As Virtigo gets worse, the anime heroes start sleuthing. Are the reality slippages linked to Homeland Security's suspicious arrest of undocumented workers nearby? More pressing: Can the heroes solve the mystery of Virtigo, help the workers and…find love?

"Madness at Mokuba" is directed by Thomas F. DeFrantz, professor of music and theater arts, with an original script by Ian Condry, associate professor and Mitsui Career Development Professor in foreign languages and literatures. The play features a cast of MIT students, faculty and members of the MIT community.

To set the stage for the show, Condry will present a lecture, "Explaining Anime's Global Power," at 4:30 p.m. Thursday, Nov. 29, in Kresgge Little Theater.

Condry, an anthropologist who specializes in Japan, media and the globalization of culture, said MIT students broadened his anime horizons and in the process helped bring about his involvement with "Madness at Mokuba."

"I knew anime classics like 'Akira,' 'Ghost in the Shell' and 'Princess Mononoke,' but my MIT students got me excited about lesser-known works, which helped inspire the 'Madness' project," Condry said. "They introduced me to the tremendous range of cutting-edge anime that is translated by fans and made available online." (To read a Q&A with Condry in which he discusses anime in greater detail, please visit the MIT News Office site at web.mit.edu/newsoffice.)

Among the MIT students taking part in the production is junior Ashley Micks, who not only performs onstage but also drew cartoons of the characters that will appear in the production.

"Madness" and Condry's kickoff lecture on Nov. 29 are sponsored by the MIT Japan Program, MIT Music and Theater Arts, MIT Foreign Languages and Literatures, SLIPPAGE: Performance, Culture, Technology, the Cool Japan Research Project and the De Florez Fund for Humor.

Performances of "Madness at Mokuba" will be held at 8 p.m. Nov. 29-Dec. 1 in Kresge Little Theater. The performances are free and open to the public. For more information, please contact Condry at condry@mit.edu or 518-542-5058, DeFrantz at defrantz@mit.edu, or K.C. Cortinovis at kccort@mit.edu or 617-253-4771.

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