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Wednesday, March 4, 2009

TechTalk

SERVING THE MIT COMMUNITY

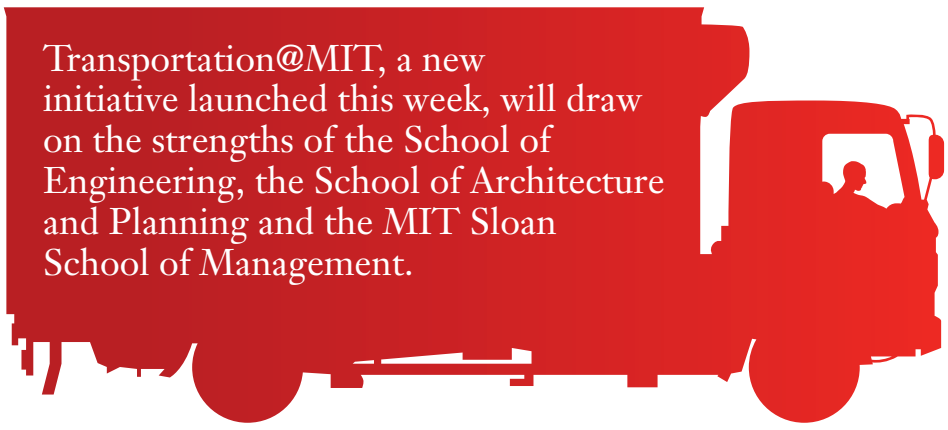
IMAGE / **JASON PONTIUS**

TRANSPORTATION, TRANSFORMED

David Chandler
News Office

When faculty members at MIT began talking about teaming up to tackle large-scale, global problems of transportation, they soon found that these problems were already getting considerable attention across campus. This realization helped spur the creation of Transportation@MIT, a new initiative launched this week that will draw on the strengths of the School of Engineering, the School of Architecture and Planning and the MIT Sloan School of Management.

"I think everyone was surprised" to discover how much work in various aspects of transportation is already under way at MIT, says Cynthia Barnhart, who will direct the new initiative, describing the results of a survey sent to faculty members and researchers. Survey results showed that at least a quarter of MIT faculty and researchers were already working on transportation-related projects.



Transportation@MIT, a new initiative launched this week, will draw on the strengths of the School of Engineering, the School of Architecture and Planning and the MIT Sloan School of Management.

"It is amazingly broad, way beyond what I imagined, and I do transportation [as a primary focus]," says Barnhart, the associate dean for academic affairs for the MIT School of Engineering and professor of civil and environmental engineering and engineering systems. Transportation@MIT will thus build on what is already in place at the Institute: interdisciplinary collaborations on transportation technology and policy that cut across schools, departments and labs.

This approach is essential, many of the researchers say, because when it comes to designing transportation systems that are more efficient, more sustainable and more pleasant for their passengers, there's only so far you can go by working on each piece of the puzzle separately. It's much more effective to tackle the issues as a whole and to design systems in an integrated way. And that's where MIT has a lot to offer.

Studying the big picture

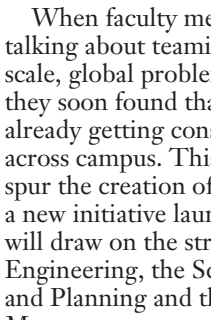
John Sterman, the Jay W. Forrester Professor of Management at MIT Sloan and director of MIT's System Dynamics Group, says that a multidisciplinary approach is essential to solving the problems of transportation. "It's not just

▶Please see TRANSPORT, **PAGE 3**

Dresselhaus wins prestigious Vannevar Bush award

Patrick Gillooly
News Office

The National Science Board has named Institute Professor Mildred Dresselhaus as the 2009 recipient of the Vannevar Bush award, which annually recognizes an individual who, through public service activities in science and technology, has made an outstanding "contribution toward the welfare of mankind and the nation."



Mildred Dresselhaus

The award, established in 1980, commemorates Bush's unique contributions to public service; it also has a unique tie-in with MIT, as Bush was an influential professor, vice president and dean of engineering at the Institute, and later an advisor to several presidents.

Dresselhaus said the award was a "total surprise," but noted that it not only honors her work, but that of all MIT faculty.

"Ever since I've been here — and I've been here for my whole career — we've been strongly influenced by service not only to MIT but the whole country; it's part of what MIT stands for, we're indoctrinated with this, and we feel good about this," she said. "It's an honor to receive this award … Vannevar Bush is somebody really special at MIT, and someone special in the nation."

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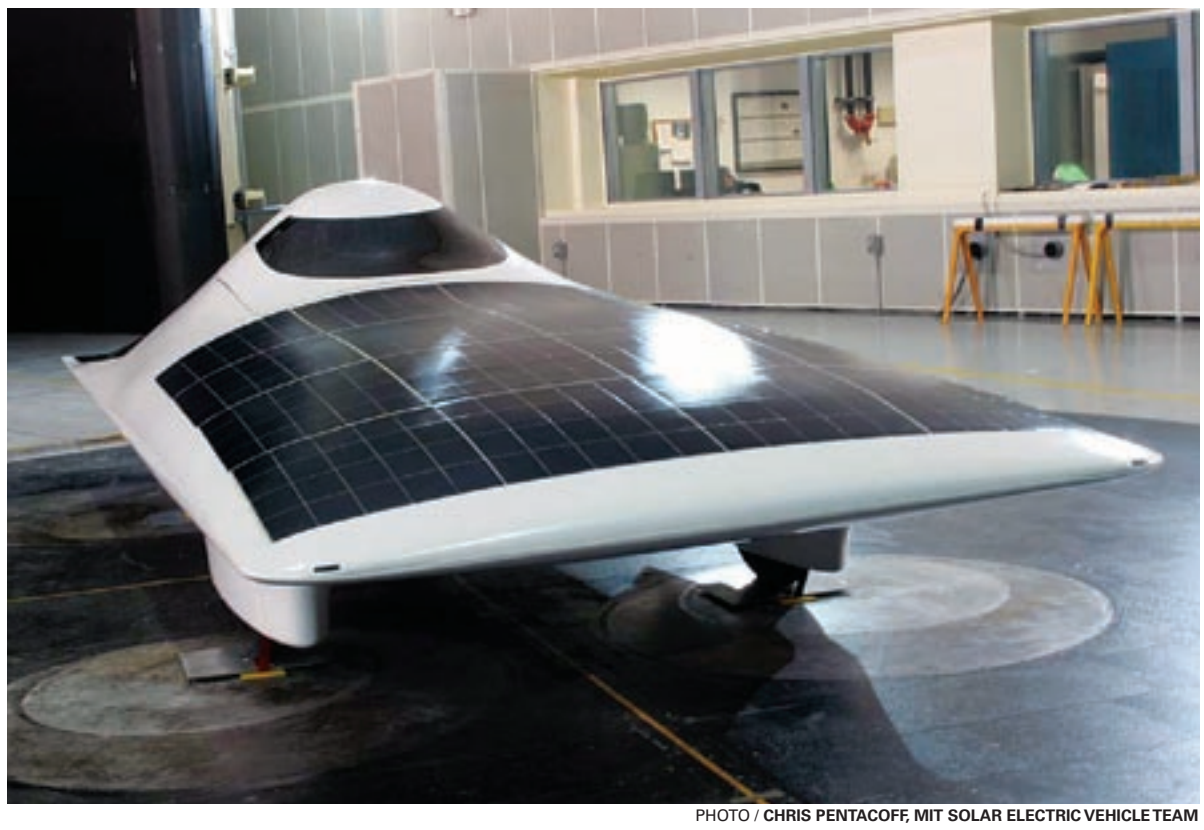


PHOTO / **CHRIS PENTACOFF, MIT SOLAR ELECTRIC VEHICLE TEAM**

Meet 'Eleanor'

MIT's Solar Electric Vehicle Team, the oldest such student team in the country, unveiled its latest high-tech car last week. The new vehicle, 'Eleanor,' is equipped with wireless links so lead and chase vehicles will be able to monitor every aspect of the car's electrical performance in real time. Its batteries have enough energy, when fully charged, to get the car from Boston to New York City without need of sunlight. See video of the new vehicle at http://web.mit.edu/newsoffice/2009/solar-car-vid-0302.html.

Events at MIT

Today

• 2009 MIT Excellence Awards. 11:30 a.m–2 p.m. W16, Kresge Auditorium and lobby. The celebration of the 2009 MIT Excellence Award recipients. These awards are among the highest honors that MIT staff can receive for their exceptional work and contributions to the Institute.

• "The Strategic Framework for U.S.-Iranian Engagement." Speaker: Hillary Mann Leverett, CEO, STRATEGA (Strategic Energy and Global Analysis). Noon-1:30 p.m. in E38-615.

• Latke-Hamantashen Debate. 8-9 p.m. in 26-100. Don't miss this exciting debate between the fruit-filled cookie known as the hamantash and the fried potato pancake otherwise known as the latke! Each team, composed of MIT's finest scholars, presents an argument in favor of their respective food. Following the debate, votes are cast, ballots are counted, and the champion is crowned. Free latkes and hamantashen are served following the debate.

Friday, March 6

• Super Tall Buildings. Speaker: Hi Choi, vice president, Thornton Tomasetti. 12:15 p.m.–1:15 p.m. in 1-150.

• MacVicar Day panel discussion. 2-3:30 p.m. in 9-057, and later, in Lobby 9. Each year, MacVicar Day honors Margaret MacVicar's memory by recognizing the significant achievements made to enhance undergraduate education. A faculty panel will discuss "New Directions in General Education at MIT."

• Legatum Center Lecture: "Bottom-up Development and Entrepreneurship in Emerging Markets." 4 p.m. in 32-155. Michael Chu and Karim Khoja (CEO of Roshan) will discuss bottom-up development in emerging markets.

Monday, March 9

• Sanctions, Containment and Science in the Islamic Republic of Iran. 4 p.m. in E51-095. Speaker: Dara Entekhabi. As part of the STS colloquium series titled Science and Technology in Africa, Asia, and Beyond, Professor Entekhabi will relate his personal experiences in scientific collaborations with researchers in the Islamic Republic of Iran. The challenges of working these collaborations and impressions about the effects of sanctions and containment policies on the development of science in Iran will be discussed.

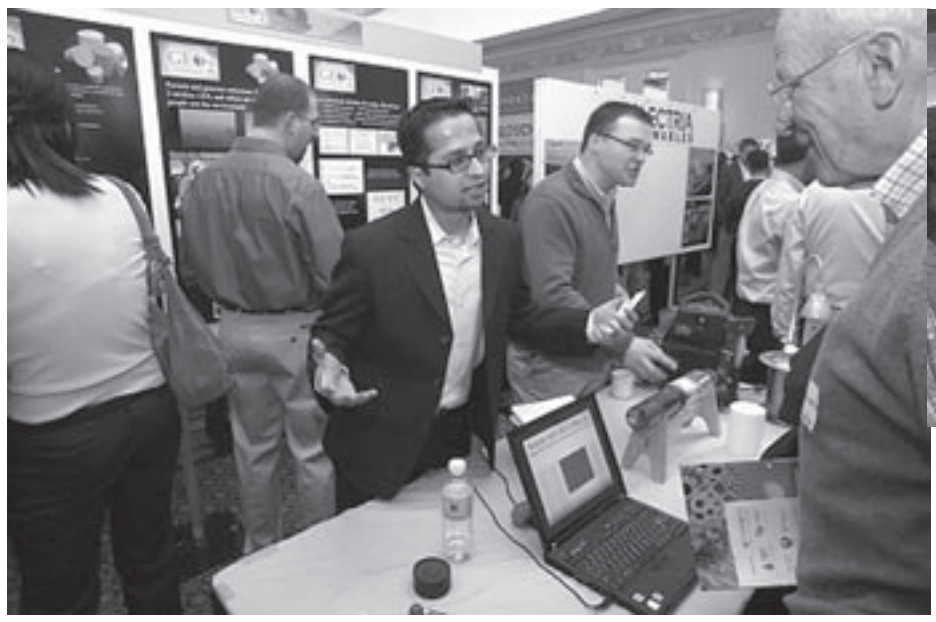
Submit your events!

Log on to events.mit.edu to add your events to MIT's online calendar. Certain events will be selected from the online calendar to be published in Tech Talk each Wednesday.

2009 ENERGY CONFERENCE

Energy-filled days

MIT's annual student-led Energy Conference adds new events



PHOTOS COURTESY OF THE MIT ENERGY CLUB

Images from previous student-run Energy Conferences. This year's conference will take place this Friday and Saturday at the Kendall Square Marriott.

MIT's annual student-run Energy Conference, now in its fourth year, continues to grow and has added some new features this year. The conference itself, being held this Saturday, is already sold out, but two topical workshops on Friday afternoon, and a showcase exhibit Friday evening, are free and still open to the public.

The theme of this year's conference is "Accelerating Change in Global Energy." The daylong event begins with a talk by MIT President Susan Hockfield, followed by a keynote talk by Lars Josefsson, the president and CEO of Sweden-based energy group Vattenfall. U.S. Rep. Jay Inslee (D-Wash.), who chairs the Sustainable Energy and Environment Coalition in the House of Representatives, will deliver a keynote address.

As always, the conference, which is co-organized by the MIT Energy Club and the MIT Sloan School of Management's Energy & Environment Club, features a wide range of leading experts from both industry and academia. For much of the day the discussions will break into two tracks, with panels on bioenergy, wind power, energy storage, baseload power, emerging economies, demand management, and transportation. A final panel, moderated by MIT Energy Initiative Director Ernest J. Moniz, will summarize the conference's theme.

Friday afternoon's sessions are a new addition to the conference agenda this year, and organizers describe them as "a unique opportunity for a more in-depth discussion around select topics." They consist of four separate workshops focused on specific energy topics. Two of them, on wind energy and on capturing carbon dioxide out of the air, are already closed, but two other sessions, on "Nuclear Power: New Markets and New Opportunities," and "The Smart Grid: Opportunities and Challenges," are still open. The workshops run from 1 to 5 p.m.

Finally, the Friday evening Energy Showcase, from 5 to 8 p.m. at the Kendall Square Marriott, will feature more than 60 posters about academic research projects on energy, as well as displays from at least 30 energy companies, many of them spinoffs from MIT research, and a variety of interactive exhibits. The free showcase is designed as an informal event, with live music, cocktails and hors d'oeuvres, to encourage mingling and networking among the participants.

Obituaries

Former Professor Mollo-Christensen, concentration camp survivor, 86

PHOTO COURTESY OF THE MIT MUSEUM

Erik L. Mollo-Christensen

Former professor and NASA scientist Erik L. Mollo-Christensen '48, SM '49, ScD '54 who resisted Nazi occupation of his native Norway and survived the Buchenwald concentration camp, died on Feb. 20. He was 86.

Mollo-Christensen taught at MIT for more than 30 years as a professor of aeronautics, meteorology and oceanography. He was credited with significant discoveries in the physics of turbulence flow, jet noise, aero elasticity, air-sea interaction and the field of fluid dynamics, including major work on blood flow.

Born Jan. 10, 1923, in Bergen, Norway, Mollo-Christensen joined the Norwegian resistance during World War II. He was captured by the Nazis and sent in 1943 to Germany's Buchenwald camp, where as many as 56,000 prisoners are estimated to have died. After the war, he returned briefly to Norway before moving to Cambridge in 1946 to begin his studies at MIT.

Hired by the Institute in 1948, he became an associate professor in 1955 and a full professor in 1962. He left MIT in the mid-1980s for NASA's Goddard Institute for Space Studies, where he served as chief of the Laboratory for Oceans and associate director of Earth Sciences. He remained a research affiliate at MIT through June 1995.

Mollo-Christensen was an avid outdoorsman who enjoyed hiking, skiing, sailing and being near the ocean. He conducted buoy research off Cuttyhunk Island, Mass., where his family built a summer home. An expert on tides and currents, he frequently advised the National Oceanic and Atmospheric Administration and worked as a consultant for the government of Bangladesh and the city of Venice.

In 1957, Mollo-Christensen was awarded a Guggenheim Fellowship. He was the 1970 Von Karman lecturer of the American Institute of Aeronautics and Astronautics. He was a fellow of the American Academy of Arts and Sciences and fellow of the American Physical Society.

He is survived by his wife of 61 years, Johanna, of Lexington; three children; six grandchildren; a brother and many nieces and nephews. Contributions in Mollo-Christensen's memory may be made to the Mount Auburn Hospital, 330 Mount St., Cambridge, MA 02138.

A memorial service will be held in the spring.

Lee Anne Coffey memorial service to be held March 6

A memorial service for Lee Anne Coffey will be held at 10 a.m. on Friday, March 6, in the MIT Chapel.

Coffey, business manager of the Environmental Health and Safety Headquarters Office, passed away on Wednesday, Jan. 28, at Massachusetts General Hospital after a courageous battle with breast cancer. She was 41.

The memorial service will be followed by a reception in the main dining room on the first floor of W11.

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What drives brain changes in macular degeneration?

MIT study sheds light on underlying neural mechanism

Cathryn Delude
McGovern Institute

In macular degeneration, the most common form of adult blindness, patients progressively lose vision in the center of their visual field, thereby depriving the corresponding part of the visual cortex of input. Previously, researchers discovered that the deprived neurons begin responding to visual input from another spot on the retina — evidence of plasticity in the adult cortex.

Just how such plasticity occurred was unknown, but a new MIT study sheds light on the underlying neural mechanism.

"This study shows us one way that the brain changes when its inputs change. Neurons seem to 'want' to receive input: when their usual input disappears, they start responding to the next best thing," said Nancy Kanwisher of the McGovern Institute for Brain Research at MIT and senior author of the study appearing in the March 4 issue of the Journal of Neuroscience.

"Our study shows that the changes we see in neural response in people with MD are probably driven by the lack of input to a population of neurons, not by a change in visual information processing strategy," said Kanwisher, the Ellen Swallow Richards Professor of Cognitive Neuroscience in MIT's Department of Brain and Cognitive Sciences.

Macular degeneration affects 1.75 million people in the United States alone. Loss of vision begins in the fovea of the retina — the central area providing high acuity vision that we use for reading and other visually demanding tasks. Patients typically compensate by using an adjacent patch of undamaged retina. This "preferred retinal locus" (PRL) is often below the blind region in the visual field, leading patients to roll their eyes upward to look at someone's face, for example.

The visual cortex has a map of the visual field on the retina, and in macular degeneration the neurons mapping to the fovea no longer receive input. But several labs, including Kanwisher's, previously found that the neurons in the visual cortex that once responded only to input from central vision begin responding to stimuli at the PRL. In other words, the visual map has reorganized.

"We wanted to know if the chronic, prior use of the PRL causes the cortical change that we had observed in the past, according to what we call the use-dependent hypothesis," said first author Daniel D. Dilks, a postdoctoral fellow in the Kanwisher lab. "Or, do the deprived neurons respond to stimulation at any peripheral location, regardless of prior visual behavior, according to the use-independent hypothesis?"

The previous studies could not answer this question because they had only tested patients' PRL. This new study tests both the PRL and another peripheral location, using functional magnetic resonance imaging (fMRI) to scan two macular degeneration patients who had no central vision, and consequently had a deprived central visual cortex.

Because patients habitually use the PRL like a new fovea, it could be that the deprived cortex might respond preferentially to this location.

But that is not what the researchers found. Instead, the deprived region responded equally to stimuli at both the preferred and nonpreferred locations.

This finding suggests that the long-term change in visual behavior is not driving the brain's remapping. Instead, the brain changes appear to be a relatively passive response to visual deprivation.

"Macular degeneration is a great opportunity to learn more about plasticity in the adult cortex," Kanwisher said. If scientists could one day develop technologies to replace the lost light-sensitive cells in the fovea, patients might be able to recover central vision since the neurons there are still alive and well.

Chris Baker of the Laboratory of Brain and Cognition (NIMH) and Eli Peli of the Schepens Eye Research Institute also contributed to this study, which was supported by the NIH, Kirschstein-NRSA, and Dr. and Mrs. Joseph Byrne.

Cynthia Barnhart, left, will lead Transportation@MIT. John Sterman, above, is among the many faculty members involved in the new initiative.

TRANSPORT: Multidisciplinary research going way beyond the car

Continued from **Page 1**

the technology, it's the deployment and diffusion," he says, cautioning that in the absence of a strategy that takes into account the big picture, many innovations "have failed, often after a spectacular start," a phenomenon he calls "sizzle and fizzle."

Examples abound: Brazil's attempt to introduce biofuels in the 1970s, and the United States' attempt to introduce electric cars in the 1990s. However, sometimes the same basic idea, managed differently, can produce a different outcome: Brazil's biofuels program of the last few years has been a great success. When Sterman addresses a given technology, he often asks crucial questions that have nothing to do with the technology itself, such as, "What kind of marketing program, such as subsidies, tax credits or other incentives, would be needed to help get it over the tipping point?"

William Mitchell of the Media Lab and the School of Architecture and Planning says that while "we already have useful cross-disciplinary connections" in several areas, the new initiative should "facilitate the further development of a community of interest, enhance interchanges, and encourage and support broad initiatives."

Mitchell's work covers a variety of transportation modes and innovative ways of deploying them. "We have," he says, "been developing some lightweight, energy-efficient electric vehicles — the CityCar, the RoboScooter and the GreenWheel bicycle — together with ways to integrate these sorts of vehicles into innovative urban personal mobility systems, particularly mobility-on-demand systems."

Besides inventing new kinds of vehicles and distribution systems, the initiative will look for ways to make existing ones more efficient. "In 2007, flight delays cost passengers, airlines and the U.S. economy more than $40 billion," says Georgia Perakis, associate professor of operations research at the MIT Sloan School of Management. "Finding ways to alleviate congestion and operate airports more efficiently is crucial." One option being studied is "congestion pricing" — essentially a tax designed to get airlines to adopt more-efficient scheduling.

'All the relevant players'

Overall, the emphasis of the initiative is to focus on whole regional transportation systems. "Our goal is to develop an integrated model of land use, transportation, environmental impacts and energy use based on human activities, for the evaluation of a range of 'green' policies and projects," says Moshe E. Ben-Akiva, the Edmund K. Turner Professor of Civil and Environmental Engineering. Toward that end, Ben-Akiva's group has developed the Integrated Transport, Energy and Activity-Based Model (ITEAM) project, creating a platform and tools to help planners evaluate the tradeoffs between different proposed transportation policies and regulations.

Joseph Sussman, the JR East Professor in the Department of Civil and Environmental Engineering and the Engineering Systems Division, also emphasizes the importance of the interdepartmental approach embodied in the new initiative. "That approach is of great value because many of the projects I work on," from an engineering perspective, "have important implementation issues, involving the institutional framework, and the social and political frameworks."

Would it make more sense for a city to expand its airport to allow more flights, or to build a high-speed rail link that would reduce the need for those flights? Typically, such decisions are made separately by different agencies, but the new initiative aims to foster ways to help regional or national planners evaluate these kinds of tradeoffs "with this broader geographic scale, as opposed to the current highly modal way that kind of planning is done," Sussman says.

Such broad-based strategic planning can also be applied at an urban scale. Christopher Zegras, who researches how land-use planning in growing cities can be optimized for efficient transportation and who has been working with communities in Chile, China and Portugal, agrees that having the new initiative will make a big difference. "MIT has all the relevant players" in the different disciplines involved in transportation, including mechanical and electrical engineering, urban planning, operations research and business management.

"Each of those will play a crucial role in solving problems in mobility," he says. The new transportation initiative "will have a major impact if it succeeds in bringing these forces together. MIT is uniquely situated to take this field into the 21st century."

See the full press release at web.mit.edu/newsoffice.

Awards &Honors

Hynes wins Pasarow research award

Richard O. Hynes, the Daniel K. Ludwig Professor for Cancer Research in the Department of Biology, has been awarded the 2008 Pasarow Medical Research Award for research in cardiovascular disease. The award, granted annually, is for distinguished accomplishment in research in order to increase public awareness of vital areas of investigation. Hynes, who is also member of the David H. Koch Institute for Integrative Cancer Research at MIT and a Howard Hughes Medical Investigator, will receive $50,000 for winning the prize.

Chemistry professors win ACS awards

MIT researchers Dan Nocera and JoAnne Stubbe were recently honored by the American Chemical Society for their work in the field of chemistry.

Stubbe, the Novartis Professor of Chemistry and professor of biology, was honored with the Nakanishi Prize, presented to recognize and stimulate significant work that extends chemical and spectroscopic methods to the study of important biological phenomena.

Nocera, the Henry Dreyfus Professor of Energy and professor of chemistry, won the ACS Award in Inorganic Chemistry, which recognizes and encourages fundamental research in the field of inorganic chemistry.

Grochow named ACM distinguished engineer

MIT Vice President for Information Services and Technology Jerrold Grochow has been recognized as a 2008 Association for Computing Machinery (ACM) Distinguished Engineer. The ACM honored 10 engineers and 27 scientists for their individual contributions to both the practical and theoretical aspects of computing and information technology.

Whitehead named top employer for postdoctoral researchers

The Whitehead Institute for Biomedical Research is the top place to work for postdoctoral researchers, according to The Scientist's seventh annual survey of research institutions nationwide.

Last year was the first time Whitehead made The Scientist's top 15 list, when it ranked 14th out of 82 U.S. institutions. According to the magazine, Whitehead's placement improved so dramatically because the institute has renewed its focus on postdocs. Specifically cited were Whitehead's generous benefits, high-caliber senior scientists and a family-friendly environment that supports a healthy work-life balance.

Engineered viruses can help fight antibiotic resistance

Anne Trafton
News Office

A new approach to fighting bacterial infections, developed at MIT and Boston University, could help prevent bacteria from developing antibiotic resistance and help kill those that have already become resistant.

Researchers from both schools have engineered a virus that knocks out bacterial defense systems, enhancing the effectiveness of antibiotics. The work was reported in the March 2 online issue of the Proceedings of the National Academy of Sciences.

Antibiotic-resistant bacteria pose a serious and growing health risk. The Centers for Disease Control and Prevention estimates that the antibiotic-resistant bacterium MRSA, or methicillin-resistant Staphylococcus aureus, causes approximately 94,000 infections and contributes to 19,000 deaths annually in the United States.

New drugs are needed to combat these superbugs, but very few new antibiotics have been developed in the past few decades. "There are a lot of targets to go after, but people haven't been able to find the drugs," said Timothy Lu, lead author of the paper and an MD candidate in the Harvard-MIT Division of Health Sciences and Technology (HST).

Lu and James Collins, Howard Hughes Medical Institute investigator and professor of biomedical engineering at BU, took a new approach: engineering existing bacteriophages (viruses that infect bacteria) to attack specific targets. "It's much easier to modify phages than to invent a new drug," said Lu.

Lu, who completed his PhD at HST last year, won the $30,000 Lemelson-MIT Student Prize and the grand prize in the National Collegiate Inventors Competition in 2008 for his work with engineered bacteriophages.

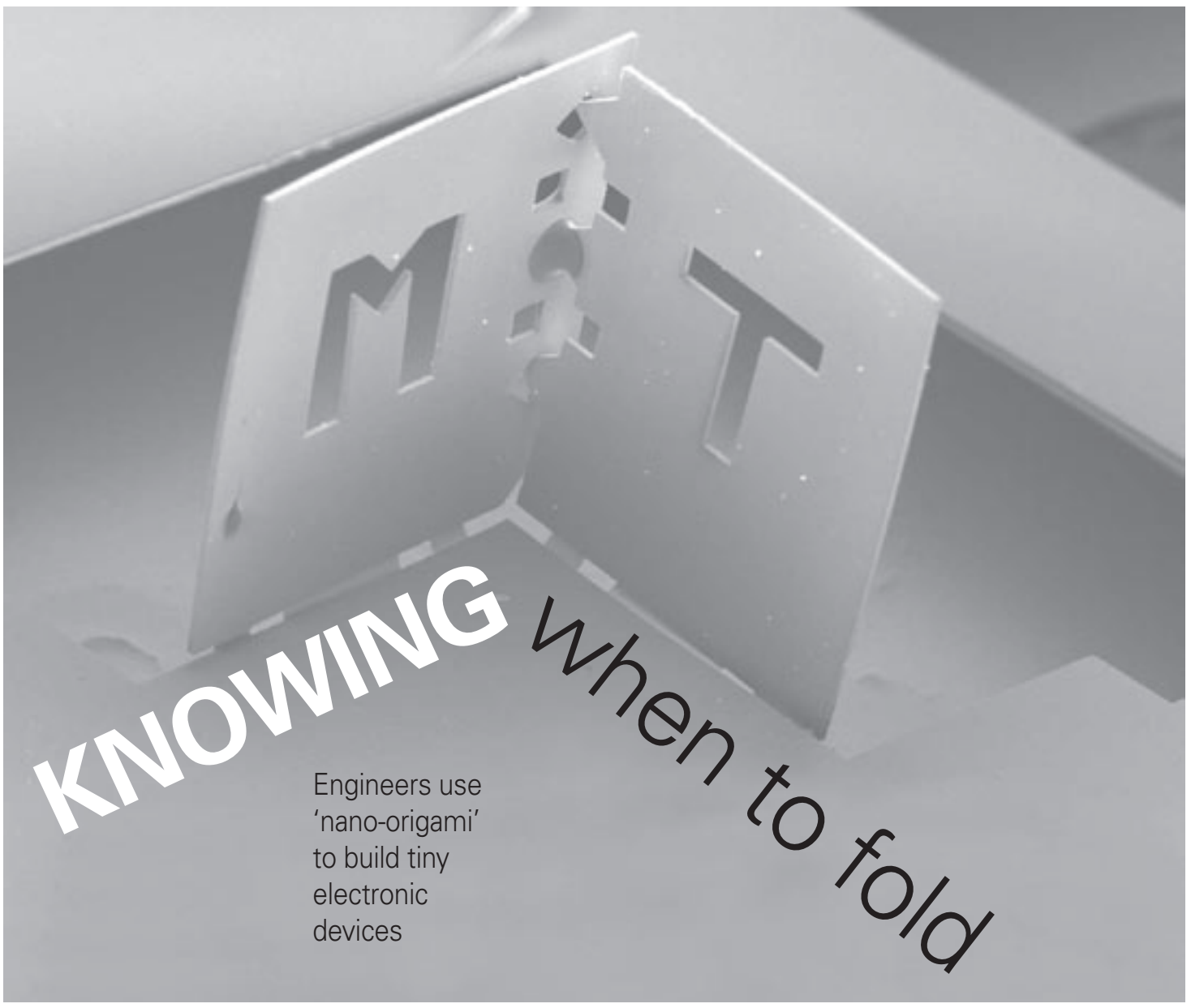
The engineered viruses described in the PNAS paper attack the SOS system, a bacterial DNA repair system enlisted when bacteria are exposed to antibiotics, and other gene networks. Used in conjunction with traditional antibiotics, the viruses undermine bacterial defense systems and prevent resistance from developing.

The researchers tested their phages with three major classes of antibiotics (quinolones, beta-lactams and aminoglyclosides) and had good results with all three. In mice infected with bacteria, those treated with both engineered bacteriophage and antibiotics had an 80 percent survival rate, compared with 50 percent for mice treated with natural bacteriophages and antibiotics, 20 percent for mice treated only with antibiotics, and 10 percent for untreated mice.

In 2007, Lu and Collins demonstrated the successful creation of an engineered virus that could attack and destroy surface "biofilms" of harmful bacteria that can form on industrial and medical devices. Such viruses could be used in food processing plants, hospitals or other settings where bacteria can accumulate.

This work was funded by the National Institutes of Health and the Howard Hughes Medical Institute.

The researchers have launched a start-up company, Novophage, to develop the engineered viruses, and are participating in several business plan competitions, including the MIT $100K Entrepreneurship Competition, the BU $50K Business Plan Competition, and the Harvard Business School Business Plan Contest.



IMAGES / **NADER SHAAR**

MIT researchers have developed a way to fold nano- and microscale polymer sheets into simple 3-D structures, such as three sides of a cube, above. Below, the researchers have manipulated the sheets to line up at different angles.

Anne Trafton
News Office

Folding paper into shapes such as a crane or a butterfly is challenging enough for most people. Now imagine trying to fold something that's about a hundred times thinner than a human hair and then putting it to use as an electronic device.

A team of researchers led by George Barbastathis, associate professor of mechanical engineering, is developing the basic principles of "nano-origami," a new technique that allows engineers to fold nanoscale materials into simple 3-D structures. The tiny folded materials could be used as motors and capacitors, potentially leading to better computer memory storage, faster microprocessors and new nanophotonic devices.

Traditional micro- and nano-fabrication techniques such as X-ray lithography and nano-imprinting work beautifully for two-dimensional structures, and are commonly used to build microprocessors and other micro-electrical-mechanical (MEMS) devices. However, they cannot create 3-D structures.

"A lot of what's done now is planar," says Tony Nichol, a mechanical engineering graduate student working on the project. "We want to take all of the nice tools that have been developed for 2-D and do 3-D things."

The MIT team uses conventional lithography tools to pattern 2-D materials at the nanoscale, then folds them into predetermined 3-D shapes, opening a new realm of possible applications.

Smaller, faster

The researchers have already demonstrated a 3-D nanoscale capacitor, developed in collaboration with MIT Professor Yang Shao-Horn, which was presented at the 2005 meeting of the Electrochemical Society. The current model has only one fold but the more folds that are added, the more energy it will be able to store. Extra layers also promote faster information flow, just as the human brain's many folds allow for quicker communication between brain regions, says Nader Shaar, a mechanical engineering graduate student working on the project.

Getting the materials to fold back and forth into an accordion-like structure has been one of the researchers' biggest challenges, along with getting the faces and edges to line up accurately.

They have worked out several ways to induce the nanomaterials to fold, including:

- Depositing metal (usually chromium) onto the surface where you want the fold to be. This causes the material to curl upward, but it does not allow for right angles or accordion-type folds.
- Directing a beam of helium ions onto the desired fold location. The beams imprint patterns that will cause the material to fold once it's removed from the surface. High-energy beams go to the bottom of the material and cause it to fold up; ions from low-energy beams accumulate at the top of the material and make it fold down.
- Embedding gold wires in the material. A current running along the gold wires interacts with an external magnetic field, creating a Lorentz force that lifts the face. This technique is a form of directed self-assembly, where the designer provides the template and then lets the device assemble itself.

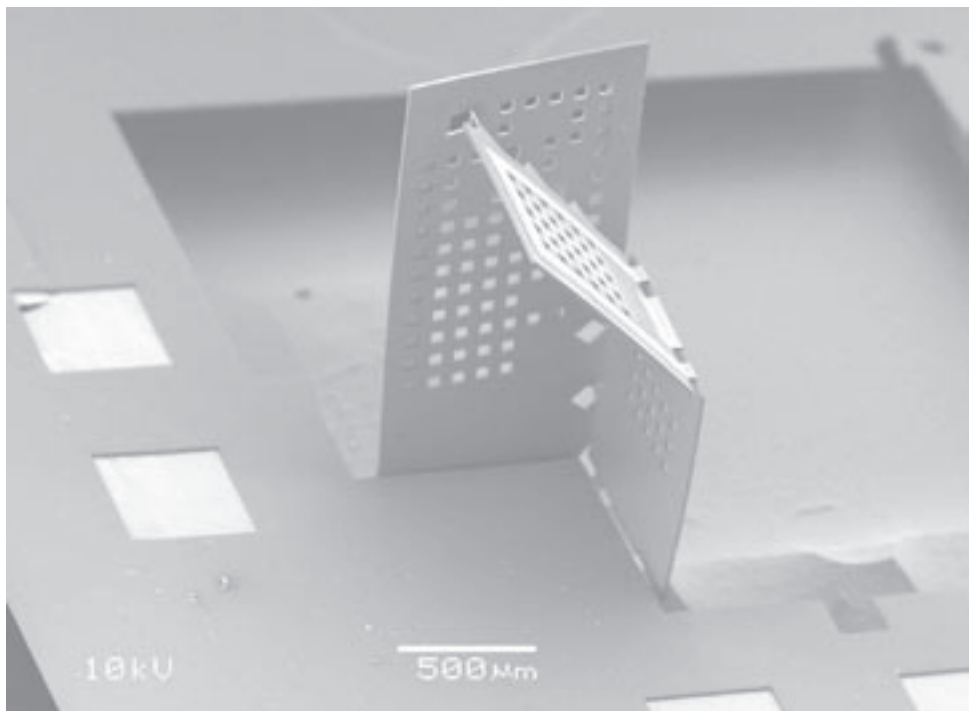
The folded shapes can be fabricated with a few different types of material, including silicon, silicon nitride (a type of ceramic) and a soft polymer known as SU-8.

Once the material is folded, the tricky part is getting the faces to align properly. The researchers have developed a few ways to do this successfully: one uses magnets; another involves attaching polymers to a certain spot on the faces and melting them with an electric current, sealing the two faces together.

They're still working on getting faces and edges of a folded cube to line up with nanoscale precision, but Shaar, co-supervised by associate professor of mechanical engineering Carol Livermore, has devised a promising method that uses three pairs of matching holes and protrusions to pull the edge and face into alignment.

The researchers are deep in the development phase of their nano-folded devices, but they are starting to think about how the technology could be used in the future. "We've got the core components figured out, and now we're just having fun with figuring out some applications," says Nichol.

See video of the 'nano-origami' at web.mit.edu/newsoffice



GOOD VIBRATIONS

Devices aid the deaf by translating sound waves to vibrations

Anne Trafton
News Office

Lip reading is a critical means of communication for many deaf people, but it has a drawback: Certain consonants (for example, p and b) can be nearly impossible to distinguish by sight alone.

Tactile devices, which translate sound waves into vibrations that can be felt by the skin, can help overcome that obstacle by conveying nuances of speech that can't be gleaned from lip reading.

Researchers in MIT's Sensory Communication Group are working on a new generation of such devices, which could be an important tool for deaf people who rely on lip reading and can't use or can't afford cochlear implants. The cost of the device and the surgery make cochlear implants prohibitive for many people, especially in developing countries.

"Most deaf people will not have access to that technology in our lifetime," said Ted Moallem, a graduate student working on the project. "Tactile devices can be several orders of magnitude cheaper than cochlear implants."

Moallem and Charlotte Reed, senior research scientist in MIT's Research Laboratory of Electronics and leader of the project, say the software they are developing could be compatible with current smart phones, allowing such devices to be transformed into unobtrusive tactile aids for the deaf.

"Anyone who has a smart phone already has much of what they would need to run the program," including a microphone, digital signal-processing capability, and a rudimentary vibration system, says Moallem.

Sensing vibrations

Tactile devices translate sound waves into vibrations that allow the user to distinguish between vibratory patterns associated with different sound frequencies. The MIT researchers are testing devices that have at least two vibration ranges, one for high-frequency sounds and one for low-frequency sounds.

Using such handheld devices, deaf people can more easily follow conversations than with lip reading alone, which requires a great deal of concentration, says Moallem.

"It's hard to have a casual conversation in a situation where you have to be paying attention like that," he says.

Current prototypes can be held in the user's hand or worn around the back of the neck, but once the acoustic processing software is developed, it could be easily incorporated into existing smart phones, according to the researchers. To lay the groundwork for such future applications, the researchers are investigating the best way to transform sound waves into vibrations.

Existing tactile aids have been in use for decades, but the MIT team hopes to improve the devices by refining the acoustic signal processing systems to provide tactile cues that are tailored to boost lip-reading performance, says Reed.

As part of their project, the researchers have done several studies on the frequency reception ability of the skin. The human ear can perceive frequencies up to 20,000 hertz, but for touch receptors in the skin, optimal frequencies are below 500 hertz.

Using a laboratory setup with a device that can provide distinct vibration patterns to three fingers simultaneously, Moallem has done preliminary studies of deaf people's ability to interpret the vibrations from tactile devices.

This project was originally inspired by earlier studies Reed did on the Tadoma technique, a communication method taught to deaf-blind people. Practitioners of that method hold their hands to someone's face while they are talking, allowing them to feel the vibrations of the face and neck.

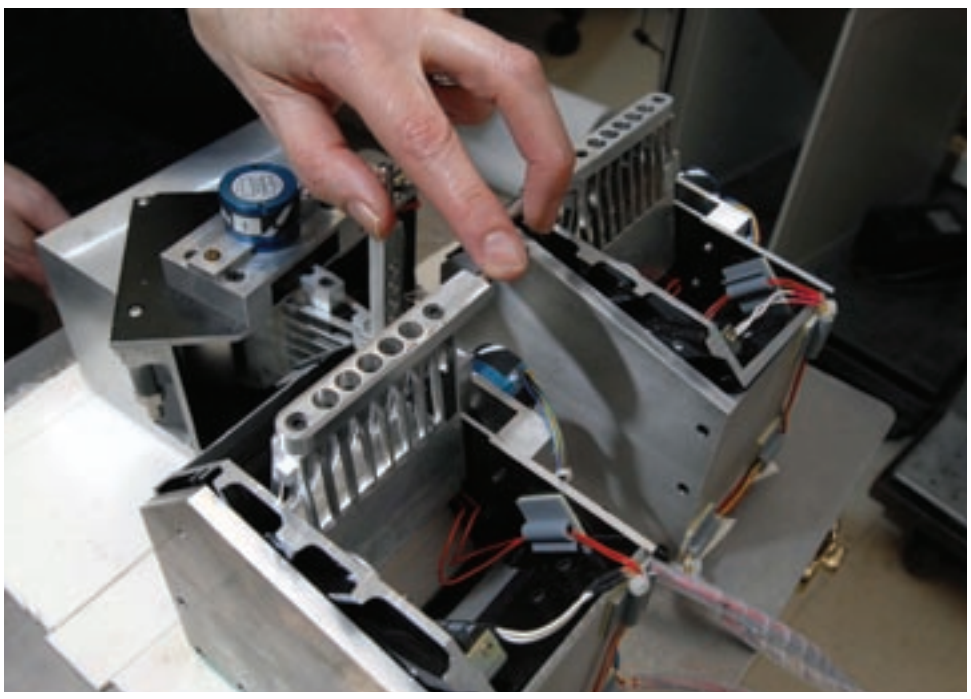
Reed's study, done about 20 years ago, showed that the deaf-blind subjects could successfully understand speech with this method — especially if the other person spoke clearly and slowly.

"We were inspired by seeing what deaf-blind people could accomplish just using the sense of touch alone," says Reed.

This research is funded by the National Institute on Deafness and Other Communication Disorders.

PHOTOS / **DONNA COVENEY**

Researchers in MIT's Research Laboratory of Electronics, led by Charlotte Reed (above with graduate research assistant Theodore Moallem), are using the sense of touch to develop communication aids for the deaf. The device converts sound waves to vibrations, which a deaf person holding the device can feel. It can help lip-readers identify sounds that can be difficult to distinguish visually.



New rocket aims for cheaper nudges in space

Plasma thruster is small, runs on inexpensive gases

Elizabeth Thomson
News Office

Satellites orbiting the Earth must occasionally be nudged to stay on the correct path. MIT scientists are developing a new rocket that could make this and other spacecraft maneuvers much less costly, a consideration of growing importance as more private companies start working in space.

The new system, called the Mini-Helicon Plasma Thruster, is much smaller than other rockets of its kind and runs on gases that are much less expensive than conventional propellants. As a result, it could slash fuel consumption by 10 times that of conventional systems used for the same applications, says Oleg Batishchev, a principal research scientist in the Department of Aeronautics and Astronautics and leader of the work.

The current propulsion systems — used for maintaining a satellite's orbit, pushing a spacecraft from one orbit to another, and otherwise maneuvering in space — rely on chemical reactions that occur within the fuel, releasing energy that ultimately propels the object.

Although such systems have brought humans to the moon and are regularly used in a variety of other applications, they have limitations. For example, chemical rockets are expensive largely due to the amount of fuel they use.

As a result, engineers have been developing alternative, non-chemical rockets. In these, an external source of electrical energy is used to accelerate the propellant that provides the thrust for moving a craft through space.

Such non-chemical rockets have been successfully used by NASA and the European Space Agency in missions including NASA's Deep Space 1, which involved the flyby of a comet and asteroid.

But the field is still relatively new, and these advanced rockets are one focus of the MIT Space Propulsion Laboratory (SPL). "The Mini-Helicon is one exciting example of the sorts of thrusters one can devise using external electrical energy instead of the locked-in chemical energy," says Manuel Martinez-Sanchez, director of the SPL and a professor in the Department of Aeronautics and Astronautics.

The Mini-Helicon is the first rocket to run on nitrogen, the most abundant gas in our atmosphere.

It was conceived through work with former astronaut Franklin Chang-Diaz ScD '77 on a much larger, more powerful system developed by Chang-Diaz. Batishchev's team did a theoretical analysis showing that the first of three parts of the larger rocket could potentially be used alone for different applications.

The idea "was that a rocket based on the first stage [of Chang-Diaz's system] could be small and simple, for more economical applications," says Batishchev, who notes that the team's prototype would fit in a large shoe box.

Since then, 12 MIT students have worked on the Mini-Helicon, resulting in one PhD and four master's theses to date. Batishchev notes, however, that it could be years before the technology can be used commercially, in part due to certification policies.

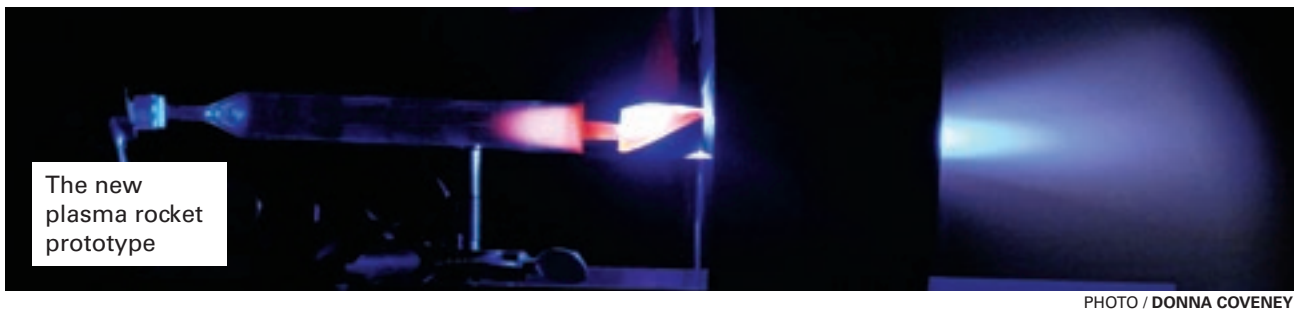
The Mini-Helicon has three general parts: a quartz tube wrapped by a coiled antenna, with magnets surrounding both. The gas of interest is pumped into the quartz tube, where radio frequency power transmitted to the gas from the antenna turns the gas into plasma, or electrically charged gas.

The magnets not only help produce the plasma, but also confine, guide and accelerate it through the system. "The plasma beam exhausted from the tube is what gives us the thrust to propel the rocket," Batishchev says.

He noted that the exhaust velocity from the new rocket is some 10 times higher than the velocity from the average chemical rocket, so much less propellant is needed.

Batishchev notes that last summer, for fun, his team built a plasma rocket based on a glass bottle (a stand-in for the quartz tube) and an aluminum can (the radio-frequency antenna), both of which previously held soft drinks. It worked. "This shows that this is a robust, simple design. So in principle, an even simpler design could be developed," he says.

This work was funded by the Air Force Research Laboratory.



The new plasma rocket prototype

PHOTO / **DONNA COVENEY**

Men's basketball team bound for the NCAA tournament

Engineers' first NEWMAC championship nets them first-ever berth

In its 100-year-plus history, the MIT men's basketball team has never made the NCAA Division III basketball tournament — until now.

With a 76-50 victory over Springfield College in the 2009 NEWMAC Tournament Championship final on Sunday, the Engineers continued their historic season by earning an entry into the NCAA tournament for the first time ever.

MIT will face Rhode Island College on Friday, March 6, at RIC's Murray Center. Tip-off is at 6 p.m.

"It's nice to be part of history," said head coach Larry Anderson. "For me, it's great to see it pay off for guys that have worked so hard over the years. No question it was a total team effort, but the credit goes to our senior tri-captains" Jimmy Bartolotta, Billy Johnson and Bradley Gampel.

The trio of seniors led the way for MIT, with Bartolotta scoring a game-high 37 points, Johnson notching 13 points, and Gampel putting up 10 assists, seven rebounds and three steals.

"It feels great to finally make the [NCAA] tournament, which has been a culmination of a lot of hard work by the players and coaches," Bartolotta said. "Winning this championship is a great achievement. So much of our season has been about the stuff that doesn't appear in the box scores, and I can't underestimate the camaraderie and closeness of the team. We've had some ups and downs this year, but at all points of the season everyone was so supportive and excited to see the team perform well above the individual."

The Engineers shot 47 percent from the floor in the championship and benefited from a significant advantage from beyond the arc, where they finished 10-of-25.

Trailing 35-26 entering the second half, Springfield sliced the MIT advantage to 37-30 following a jumper by Pat Crean with 17:21 to go. Bartolotta pushed the lead back to nine with a layup on MIT's next possession, while Johnson put the lead in double figures for the duration with a three on MIT's next shot.

MIT slowly expanded the advantage during the half, but with Johnson and rookie sharpshooter Jamie Karraker sidelined with four fouls each, the Engineers received key contributions from the bench to ignite a 19-3 run. A three by freshman Billy Bender gave MIT its largest lead of the afternoon at 76-48 with 57 seconds left in regulation.

PHOTO COURTESY OF MIT ATHLETICS

Jimmy Bartolotta makes a move during a recent game.

Bartolotta named to Academic All-America team

First in history of MIT men's basketball team

MIT senior and men's basketball guard Jimmy Bartolotta, who this year became MIT's all-time leading scorer and has led the Engineers to a spot in the semifinals of the NEWMAC Championship Tournament, was honored again this week by being named to this year's ESPN The Magazine Academic All-America men's basketball team.

Bartolotta is MIT's fourth Academic All-American overall, and the first in the history of the men's basketball program.

The 6-foot, 4-inch double major in management science and physics is also a finalist for the coveted Jostens Trophy, which honors the most outstanding men's and women's Division III basketball players of the year. This is the second consecutive year that Bartolotta has been a finalist for the trophy.

A native of Littleton, Colo., Bartolotta currently has 2,175 points in his career, is the nation's third-leading scorer with an average of 27.8 points per game, and broke the MIT single game scoring record with 43 points earlier this year. A two-time All-NEWMAC first-team selection, he led the conference in scoring as a junior with a 23.9 scoring average.

While leading MIT to an 18-8 regular season record — and breaking records along the way — Bartolotta has also maintained a 4.6 grade-point average and volunteers his time mentoring middle school students at the Cambridge Community Charter School.

News in brief

3-D day: 21st century holography to be explored in MIT Museum forum

Once the very symbol of the future (think of Star Trek's fantasy "holodeck"), holograms have become as commonplace as those 3-D symbols on your credit cards. An upcoming two-day forum at the MIT Museum will take holography back to the future with presentations on its potential when matched with digital technology.

The March 6 and 7 interdisciplinary forum, "Photons, Neurons and Bits: Holography for the 21st Century," will explore innovations in medical and biological applications of holography, plus the field's continuing impact on photography and art.

"Holography has gone digital, and with that has come the possibility of interaction between holography and many other technologies and fields of research," says Seth Riskin, MIT Museum manager and organizer of the forum. "Holography is like a seed that has been waiting for this soil."

MIT President Emeritus Charles Vest will give the keynote address on March 6 followed by a daylong series of presentations on March 7 by researchers from MIT and other institutions.

The presenters represent a broad body of work spanning physical, biological and digital realms, Riskin says. Several MIT researchers, including Aude Oliva, associate professor in MIT's Department of Brain and Cognitive Sciences, and Antonio Torralba, the Esther and Harold Edgerton Career Development Associate Professor in the Department of Electrical Engineering and Computer Science, are scheduled to speak. A full list of presenters and their topics is posted on the event's web site at http://web.mit.edu/museum/forum/.

The forum will be held March 6, from 5-8 p.m., and March 7, from 9 a.m. to 5 p.m. at the MIT Museum, 265 Massachusetts Ave., Cambridge. Friday's keynote and reception are free and open to the public; registration required at http://web.mit.edu/museum/forum/. Saturday's forum is free to the MIT community and $60 for the public.

Legatum lectures and poster session on March 6

The MIT Legatum Lecture series continues on March 6 with Michael Chu and Karim Khoja, who will discuss bottom-up development in emerging markets. As CEO of Roshan, Afghanistan's leading mobile-phone company, Khoja is a thought-leader on the role of mobile communications to spur development. A microcredit pioneer and the former CEO of ACCION International, Chu is currently on the faculty of Harvard Business School and managing director of Ignia Fund.

The lectures begin at 4 p.m. in Stata 32-155.

After the lectures, 12 teams of MIT students who received 2009 IAP Seed Grants from the Legatum Center will present their projects in such areas as renewable energy, health, water, biotechnology and mobile services. A poster session and reception (with refreshments) will begin at 5:30 p.m. in the Stata Center Student Street.

Visit http://legatum.mit.edu/ for more information.

Dalai Lama's ideals fuel new center

A new center will promote the Dalai Lama's vision of a better world by sponsoring interdisciplinary programs and deliberations on ethics. The center will be formally launched by the Dalai Lama during a visit to MIT on April 30.

"There is much work to be done to integrate the various fragments of life and its general understanding through interdisciplinary inquiry, and no one intellectual discipline alone can fulfill this need," said Tenzin Priyadarshi, the Institute's Buddhist chaplain and the director of the Dalai Lama Center for Ethics and Transformative Values at MIT.

"That is why this center is needed," Priyadarshi continued, noting that the center comes as MIT focuses more intently on preparing students for the challenges of global leadership. "In addressing the very question of what it means to be human and how we can create and sustain positive societies, the center will nurture a new generation of enlightened leaders who will be luminaries for a better world."

Priyadarshi said the center will engage faculty, students and various partners to examine a range of topics, possibly including what biological or behavioral components make a person generous or visionary, for example, or how and why a person's sense of creativity and leadership can be fostered through contemplative techniques.

A collaborative think tank, the center is supported through the generosity of friends who recognize its potential to help shape tomorrow's leaders. It will invite distinguished researchers, educators, entrepreneurs, policymakers, artists and others from diverse cultural, religious and educational backgrounds to contribute to its objectives through workshops and lecture series.

The center will host its first public conference, "The Human Impact," in late April, culminating with an April 30 talk by the Dalai Lama on "Ethics and Enlightened Leadership." For more information, please visit http://thecenter.mit.edu/.

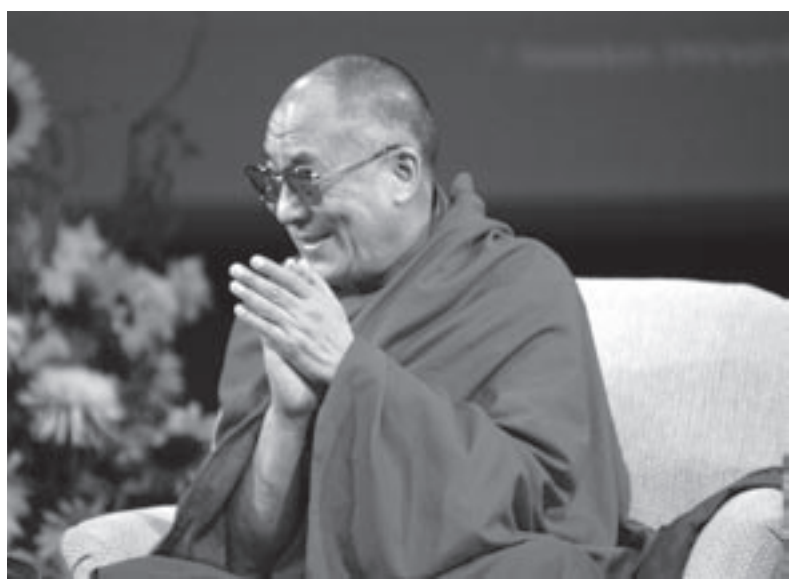


PHOTO / DONNA COVENEY

The Dalai Lama, during a visit to MIT in 2003.

Video artist Bill Viola to receive McDermott award

PHOTO / KIRA PEROV

Internationally renowned video artist Bill Viola has been selected by MIT's Council for the Arts as the recipient of the Eugene McDermott Award in the Arts, which recognizes the highest standard of creative achievement on a national level.

Viola, who has been instrumental in establishing video as a vital medium of contemporary art, will receive $75,000 and spend a week in March at MIT working with students to help enhance the creative life of the MIT community.

Viola uses video to explore the human phenomena of sense perception as a path that leads to self-knowledge. His work focuses on universal human experiences — birth, death, the unfolding of consciousness — and has roots in both Eastern and Western art.

Viola has exhibited at the world's most prestigious museums and institutions, including at the Museum of Modern Art, New York; the Guggenheim Museum, New York; the J. Paul Getty Museum, Los Angeles; and the Whitney Museum of American Art, which in 1997 organized an exhibition entitled "Bill Viola: A 25-Year Survey."

"The week-long residency component of the Eugene McDermott Award in the Arts provides a rare opportunity for our students," said MIT Associate Provost and Ford International Professor of History Philip S. Khoury. "Thanks to the generosity of Margaret McDermott, MIT undergraduate and graduate students will have the chance to meet Mr. Viola in an intimate setting, not only to learn about his innovative and pioneering work, but to share their creative work and research with him."

The Eugene McDermott Award recognizes an individual for his or her innovation and contribution to the arts while reinforcing MIT's commitment to risk taking, problem solving and connecting creative minds across disciplines. Past recipients include playwright Suzan-Lori Parks, architect Santiago Calatrava, artist Isaac Julian, architect I.M. Pei '40 and author Junot Díaz, now a professor in MIT's Program in Writing and Humanistic Studies.

Viola will begin his residency on March 9. He will be presented with the award and present his work at 6:30 p.m. on March 10 in Room 10-250. MIT students and faculty will be given seating priority.

More information available at web.mit.edu/arts/about/awards/mcdermott.html.

'Nanostitching' could lead to much stronger airplane skins, more

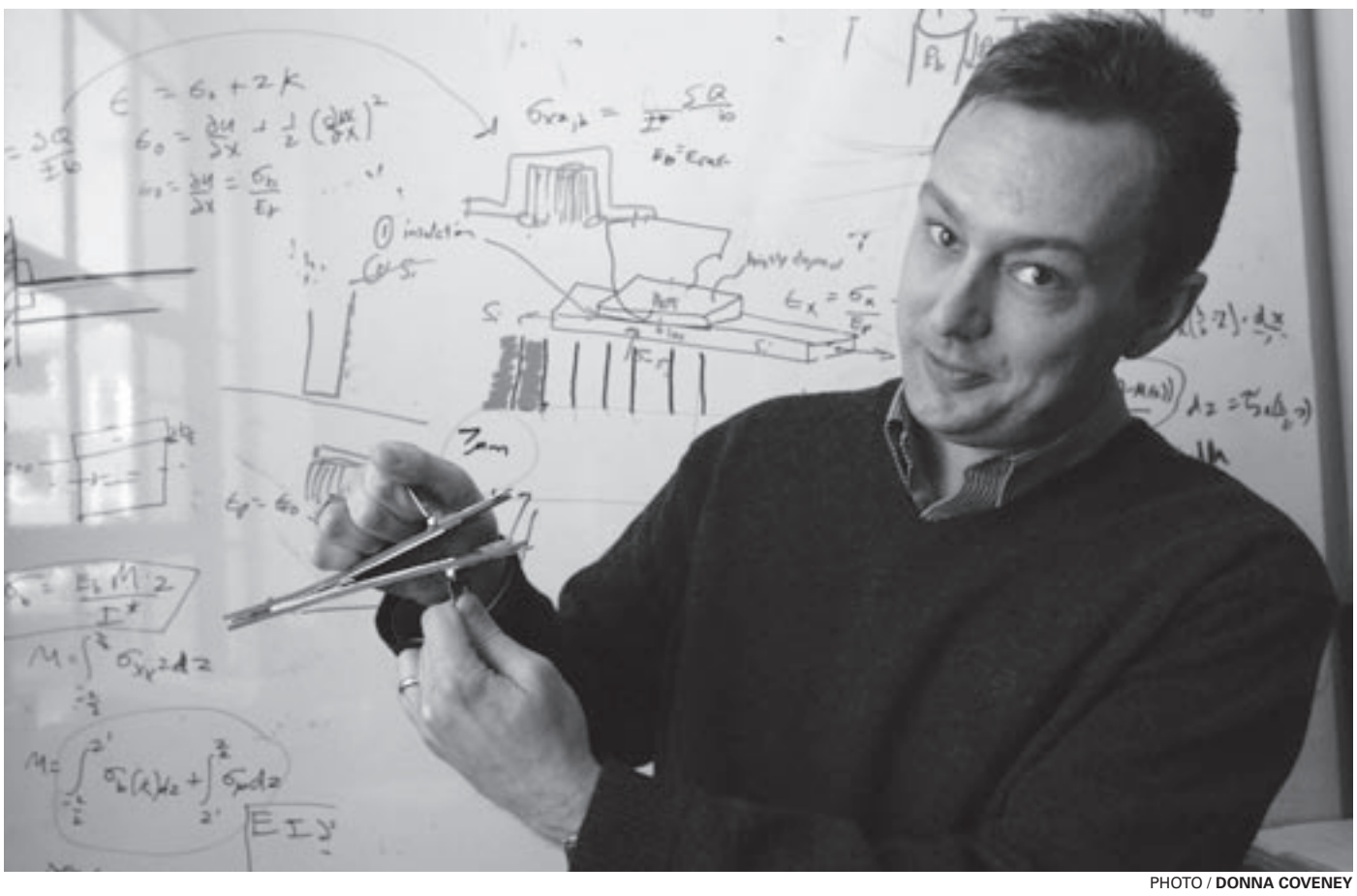


PHOTO / DONNA COVENEY

Brian Wardle, the Charles Stark Draper Assistant Professor in the Department of Aeronautics and Astronautics, shows an advanced composite material held together by 'nanostitching,' a technique developed at MIT that could make airplane skins and other products stronger at a nominal increase in cost.

Elizabeth Thomson
News Office

MIT engineers are using carbon nanotubes only billionths of a meter thick to stitch together aerospace materials in work that could make airplane skins and other products some 10 times stronger at a nominal increase in cost.

Moreover, advanced composites reinforced with nanotubes are also more than one million times more electrically conductive than their counterparts without nanotubes, meaning aircraft built with such materials would have greater protection against damage from lightning, said Brian L. Wardle, the Charles Stark Draper Assistant Professor in the Department of Aeronautics and Astronautics.

Wardle is lead author of a theoretical paper on the new nanotube-reinforced composites that will appear in the Journal of Composite Materials (http://jcm.sagepub.com/). He also described the work as keynote speaker at a Society of Plastics Engineers conference this week.

The advanced materials currently used for many aerospace applications are composed of layers, or plies, of carbon fibers that in turn are held together with a polymer glue. But that glue can crack and otherwise result in the carbon-fiber plies coming apart. As a result, engineers have explored a variety of ways to reinforce the interface between the layers by stitching, braiding, weaving or pinning them together.

All of these processes, however, are problematic because the relatively large stitches or pins penetrate and damage the carbon-fiber plies themselves. "And those fiber plies are what make composites so strong," Wardle said.

So Wardle wondered whether it would make sense to reinforce the plies in advanced composites with nanotubes aligned perpendicular to the carbon-fiber plies. Using computer models of how such a material would fracture, "we convinced ourselves that reinforcing with nanotubes should work far better than all other approaches," Wardle said. His team went on to develop processing techniques for creating the nanotubes and for incorporating them into existing aerospace composites, work that was published last year in two separate journals.

How does nanostitching work? The polymer glue between two carbon-fiber layers is heated, becoming more liquid-like. Billions of nanotubes positioned perpendicular to each carbon-fiber layer are then sucked up into the glue on both sides of each layer. Because the nanotubes are 1000 times smaller than the carbon fibers, they don't detrimentally affect the much larger carbon fibers, but instead fill the spaces around them, stitching the layers together.

"So we're putting the strongest fibers known to humankind [the nanotubes] in the place where the composite is weakest, and where they're needed most," Wardle said. He noted that these dramatic improvements can be achieved with nanotubes comprising less than one percent of the mass of the overall composite. In addition, he said, the nanotubes should add only a few percent to the cost of the composite, "while providing substantial improvements in bulk multifunctional properties."

Wardle's co-authors on the Journal of Composite Materials paper are Joaquin Blanco, a visiting graduate student in the Department of Aeronautics and Astronautics, Enrique J. Garcia SM '06, and Roberto Guzman deVilloria, a postdoctoral associate in the department.

This research was sponsored by MIT's Nano-Engineered Composite aerospace STructures (NECST) Consortium (necst.mit.edu).

AWARD: Dresselhaus wins NSB honor

Continued from **Page 1**

A native of the Bronx, Dresselhaus received her PhD from the University of Chicago, and began her MIT career at the Lincoln Laboratory studying superconductivity; she later switched to magneto-optics, carrying out a series of experiments that led to a fundamental understanding of the electronic structure of semi-metals, especially graphite.

Dresselhaus was the first tenured woman professor at MIT's School of Engineering, one of the first women ever to receive a Fulbright Fellowship, and was named an Institute Professor in 1985. She has received numerous awards, including the U.S. National Medal of Science and 25 honorary doctorates worldwide.

Dean of the School of Science Marc Kastner, who also recommended Dresselhaus for the award, noted the breadth of work she has undertaken at the Institute.

"Millie Dresselhaus has done it all. She is an exceptional physicist, classroom teacher and mentor of young scientists, and she is now being recognized for her great public service," he said. "It is wonderful that her name is now permanently linked with that of another of MIT's heroes, Vannevar Bush."

Among other criteria, the award selects candidates who have distinguished himself/herself through public service activities in science and technology; pioneered the exploration, charting and settlement of new frontiers in science, technology, education and public service.

Several former members of the MIT community have won the award, including former presidents Jerome B. Wiesner and James R. Killian Jr., who won it in 1992 and 1980, respectively.

CLASSIFIED ADS

GOLD star

Geoffrey von Maltzahn awarded $30,000 Lemelson-MIT Student Prize for innovations in the fight against cancer

MIT graduate student and biomedical engineer Geoffrey von Maltzahn is this year's winner of the $30,000 Lemelson-MIT Student Prize for his promising innovations in the area of cancer therapy. The 28-year-old PhD candidate in the Harvard-MIT Division of Health Sciences and Technology (HST) was selected specifically for two of his inventions in nanomedicine: a new class of cancer therapeutics and a new paradigm for enhancing drug delivery to tumors.

Cancer currently kills more people worldwide than HIV/AIDS, tuberculosis and malaria combined. Despite billions of dollars invested in drug development and decades of research, selectively eradicating cancer cells has remained an elusive goal. Chemotherapies, a common class of cancer treatments, are intended to kill the fast-growing cells that form tumors. However, these drugs travel throughout the entire body, and often affect normal, healthy tissue along with cancer cells, causing side effects such as hair loss, nausea, anemia, and even nerve and muscle problems. Furthermore, people can develop resistance to these drugs, causing even initially successful treatment regimens to fail.

Working at the confluence of nanotechnology, engineering and medicine, von Maltzahn's innovations have the potential to reduce side effects and overpower drug resistance mechanisms by more powerfully concentrating external energy and targeted therapeutics in tumors.

'Nano-antennas'

Since 2004, von Maltzahn has worked closely with his advisor, Sangeeta N. Bhatia, a professor in HST and in the Department of Electrical Engineering and Computer Science, to invent novel treatments that could precisely target and destroy tumor cells without affecting healthy tissue. Seeking to improve the specificity of cancer ablation — the destruction of tumors through the application of heat — von Maltzahn developed polymer-coated gold "nano-antennas" that can target tumors and convert benign-infrared light into heat.

The nanoparticles are designed to be injected intravenously, where they circulate through the bloodstream and progressively concentrate at the tumor site by infiltrating pores in rapidly growing tumor blood vessels. Once in the tumor, the antennas can be precisely heated with a noninvasive, near-infrared light to specifically kill the cancerous cells. "The polymer-coated gold nano-antennas are the longest-circulating and most efficiently heated to date," said Bhatia, who is also affiliated with the Microsystems Technology Laboratories, the David H. Koch Institute for Integrative Cancer Research, and the Center for Environmental Health Sciences. "Pre-clinical trials reveal that a single intravenous nanoparticle injection eradicated 100 percent of tumors in mice using a near-infrared light. The results of these trials are very promising, meaning that the impact of this technology is wide-reaching with many potential applications."

Von Maltzahn's second invention aims to fundamentally improve the intravenous delivery of therapeutics to tumors by taking a systems approach to their design. This work draws on insights from biological systems, such as ants foraging and bees swarming, where relatively simple methods of communication can lead to very sophisticated system behaviors.

Inspired by the potential for inter-nanoparticle communication to improve therapeutics' ability to find tumors, von Maltzahn invented a series of ways for nanoparticles to talk to one another in the body. One method involves benign scout particles that initially locate the tumor and, once inside, send powerful signals to recruit secondary, 'assassin' particles that contain the therapeutics. In preclinical trials, this system has been able to deliver more than 40 times stronger doses of therapeutics to tumors in mice, in comparison to non-communicating control nanoparticles.

"If such highly targeted delivery can be achieved clinically, this method would enable doctors to increase the drug dose that is delivered to tumors, increasing its overall efficacy and reducing side effects," von Maltzahn explains.

Looking forward

Von Maltzahn's work has already made a significant impact scientifically and commercially, resulting in eight patent applications, 19 submitted or published papers, and his founding roles in two companies: Nanopartz Inc. (www.nanopartz.com) and Resonance Therapeutics.

PHOTO COURTESY OF THE LEMELSON-MIT PROGRAM

Geoffrey von Maltzahn, this year's winner of the $30,000 Lemelson-MIT Student Prize.

Nanopartz was founded more than a year ago to address the nanotechnology industry's need for dependable and standardized nanoparticle sources. Von Maltzahn's goal with Nanopartz is to aid in research endeavors worldwide by supplying a repertoire of gold nanoparticles for a broad spectrum of commercial applications, ranging from biomedicine to energy.

Resonance Therapeutics was founded to bring nanorods toward clinical applications and to develop technologies that amplify the efficacy of existing cancer therapeutics.

"In addition to the long hours spent in the lab, finishing up his PhD, and founding two companies, Geoff mentored 14 undergraduate students, taking them out of the classroom setting and inspiring them to make the link from science to the real world," says Joshua Schuler, executive director of the Lemelson-MIT Program. "Geoff is not only a mentor for aspiring scientists, but also a shining example of bridging the gap between technological invention and entrepreneurship."

During von Maltzahn's time at MIT he has also developed inventions outside of the polymer nanorods and systems nanotechnology paradigm for improving drug delivery, including a low-cost method for hemorrhage detection; a new class of self-assembling lipid-like peptides with promising applications in gene therapy; sensors for detecting tumor protease hot-spots in MRI; a method for remotely controlling drug release from nanoparticles; and a variety of new nanostructures for improved drug delivery and imaging.

The $30,000 Lemelson-MIT Student Prize is awarded annually to an MIT senior or graduate student who has created or improved a product or process, applied a technology in a new way, redesigned a system, or demonstrated remarkable inventiveness in other ways. A distinguished panel of MIT alumni including scientists, technologists, engineers and entrepreneurs chooses the winner.

The Lemelson-MIT Program recognizes outstanding inventors, encourages sustainable new solutions to real-world problems, and enables and inspires young people to pursue creative lives and careers through invention. More information on the Lemelson-MIT Program is online at http://web.mit.edu/invent/.