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TechTalk
SERVING THE MIT COMMUNITY

PHOTO / **DONNA COVENEY**

State of the Institute

MIT President Susan Hockfield greets Lawrence Neeley, a postdoctoral associate in mechanical engineering, following the Oct. 2 State of the Institute Forum in Kresge Auditorium. Hockfield reported a strong year for MIT in fundraising and admissions, and she lauded the progress of the MIT Energy Initiative. Provost Rafael Reif, Chancellor Phillip Clay and Executive Vice President and Treasurer Theresa Stone also spoke at the forum.

A dream fulfilled

Robert M. Randolph installed as first chaplain to the Institute

Greg Frost
News Office

Robert M. Randolph was officially installed Sept. 30 as MIT's first chaplain to the Institute, an appointment that underscores the role of religious life at MIT and fulfills a dream originally laid out more than a half-century ago.

Randolph, who most recently served as senior associate dean for student life, was installed in his new position during a ceremony at Kresge Auditorium attended by hundreds of members of the MIT community. Speakers at the service included President Susan Hockfield and the Rev. Peter J. Gomes of the Memorial Church of Harvard University.

As chaplain to the Institute, Randolph will be charged with working alongside the members of the Board of Chaplains, who represent many religious traditions, in fostering interfaith discourse and educating the MIT community about the history and role of religions around the world. His portfolio includes coordinating pastoral response in times of crisis at the Institute, raising the profile of religious life at MIT, and leading reflection on issues of social justice and core values.

In an interview with Tech Talk, Randolph said he sees his new role as particularly relevant at a time when religion is a dominant force in global events.

"At this time of a clash of cultures, it is clear that religion has become the point of the sword," he said. "My job will be to help knit together the fabric of faiths that already transcend our community."

Randolph said MIT's preeminence in science and technology means religion and matters of faith have a com-

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MIT, Novartis form partnership

Venture aims to transform pharmaceutical manufacturing

Patti Richards
News Office

Swiss-based drugmaker Novartis AG and MIT launched a long-term research collaboration Sept. 28 aimed at transforming the way pharmaceuticals are produced.

The 10-year partnership, known as the Novartis-MIT Center for Continuous Manufacturing, will work to develop new technologies that could replace the conventional batch-based system in the pharmaceuticals industry—which often includes many interruptions and work at separate sites—with continuous manufacturing processes from start to finish.

The Novartis-MIT Center for Continuous Manufacturing combines the industrial expertise of Novartis with MIT's leadership in scientific and technological innovation. Novartis will invest $65 million in research activities at MIT over the next 10 years.

"This partnership demonstrates our commitment to lead not only in discovering innovative treatments for patients but also in improving manufacturing processes, which are critical to ensuring a high-quality, efficient and reliable supply of medicines to patients," said Dr. Daniel Vasella, chair and CEO of Novartis.

"Our collaboration with MIT, a worldwide leader in developing cutting edge technologies, holds the promise to achieve a quantum leap in the production of pharmaceuticals, a field which has received rather little attention in the past," he added.

Novartis and MIT expect the technologies created in this collaboration will benefit patients and healthcare providers through a positive impact on supply availability and the quality of medicines. These technologies will also seek to reduce the environmental impact of manufacturing activities.

"The Novartis-MIT Center for Continuous Manufacturing has the potential to revolutionize drug development and production," said MIT President Susan Hockfield. "We are delighted to collaborate with Novartis to help improve the way that drugs are manufactured so that patients have quicker and more reliable access to the medications they need. The new educational opportunities that this program will provide for our students make this partnership even more exciting."

The pharmaceutical industry currently uses batch-based manufacturing that has been common for several years, even though other industries have moved to continuous manufacturing.

In this often time-consuming process, pharmaceutical active ingredients are synthesized in a chemical manufac-

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PHOTO / **DAN BERSAK**

Robert M. Randolph addresses a crowd of hundreds of people Sept. 30 at Kresge Auditorium during his installation as MIT's first chaplain to the Institute.

OBITUARIES

Oct. 4 memorial for Stephen M. Meyer

A memorial service for Stephen M. Meyer will be held Thursday, Oct. 4, at 4 p.m. in the MIT Chapel, the Department of Political Science announced. A reception will immediately follow the service in the Brown Living Room of McCormick Hall.

Meyer, a political science professor, an expert in national security issues and a passionate advocate of global biodiversity, died last year of cancer at the age of 54.

Meyer focused his teaching and research on the interaction of science, economics and politics in policy-making, particularly in the areas of natural resource exploitation, land use and wildlife habitat preservation.

His last book, "The End of the Wild," on the extinction of wildlife species and human responsibility, appeared in December 2006.

Nancy Vandom Sotak, 73

Nancy Vandom Sotak, 73, former secretary to the associate head of optics in Division 5 at Lincoln Laboratory, died Sept. 17 at Lahey Clinic following a cerebral hemorrhage. A member of the MIT Quarter Century Club, she joined Lincoln Laboratory in 1973 and retired in 1999.

She was born in Los Angeles and raised in Reseda, Calif. She is survived by her husband of 54 years, Arthur E. Sotak, two daughters, a brother, and two nieces and a nephew.

A service was held Sept. 20 at Westview Cemetery in Lexington, Mass. Donations in her memory may be made to the American Parkinson Disease Association.

CLASSIFIED ADS

Members of the MIT community may submit one ad each issue. Ads should be 30 words maximum; they will be edited. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.

FOR SALE

Suunto Altimax Wristop Computer combines altimeter, barometer, watch & stopwatch. Regular price $199. I bought it new for $149. Used 1 week. Will accept BO. Contact corkin@mit.edu or x3-5762.

One custom-designed 3" lens Refractor Telescope—8 additional eye pieces. Exc. condition. $500. Used & constructed by MIT Millstone research engineer. Call 617-332-7482 after 6 p.m.

HOUSING

Two-family home for sale in Truro, MA. 2BR & large studio. Parking for 4 cars. Asking $499,000. Close to beaches and trails. MLS #20603889. Contact John Foley at 508-246-2689.

Huge condo for sale in JFK Dorchester neighborhood, 20 min. to MIT, Red Line T. Hardwood throughout, endless kitchen & storage, 1900 charm, off-street parking. $264,900. Julie Simmons 617-297-4002.

MISCELLANEOUS

Do you love to sing? The Broadmoor Chamber Singers invite you to join. Open rehearsals in October. Monday evenings 7:30-9. Christ Lutheran Church, 113 Union St., Natick. Repertoire: classical, jazz, folk, gospel, popular. No auditions, experience in part singing required. For more info, e-mail broadmoorsingers@yahoo.com or call John or Lani at 508-655-7031.

Amon, Golub win cancer prize

Paul Marks Prize recognizes significant research contributions

Elizabeth Thomson
News Office

MIT Professor Angelika Amon and Todd R. Golub of the Broad Institute of MIT and Harvard will share the 2007 Paul Marks Prize for Cancer Research, an award of $150,000, with Gregory J. Hannon from Cold Spring Harbor Laboratory.

The prize, from the Memorial Sloan-Kettering Cancer Center (MSKCC), recognizes significant contributions to the basic understanding and treatment of cancer by scientists no more than 45 years old at the time they are nominated.

Amon was cited for her work in studying how chromosomes segregate during cell division, while Golub was cited for developing genomic approaches to better classify subtypes of cancer. Hannon won for using model systems to study the biochemistry and biology of the RNA interference mechanism.

A current focus of Amon's laboratory is studying the effects of aneuploidy on the way that cells proliferate. Aneuploidy, in which a cell has an abnormal number of chromosomes, occurs if chromosomes do not separate properly. "Our recent work has dealt with the question of how aneuploidy affects the yeast cell's physiology," explained Amon, a professor of biology at MIT, member of the MIT Center for Cancer Research (CCR) and a Howard Hughes Medical Institute (HHMI) investigator. "We are now eager to investigate how aneuploidy affects mammalian cells."

"There is no doubt that Angelika Amon is a true star in basic cancer research," said Tyler E. Jacks, director of the CCR, a professor of biology at the Institute, and an HHMI investigator. "Her work has had a deep and lasting impact on our understanding of mechanisms crucial to proper cell division, which has helped to shape our insight into how defects in these processes contribute to cancer and other disorders."

Golub's group has made important discoveries on the molecular basis of several types of leukemia, some of which have resulted in genetic tests that are now standard at most major medical centers worldwide. His team was among the first to use microarrays (also known as DNA chips) for the classification of cancer. "The goal of our work is to develop a new molecular taxonomy of cancer," said Golub, an HHMI investigator who is also affiliated with the Dana-Farber Cancer Institute. "It is not enough to say someone has breast cancer or lung cancer, for example. There is a real need to subclassify patients, so that we can match patients very closely with targeted drugs and conduct smarter clinical trials."

"Todd Golub has made important contributions—both conceptual and technical—that have had wide-ranging impact on cancer research," said Eric Lander, founding director of the Broad Institute and a professor of biology at MIT. "In my opinion, he is one of the most creative and accomplished cancer scientists of his generation."

MSKCC President Harold Varmus described the winners as leaders in their respective fields. He said the scientists had made major contributions to the biological understanding of cancer, shedding light on what causes cancer and offering promising solutions that may someday provide benefits to patients everywhere.

Jacks shared the Marks Prize in 2005 for his work in advancing the understanding of the pathogenesis of cancer.

PHOTO / **DONNA COVENEY**

Angelika Amon

PHOTO / **BROAD INSTITUTE / L. BARRY HETHERINGTON**

Todd Golub

New executive director of MIT Careers Office

Melanie Parker was named executive director of the MIT Careers Office in July 2007. Prior to coming to MIT, she served as the executive director of career services and experiential learning at the University of Central Florida. She has worked in university career services for nearly 20 years, including progressively responsible positions at Mississippi State University and the University of Florida. She is the 2005 recipient of the national NACE/Chevron award for groundbreaking and innovative career programming. Melanie received her Master of Education from Mississippi State University and her Bachelor of Sciences in business administration from the University of Maryland.

"We have already begun a strategic planning process to take career services and study abroad programs to the next level at MIT," Parker said, explaining her vision for the Careers Office.

She said areas of focus include supporting the strategic initiative to increase global education at MIT; incorporating a holistic, competency-based career development model to prepare students to effectively plan and manage their careers; and developing innovative techniques to incorporate educational technology into the delivery of career services.

Airline Data Project launched

New web site compiles key airline data

MIT's Global Airline Industry Program and the International Center for Air Transportation launched the Airline Data Project (ADP) Oct. 1 featuring an online databank that provides a comprehensive collection and analysis of airline data since 1995.

The ADP's online databank, www.airlinedataproject.mit.edu, gives comparisons of the largest U.S. carriers on scores of different cost, revenue and productivity measures. The resource will let users compare 15 U.S. airlines on a wide variety of measures, including fleet utilization, labor costs, cash flow and profitability.

The project allows researchers to confirm—and in some cases dispel—conventional wisdom about the airline industry by presenting information within a historical landscape.

> The ADP online databank gives comparisons of the largest U.S. carriers

"The Airline Data Project will serve as an excellent data source for research and analysis not only for MIT students and faculty, but for airline executives, analysts, labor leaders and industry observers," said Peter P. Belobaba, program manager for the Global Airline Industry Program. "It is a natural extension of our ongoing work and supports our goal of developing a body of knowledge for understanding the development, growth and competitive factors that affect this industry."

The ADP was created in conjunction with the MIT Airline Industry Consortium and with support from the Industry Studies Program of the Alfred P. Sloan Foundation. All of the data on the site is based on company filings with the U.S. Department of Transportation and the Securities and Exchange Commission.

"The airline industry is at its most critical crossroads since deregulation, and the information on this site tells hundreds of different stories that will bear that out," said ADP developer and manager William Swelbar, a research engineer at MIT and one of the aviation industry's most highly regarded economic analysts.

"Restructuring in the airline industry is not complete, despite extraordinary changes over the past six years," Swelbar said. "With new competition from foreign carriers through 'open skies' agreements and continued prospects for mergers and consolidation, the coming years could bring even more change."

Data on the ADP web site will be updated regularly with additional charts and analysis available.

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MIT, Ford announce energy partnership

Ford becomes inaugural sustaining member of MIT Energy Initiative

MIT and the Ford Motor Company announced a major new energy research partnership Oct. 1 that will focus on new powertrain, fuel and energy technologies to deliver sustainable transportation for consumers.

The new energy research partnership builds on the existing Ford-MIT Alliance. With the establishment of this partnership, Ford becomes the inaugural Sustaining Member of the MIT Energy Initiative (MITEI), which was formally established in November 2006 to address global energy issues.

"Ford and MIT have a long and productive history of working together to meet critical national needs through research," said MIT President Susan Hockfield. "This expansion of the Ford-MIT Alliance will pair innovators at Ford and MIT to help meet the world's energy challenges. We are excited about Ford's support for the MIT Energy Initiative and its key role as the initiative's first Sustaining Member."

As the inaugural Sustaining Member, Ford Motor Company will have the initial seat on the MITEI Executive Committee, which is responsible for the overall strategic direction of the initiative. This five-year collaboration will support Ford's research program to develop new technologies and will include Ford's sponsorship of two named MITEI fellowships—the Ford Alliance Energy Fellows.

"Energy related issues pose some of society's greatest challenges," said Sue Cischke, Ford's senior vice president—sustainability, environment and safety engineering. "We are delighted to work with MIT toward sustainable solutions."

"Ford and MIT have a long history of innovating together," said Gerhard Schmidt, vice president, Ford research and advanced engineering. "Focusing our combined efforts on energy challenges is crucial and timely."

The partnership will also support MITEI's energy research "seed fund" to promote the development of a broad range of novel, innovative energy technologies and concepts from innovators across the Institute.

"The development of new transportation technologies is critical for meeting the world's energy needs," noted Professor Ernest Moniz, director of MITEI. "As the first mover for the automotive technologies of the 20th century, Ford Motor Company transformed the world. This research collaboration is designed to support Ford's commitment to providing similar transformational technologies for a new century."

Make hay (and a lot more) while the sun shines

MIT team aims to win annual solar house contest in Washington

Sarah H. Wright
News Office

A team of MIT students, faculty and volunteers has taken on the challenge of designing and building a house that relies entirely on solar energy to meet the electricity needs of a typical American family, from drying towels to cooking dinner.

Being from MIT, they also took on the challenge of being the best: For the first time, MIT has an entry in the Department of Energy's annual Solar Decathlon—a village of 20 off-grid solar homes built by college students to be assembled and open to the public on the National Mall in Washington from Oct. 12 to Oct. 20.

MIT's off-grid home, known as Solar7, is en route to the capital now. Designed and built at MIT on an asphalt lot at the corner of Albany and Portland Streets in Cambridge, Solar7 was broken into modules and sent off by flatbed truck.

About 20 MIT students and volunteers will reassemble the house in Washington and participate in the DOE contest in various roles.

Kurt Keville, faculty advisor to the Solar7 team and a research specialist at the Institute for Soldier Nanotechnologies, already has his eye on MIT's worthiest opponent. "The University of Colorado won the past two years; they're the team to beat," he said.

Each 800-square-foot solar home, once assembled in the Solar Decathlon Village, vies for points in 10 categories related to energy efficiency, design and marketability, which the DOE calls "communications."

As Corey Fucetola, student project leader and a graduate student in electrical engineering and computer science, said, "The best way to change human behavior is give people the information they need to change."

The MIT solar house team will communicate through student tour guides (the DOE expects 30,000 visitors to the contest) and an information panel in the kitchen that will give feedback on about 40 sensors monitoring light, temperature and energy use.

All Solar Decathlon entries must meet specific livability standards. Each home must retain warmth but not bake its residents. Each must have sufficient light to endure rainy days; it must provide warm water for showers; it must be handicapped-accessible; it must store enough energy to run a dishwasher and an electric car. It must use commercial building materials and available technologies—no weird science, no fresh-from-the-lab contraptions.

"You can't yank something out of the lab and throw it up on the roof. You have to use production-grade products," Keville said.

The consolations of technology

Since construction began last spring, Keville, Fucetola and construction manager Tom Pittsley had plenty of technology and new materials to keep their interest and to engage the weekend warriors managed by volunteer coordinator Arlis Reynolds.

For any passive solar home, the challenge is keeping the heat. The Solar7 team built a south-facing light wall made of 1-foot-thick square tiles. Each looks like a sandwich: Two opaque plastic squares are the "bread" for a filling of water and a layer of a thermal insulating gel spread on the inside of one of the tiles "slices."

The insulating gel transfers the sun's heat from the outside, through the water, to the inside wall.

Energy-efficient windows made of three panels of glass with krypton gas as an insulator are used elsewhere in the house.

Photovoltaic cells cover the south-facing roof of Solar7 and do the heavy lifting, energy-wise. They generate about nine kilowatts of energy per hour; electricity will be stored in 24 batteries. These can hold about 70 kilowatt-hours and can power the house for about 48 hours.

The batteries must also power the team's electric car—a potential deal-breaker, since the car that goes the furthest wins.

PHOTO / **DONNA COVENEY**

Many hands volunteered in the making of MIT's solar house.

PHOTO / **DONNA COVENEY**

Roof of MIT's solar house being powered up by...the sun!

Solar7's south face also holds 60 evacuated tubes that will carry solar-heated water into the house for showers and washing and for circulation in the warmboards, a radiant heating system based on a molded subfloor that's embedded with plastic tubing.

The house contains a kitchen, full bathroom, living and dining area, and a flexible bedroom/office space, defined by opaque pocket doors. It has a wide, gracious deck and ramps for accessibility.

It takes a village

The 2007 Solar Decathlon is more than a competition: It's a community of 20 universities, 20 houses, and hundreds of students. Some DOE contests challenge both energy and labor efficiency.

For example, there's the hot shower contest: Each team must be able to heat a bucket of water to 11 degrees.

Then there's the dinner party. The Decathlon Solar Village is divided into neighborhoods of four or five houses, and each solar house team must prepare a three-course vegetarian meal for their neighbors, using their stored energy, powering kitchen appliances, to cook and to clean up.

The MIT dinner menu is nothing short of sumptuous. It starts with pumpkin crab soup, offers meatless sausage kabobs or spinach tortellini for a main course, and sorbet and chocolate chip pudding cookies for dessert. The drink menu—minty "virgin mojitos" or fruity "Safe Sex on the Beaches"—is alcohol-free.

But dinner's a one-time thing; as in life, solar laundry is forever. The DOE requires each team to wash and fluff-dry a load of towels, just like home.

Converting brain signals into action

MIT researchers develop algorithm to help create neural prosthetic devices

MIT researchers have developed a new algorithm to help create prosthetic devices that convert brain signals into action in patients who have been paralyzed or had limbs amputated.

The technique, described in a paper published as the cover article in the October edition of the Journal of Neurophysiology, unifies seemingly disparate approaches taken by experimental groups that prototype these neural prosthetic devices in animals or humans.

"The work represents an important advance in our understanding of how to construct algorithms in neural prosthetic devices for people who cannot move to act or speak," said Lakshminarayan "Ram" Srinivasan (S.M., Ph.D. 2006), lead author of the paper.

Srinivasan, currently a postdoctoral researcher at the Center for Nervous System Repair at Massachusetts General Hospital and a medical student in the Harvard-MIT Division of Health Sciences and Technology (HST), began working on the algorithm while a graduate student in MIT's Department of Electrical Engineering and Computer Science (EECS).

Trauma and disease can lead to paralysis or amputation, reducing the ability to move or talk despite the capacity to think and form intentions. In spinal cord injuries, strokes, and diseases such as amyotrophic lateral sclerosis (Lou Gehrig's disease), the neurons that carry commands from the brain to muscle can be injured. In amputation, both nerves and muscle are lost.

Neural prosthetic devices represent an engineer's approach to treating paralysis and amputation. Here, electronics are used to monitor the neural signals that reflect an individual's intentions for the prosthesis or computer they are trying to use. Algorithms form the link between neural signals that are recorded and the user's intentions that are decoded to drive the prosthetic device.

Over the past decade, efforts at prototyping these devices have divided along various boundaries related to brain regions, recording modalities, and applications. The MIT technique provides a common framework that underlies all these various efforts.

The research uses a method called graphical models that has been widely applied to problems in computer science like speech-to-text or automated video analysis. The graphical models used by the MIT team are diagrams composed of circles and arrows that represent how neural activity results from a person's intentions for the prosthetic device they are using.

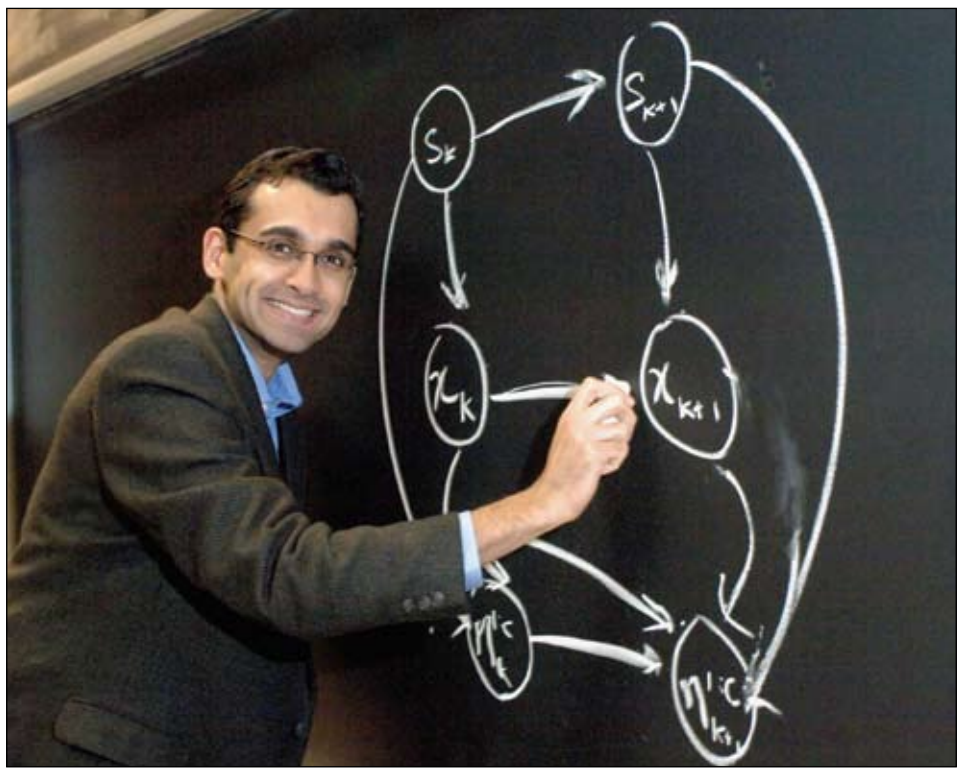

PHOTO / **DONNA COVENEY**

Lakshminarayan Srinivasan (S.M., Ph.D. 2006) is part of a team that develops standardizing math equations to allow neural prostheses to work better. He is currently a medical student in the Harvard-MIT Division of Health Sciences and Technology and a postdoctoral researcher at the Center for Nervous System Repair at Massachusetts General Hospital.

The diagrams represent the mathematical relationship between the person's intentions and the neural manifestation of that intention, whether the intention is measured by an electoencephalography (EEG), intracranial electrode arrays or optical imaging. These signals could come from a number of brain regions, including cortical or subcortical structures.

Until now, researchers working on brain prosthetics have used different algorithms depending on what method they were using to measure brain activity. The new model is applicable no matter what measurement technique is used, according to Srinivasan. "We don't need to reinvent a new paradigm for each modality or brain region," he said.

Srinivasan is quick to underscore that many challenges remain in designing neural prosthetic algorithms before they are available for people to use. While the algorithm is unifying, it is not universal: the algorithm consolidates multiple avenues of development in prostheses, but it isn't the final and only approach these researchers expect to see in the years to come. Moreover, energy efficiency and robustness are key considerations for any portable, implantable bio-electronic device.

Through a better quantitative understanding of how the brain normally controls movement and the mechanisms of disease, he hopes these devices could one day allow for a level of dexterity depicted in movies, such as actor Will Smith's mechanical arm in the movie, "I Robot."

The gap between existing prototypes and that final goal is wide. Translating an algorithm into a fully functioning clinical device will require a great deal of work, but also represents an intriguing road of scientific and engineering development for the years to come.

Other authors on the paper are Uri Eden (Ph.D. 2005), assistant professor in mathematics and statistics at Boston University; Sanjoy Mitter, professor in EECS and MIT's Engineering Systems Division; and Emery Brown, professor in brain and cognitive sciences, HST, and anesthesia and critical care at Massachusetts General Hospital. The cover image for the October issue of Journal of Neurophysiology that depicts this research was designed by Rene Chen (B.S. 2007) and Eric Pesanelli.

This work was sponsored by the National Institutes of Health and the National Science Foundation.

Team demos safety of RNA therapy

Research could lead to treatments for cancer, many other diseases

Anne Trafton
News Office

Researchers from MIT, Alnylam Pharmaceuticals and other institutions have demonstrated the safety of a promising type of genetic therapy that could lead to treatments for a wide range of diseases such as cancer and viral diseases.

The work, which will be published in the Oct. 11 issue of Nature, describes a new approach to conducting the therapy. A paper in Nature last year reported that another commonly used approach caused fatalities in mice.

The research focuses on RNA interference, or RNAi, a key part of the body's genetic machinery. RNAi works by using short strands of RNA to block the expression of specific genes.

"RNAi has huge potential as a therapeutic agent," said Daniel Anderson, a research associate at MIT's Center for Cancer Research and one of the authors of the new paper.

However, a paper published in Nature last year by a different team showed that large doses of one type of RNA used for RNAi, short hairpin RNA (shRNA), disrupted another key RNA pathway, the microRNA pathway, and caused the mice in the study to die. That result worried some RNAi researchers, said Anderson.

"That first paper demonstrated that short hairpin RNA could lead to mouse fatality," he said. "Researchers were concerned that a second type of RNA, small interfering RNA (siRNA), would induce the same toxicity."

In the current study, the researchers demonstrated that siRNA did not have the same toxic effects as large doses of shRNA because it does not interfere with the microRNA pathway. Further, they achieved 80 percent silencing of target genes in mice and hamster liver cells.

"Using chemically synthesized siRNA, you can deliver sufficient siRNA to achieve therapeutically valuable gene silencing, without interfering with the cell's endogenous microRNA," said David Bumcrot, a director of research at Alnylam (an MIT start-up) and one of the authors of the paper.

The research team used a new RNA delivery system developed at MIT, the details of which will be published in another upcoming paper, to perform the RNA interference.

In many RNAi studies, including the one that the MIT/Alnylam team was following up on, researchers use retroviruses to deliver genes that code for short hairpin RNA, which is a precursor to siRNA. Once the gene is incorporated into the cell's DNA, short hairpin RNA is synthesized and transported from the cell nucleus to the cytoplasm for further processing.

The earlier study showed that large amounts of short hairpin RNA blocked the cell's ability to export microRNA, which uses the same export pathway. Without normally functioning microRNA, the mice died. Low doses of short hairpin RNA were not toxic, but the dosage is difficult to control because once the shRNA gene is incorporated into the DNA of the host cells, it is expressed for long periods of time, said Bumcrot.

In the current MIT/Alnylam study, siRNA was delivered directly to the cell cytoplasm, so it did not compete with the export of microRNA.

"We wanted to demonstrate that if you go downstream of that (export) step in the pathway, you don't get interference with the microRNA pathway," said Bumcrot. "With synthetic siRNAs, we deliver a defined dose and we know how long the effect lasts. If toxicity issues arise, dosing can be stopped at any time. It's much easier to control and, therefore, safer."

Other MIT authors on the paper are Institute Professor Robert Langer and Michael Goldberg, a graduate student in chemistry. Researchers from the University of Texas Southwestern Medical Center and the Swiss Federal Institute of Technology are also authors on the paper.

The work at MIT was funded by the National Institutes of Health.

Study: Genes influence people's economic choices

Greg Frost
News Office

An international team of researchers including an MIT graduate student has demonstrated for the first time that genes exert influence on people's behavior in a very common experimental economic game.

Traditionally, social scientists have been quite hesitant to acknowledge a role for genes in explaining economic behavior. But a study by David Cesarini, a Ph.D. student in MIT's Department of Economics, and colleagues in Sweden indicates that there is a genetic component to people's perception of what is fair and what is unfair.

The paper, published in the Oct. 1 advanced online issue of the Proceedings of the National Academy of Sciences, looked at the ultimatum game, in which a proposer makes an offer to a responder on how to divide a sum of money. This offer is an ultimatum; if the responder rejects it, both parties receive nothing.

Because rejections in the game entail a zero payoff for both parties, theories of narrow self-interest predict that any positive amount will be accepted by a responder. The intriguing finding in the laboratory is that responders routinely reject free money, presumably in order to punish proposers for offers perceived as unfair.

To study genetic influence in the game, Cesarini and colleagues took the unusual step of recruiting twins from the Swedish Twin Registry, and had them play the game under controlled circumstances. Because identical twins share the same genes but fraternal twins do not, the researchers were able to detect genetic influences by comparing the similarity with which identical and fraternal twins played the game.

The researchers' findings suggest that genetic influences account for as much as 40 percent of the variation in how people respond to unfair offers. In other words, identical twins were more likely to play with the same strategy than fraternal twins.

"Compared to common environmental influences such as upbringing, genetic influences appear to be a much more important source of variation in how people play the game," Cesarini said.

"This raises the intriguing possibility that many of our preferences and personal economic choices are subject to substantial genetic influence," said lead author Bjorn Wallace of the Stockholm School of Economics, who conceived of the study.

Other members of the research team include Paul Lichtenstein of the Swedish Twin Registry and senior author Magnus Johannesson of the Stockholm School of Economics.

The research was funded by the Jan Wallander and Tom Hedelius Foundation and the Swedish Research Council.

PHOTO / **DONNA COVENEY**

David Cesarini

Physics professor probes superconductivity

Richard Anthony
MIT Office of Communications

When Eric Hudson was introduced to high-temperature superconductivity as a graduate student, it was still, so to speak, a hot topic.

The phenomenon, discovered in the 1980s, reflects the fact that if you develop the right types of compounds, you can create electrical conductors that are completely resistance-free at temperatures well above the threshold for conventional superconductors.

"With conventional systems, you get to about 25 degrees Kelvin [-415 F] and then plateau," says Hudson, now the Class of 1958 Assistant Professor of Physics at MIT. "With high-temperature superconductivity, you were suddenly at 90 degrees Kelvin."

That figure is well above the mark at which nitrogen gas turns liquid. This meant you could create devices like the high-powered electromagnets used in many MRI scanners without having to use costly liquid helium to cool the magnets' coils to superconducting temperatures. (Helium, which liquefies at a hyper-frigid 4 degrees above absolute zero, is a must for conventional superconducting devices.)

More exciting yet, the discovery seemed to signal that room-temperature superconductivity was on its way. This triggered claims that problems like electricity line losses—the often-hefty amount of power lost to resistance in electrical transmission networks—would soon disappear.

But tough technological hurdles dampened hopes of a resistance-free electrical grid. And for physicists like Hudson, the prospect of figuring out how high-temperature superconductivity (HTS) works at the scale of electrons and protons also faded.

"Initially, a ton of people rushed into the field," he notes. "But in the late 1990s, a lot of them got fed up and left."

Hudson was one of them, switching to another challenging physics problem. But the HTS issue continued to lure him, and after two years he resumed his studies of the phenomenon.

Why? Basically because it's so compelling. "It's a very difficult problem," he notes, "and I feel that when we do understand it, that will open up a whole new world, not only in superconductivity but in related systems."

Hudson has probably helped hasten that day. He's an expert in scanning tunneling microscopy, which is based on the stunning fact that by bringing the right type of tiny metal tip within a few atoms' width of a surface, and generating a voltage between the tip and that surface, you can actually map its individual atoms. (To get a notion of the length scales he's dealing with, consider that an atom of copper—a standard component of many HTS compounds—is to a ping pong ball as the ball is to the moon.)

Now, Hudson and his co-workers have contributed an advance in the technology that promises new progress in unveiling HTS's secrets. Given the all-but infinitesimal size of individual atoms, tunneling microscope users until recently haven't been able to track individual atoms within a compound as they lowered the compound's temperature. By tweaking the makeup of a key part of their microscope, though, the MIT group has solved the problem. That matters, says Hudson.

"If you want to understand what's going on as a function of temperature in these materials," he explains, "you need to be able to follow individual atoms."

The group's recent studies have already undercut one popular theory about the changes that affect HTS materials as their temperature falls. That finding may in turn clear the way for competing hypotheses.

Such advances, and the fact that organizations such as the U.S. Department of Energy are again giving priority to the HTS phenomenon, show the field is regaining its momentum. Yet while the world's first-ever HTS electrical transmission line—an underground Albany-area cable cooled by liquid nitrogen—went live on test basis last year, the steps forward so far don't mean dramatic new applications are imminent.

On the other hand, Hudson does think basic research on the HTS phenomenon is making real head way. "Things are at a point now," he says, "where I believe we'll solve this within my professional lifetime."

–Reprinted from MIT SPECTRVM

PHOTO / **LEN RUBENSTEIN**

Eric Hudson and colleagues are trying to understand the secrets of high-temperature superconductivity by tracking individual atoms.

MIT student turns hearing loss into knowledge gain

Elizabeth Dougherty
Harvard-MIT Division of
Health Sciences and Technology

Brad Buran, a Harvard-MIT Division of Health Sciences and Technology (HST) graduate student, lost his hearing to pneumococcal meningitis when he was 14 months old. Today, the fifth-year doctoral candidate studies in HST's Speech and Hearing Biosciences and Technology program is becoming an expert in the neuroscience of speech and hearing.

Because he is immersed in an environment filled with researchers investigating hearing loss, speech therapy, linguistics, and cochlear implants, Buran sometimes becomes the subject of probing conversations. This constant scrutiny might be off-putting for some, but for Buran, it is fodder for his own musings about the way his brain works.

"It's interesting, because so many people in the program are specialists in an area that relates to me personally," says Buran.

His growing scientific expertise, combined with his personal experience, allow him to go from talking with a programmer about ways to improve cochlear implant coding strategies to discussing linguistics with a speech pathologist without missing a beat. And according to classmate Adrian "K.C." Lee, having Buran as a classmate, colleague and friend enriches his own learning experience by revealing to him the nuances of social communications, such as how people perceive accents (Lee is Australian) or pick up idioms.

Buran uses a technique called cued speech to follow lectures, conversations, and the subtle cues hearing people take for granted, such as the rustle of papers as the class flips to the next page. This technique turns sounds—from speech to

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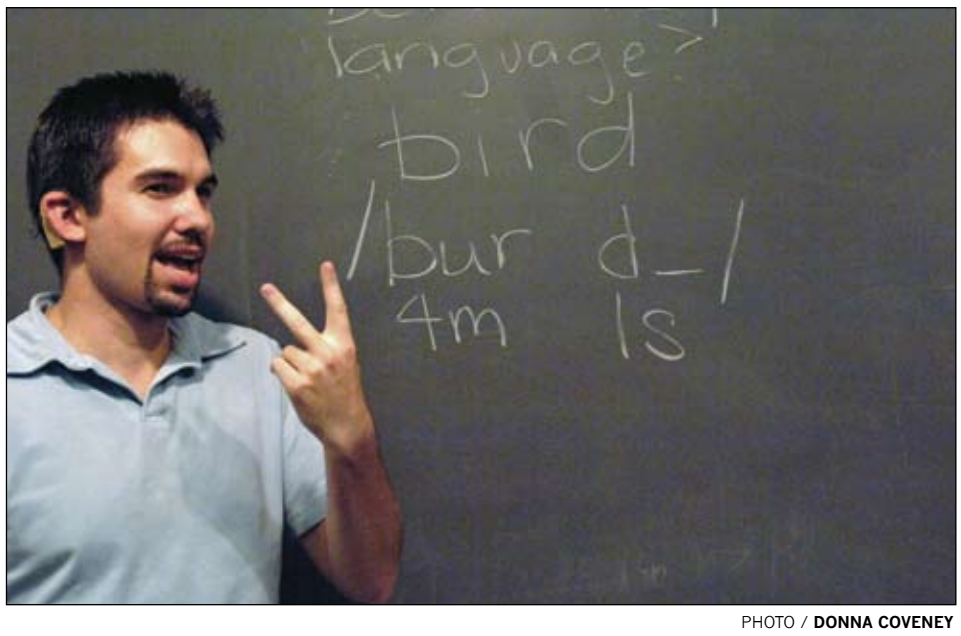

PHOTO / **DONNA COVENEY**

HST graduate student Brad Buran investigates the physiology and molecular biology of the inner ear, the part of the auditory system where mechanical vibrations are turned into electrical signals in nerve fibers. Here he demonstrates the basics of cued speech, a system many students and colleagues have learned.

Team proves role of microRNAs in movement of cancer cells

Alyssa Kneller
Whitehead Institute

MIT scientists have proved that microRNAs, tiny molecules that fine-tune protein production and play a powerful role in biological processes, can prompt otherwise sedentary cancer cells to move and invade other tissues.

Labs have been probing the relationship between aberrant microRNA levels and cancer for several years. They've shown that some microRNAs cause normal cells to divide rapidly and form tumors, but they've never demonstrated that microRNAs subsequently cause cancer cells to metastasize or spread.

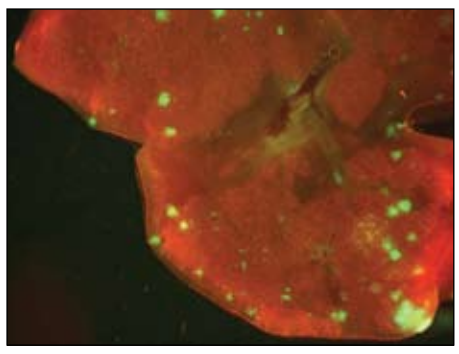

PHOTO / **LI MA**

Small secondary tumors (shown in green) formed in the lungs of mice after human breast cancer cells were inserted into their mammary fat pads.

Working in the lab of MIT Biology Professor and Whitehead Member Robert Weinberg, postdoctoral fellow Li Ma has coaxed cancer cells to break away from a tumor and colonize distant tissues in mice by simply increasing the level of one microRNA.

The work appeared in the Sept. 26 advance online edition of Nature.

"Li has shown that a specific microRNA is able to cause profound changes in the behavior of cancer cells, which is striking considering that 10 years ago no one suspected microRNAs were involved in any biological process," said Weinberg.

Ma began with a list of 29 microRNAs expressed at different levels in tumors versus normal tissue. She examined their production in two groups of cancer cells—metastatic and nonmetastatic. Metastatic cancer cells (including those taken directly from patients) contained much higher levels of one microRNA called microRNA-10b.

Next, Ma forced nonmetastatic human breast cancer cells to produce lots of microRNA-10b by inserting extra copies of the gene. She injected the altered cancer cells into the mammary fat pads of mice, which soon developed breast tumors that metastasized.

So what caused this stunning metamorphosis?

MicroRNAs typically disrupt protein production by binding to the messenger RNAs that copy DNA instructions for proteins and carry them to "translators." Ma used a program developed in the lab of Whitehead member David Bartel to search for the target of microRNA-10b. She identified several candidates, including the messenger RNA for a gene called HoxD10.

Generally involved in development, Hox proteins control many genes active in an embryo. Some Hox proteins have also been implicated in cancer. HoxD10, for example, can block the expression of genes required for cancer cells to move—essentially applying the brakes to a migration process.

To test whether she had removed the brakes during her experiment, awakening the dormant migration process, Ma boosted the level of HoxD10 in the cancer cells with artificially high levels of microRNA-10b. The cells lost their newly acquired abilities to move and invade.

"I was able to fully reverse microRNA-10b induced migration and invasion, suggesting that HoxD10 is indeed a functional target," Ma explained.

"During normal development, this microRNA probably enables cells to move from one part of the embryo to another," added Weinberg. "Its original function has been co-opted by carcinoma cells."

This research is funded by the Life Sciences Research Foundation, the National Institutes of Health and the Ludwig Center for Molecular Oncology at MIT.

CHAPLAIN —

Continued from Page 1

paratively lower profile on campus but nonetheless thrive in their own right. MIT is home to 15 chaplains of different faiths and more than 35 student religious organizations, he said. In addition, a large number of interfaith activities can be found at the Institute; one recent example Randolph cited involved Muslim and Jewish students breaking fast together after sundown on Yom Kippur.

Since coming to MIT in 1979, Randolph has worked extensively with MIT's religious communities. He said he sees his new role as chaplain to the Institute partly as an extension of what he has already been doing, but with added responsibilities such as resource development.

Randolph credited Dean for Student Life Larry Benedict with having the vision that made it possible for the Institute chaplain position to be created. But Benedict said Randolph's position was really the result of a vision laid out more than 50 years ago by former MIT President James Killian.

Killian felt strongly that MIT pay more attention to the spiritual life and to the place of religion in human history and contemporary society. Accordingly, Killian pushed for the building of both Kresge Auditorium and the adjacent chapel, both of which were intended to buoy spiritual life on campus. Plans for a chaplain were also in the works, but were put on hold when Killian left MIT to become special assistant for science and technology to President Eisenhower.

Benedict said the need for an Institute-wide chaplain today is arguably just as pressing—or more so—as it was in 1950s Cold War America.

"This is a milestone in the history of MIT that will be seen that way for generations to come," Benedict said.

"We really need a chaplain of the Institute to be a voice for justice, integrity and ethical conduct on campus," Benedict said. "At the same time, fostering interfaith dialogue becomes a major priority with an increasingly diverse population, with internationalization and with diverse religious groups on campus. This is especially true at a time when there is so much strife and stress in the world among and within various religions and sects."

NOVARTIS

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turing plant. These ingredients are then shipped to a manufacturing facility, often at another site, where they are converted through defined processes into giant batches of pills, liquid or cream. With multiple interruptions, including transport to separate locations, each batch may take weeks to produce. In addition, manufacturing design and scale-up for a new drug are very costly and time-consuming.

Expected benefits of continuous manufacturing include accelerating the introduction of new drugs by designing production processes earlier; using smaller production facilities, with lower building and capital costs; minimizing waste, energy consumption and raw material use; monitoring quality assurance on a continuous basis instead of postproduction batch-based testing; and enhancing process reliability and flexibility to respond to market needs.

The initial research of the Novartis-MIT Center for Continuous Manufacturing will be conducted primarily through Ph.D. programs at MIT laboratories and then transferred to Novartis for further development to industrial-scale projects.

The partners expect the Center's work to involve seven to ten MIT faculty members, as well as students, postdoctoral fellows and staff scientists. Novartis will commit its manufacturing and R&D resources and will pilot new manufacturing processes with one of its pharmaceutical products.

PHOTO / **L. BARRY HETHERINGTON**

Daniel Vasella, CEO of Novartis, and MIT President Susan Hockfield at the Sept. 28 launch of the Novartis-MIT Center for Continuous Manufacturing, a long-term research collaboration aimed at transforming the way pharmaceuticals are produced.

HEARING

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sneezes and even page turns—into hand gestures to create a visual likeness of what he is unable to hear.

For instance, the word "bat" involves three sounds: "b," "a," and "t." Cued speech combines three cues—hand gestures paired with locations around the mouth and throat—to convey these distinct sounds visually. These gestures help Buran distinguish "bat" from "pat," two words that look the same to a lip reader. At the same time, they preserve similarities, allowing him to see that the words rhyme.

Cued speech has played a significant role in helping Buran reach his potential as a scientist by giving him access to the same information as his hearing peers. In this regard, cued speech differs from American Sign Language (ASL). ASL is a distinct language, not a way to represent English with the hands. Translating English into ASL requires interpretation of the meaning and then approximating it using signs.

In contrast, "Cued speech is a modality for language, like speaking or writing," says Tom Shull, a Boston-area cued speech professional. "When I cue, I'm not an interpreter. I'm a transliterator."

Transliteration transparently relays language phoneme by phoneme. "The sounds are just going into the transliterator and coming out as gestures. All the decoding happens at Brad's end," says Lee.

Because cued speech is not a language, it is relatively easy to learn. Lee and more than a dozen of Buran's classmates learned cued speech after meeting Buran. In fact, one friend nearly mastered the technique over a weekend. Now, the group cues during meetings, classes and social events.

"He's certainly not isolated by his impairment," says Buran's advisor Charles Liberman, an HST professor and director of the Eaton-Peabody Laboratory of Auditory Physiology at Massachusetts Eye and Ear Infirmary. "He's in there, organizing [things], galvanizing his classmates to take cued speech classes or to go skiing."

Buran also has a cochlear implant and is learning to use it more effectively. He aims to communicate well on the phone, in large groups and in noisy environments. By listening to himself, he is also improving his speech and intonation. "I can be a very sarcastic person, but you have to see it in my face," he said. "I am not good at using my voice for that yet."

Meanwhile, Buran thinks constantly about his own research. Though he now studies the physiology and molecular biology of the inner ear, his real interest is in language cognition. Because he acquired language both aurally and visually and because he speaks with his hands as well as his voice, he often thinks about how this works inside his brain. "When you decide to say something, what creates the appropriate motor sequence?" How does his brain pick between moving his mouth to speak and his hands to cue?

"No one really understands how all of that works," says Buran. More than likely, someday, he will.

MIT launches Kerberos Consortium

Patti Richards
News Office

MIT announced Sept. 27 the launch of the Kerberos Consortium, embarking on an ambitious mission to create a universal authentication platform to protect the world's computer networks.

MIT also announced that Centrify Corporation, the Financial Services Technology Consortium, Google, Stanford University, Sun Microsystems, TeamF1, and the University of Michigan are founding sponsors of the consortium. The consortium also will receive generous support from Apple.

Kerberos is a network authentication protocol, originally developed for MIT's Project Athena in the 1980s. Over the past two decades, it has grown to become the most widely deployed system for authentication and authorization in modern computer networks. However, it is currently mostly available only in large corporate networks. Kerberos' ability to require strong mutual authentication has enormous potential to protect consumers doing business on the public Internet from phishing and other types of attacks.

"By establishing the Kerberos Consortium, MIT seeks to permit Kerberos to continue to grow and develop as a stable and universal 'single sign-on' mechanism for the users of modern computer networks," said Stephen Buckley, executive director of the Kerberos Consortium. "The consortium will provide a mechanism to permit greater industry participation in the funding and development of Kerberos, and thus allow it to evolve into the universal 'single sign-on mechanism' users need but do not yet have."

"We foresee a day when Kerberos-based authentication and authorization will be as ubiquitous as TCP/IP-based networking itself," said Sam Hartman, chief technologist for the Kerberos Consortium. "We want to make Kerberos more useful and available than ever before."

As an example, Hartman noted that if Kerberos were available on mobile devices, it would be more attractive in the health care industry as a mechanism for securing privacy of health records. If made available for consumers, it could make electronic commerce less susceptible to phishing and identity theft.

"We see a number of our customers asking for open source, stable and interoperable single-sign on technology, based on the Kerberos protocol" said Kathy Jenks, director, Sun Microsystems. "The MIT Kerberos Consortium is an outstanding way to address our customers' requirements and a continuation of the work we have been doing within the Kerberos community over the last several years."

"The bright future for Kerberos depends on our ability to standardize the technologies layered above Kerberos—hence the need for an organization like the Kerberos Consortium," said Clifford Neuman, director of the USC Center for Computer Systems Security and the original principal designer of Kerberos. "I am delighted to see industry, academia, and the business community coming together to promote the growth of Kerberos into new areas."

The consortium will perform software development and the documentation activities necessary to achieve its goal of ubiquitous support for Kerberos-based single sign-on solutions across all aspects of the world's communication infrastructure.

A primary objective of the consortium is to implement the solutions it promotes in the form of open-source reference implementations that can be used by consortium members within their products and organizations without licensing fees.

NEWS YOU CAN USE

International Development Fair

MIT's annual International Development Fair will take place on Friday, Oct. 5, from 1 p.m. to 3 p.m. in Lobby 13. The fair provides incoming and continuing MIT students the opportunity to learn about ways that they can become engaged in international development through student groups, nonprofit organizations or academic course offerings in and around MIT. Groups and organizations of all types set up booths to display their development projects and enlist the interested students who pass through the lobby. For more info, please visit: http://web.mit.edu/idn/idf/.

Bookmobile

The Humanities Library will hold its next Bookmobile from 11 a.m. to 2 p.m. Oct. 5 in Lobby 10, offering books, DVDs and CDs to Institute community members ahead of the three-day weekend. MIT ID is required to borrow from the Bookmobile.

Environment, Health and Safety open house

The MIT Environment, Health, and Safety Office will hold an open house Thursday, Oct. 11, from 10 a.m. to 3 p.m. on the fourth floor of N52 at 265 Mass. Ave.

The event will acquaint members of the MIT community with the services EHS offers, including its support of chemical safety, biosafety, radiation protection, fire safety and emergency response. The open house will feature tours of the EHS lab, free food, giveaways and contest prizes. For more information, contact Robert A. Weker at 617-324-0043 or visit http://mit.edu/ehs-ms/.

No Tech Talk next week

In honor of Columbus Day, there will be no Tech Talk on Wednesday, Oct. 10. The next Tech Talk will be published on Oct. 17. For ongoing MIT news updates, please go to the News Office web site, web.mit.edu/newsoffice/.

Students shape materials for their own devices

Anne Trafton
News Office

A team of MIT students has taken the concept of using biomass to generate energy and shrunk it to fit inside a handheld device that could be used to charge cell phones.

The team of materials science students, known as BioVolt, won first prize in the inaugural MADMEC (MIT and Dow Materials Engineering Contest), held Sept. 25.

The BioVolt device generates electricity from cellulosic biomass for household use in economically underdeveloped countries. In particular, the gadget is designed to charge mobile phones in rural areas where electricity can be scarce.

Professor Edwin (Ned) Thomas, head of the Department of Materials Science and Engineering, said the judges were impressed by the team's creativity. The BioVolt prototype uses anaerobic microorganisms to digest cellulose and convert it to electricity and water in a microbial fuel cell.

"They took risks, and it was really different. They had done a lot of materials work," Thomas said.

Five teams reached the finals of the MADMEC competition, which challenged students to use principles of materials science and engineering to build a prototype device that harvests, stores or exploits alternative energy sources. Teams were judged on the creativity, practicality and potential useful impact of their inventions, said Thomas.

Members of the winning team, which took home $5,000, are graduate students Ethan Crumlin, Gerardo Jose la O' and Joseph Walish, and sophomores John Craven and Andrew Hoy.

The second-place team was Biogas Nicaragua, which included graduate student Jonathan Rose, 2007 graduates Chris Tostado and Julian Villarreal, and sophomores Xavier Gonzalez and Russell Rodewald. Biogas Nicaragua developed a prototype that uses microbes to convert biomass such as crop waste and animal dung into methane that can be used for cooking. The team has set up a testing station in Nicaragua and plans to continue the project next summer.

Third place went to the Curie Brothers, who designed a prototype to improve automobile engine efficiency. Their redesigned piston pumps fluid out of the piston, generating electricity that can be stored in the car's battery. Team members are seniors Vladimir Tarasov and Paul Abel, and junior Shakeel Avadhany.

The prize for second place was $3,000 and the third-place team won $2,000.

Judges for the competition were MIT Department of Materials Science and Engineering faculty members Eugene Fitzgerald, Michael Cima, Yoel Fink and Francesco Stellacci, plus two representatives from contest sponsor Dow Chemical, who are also MIT alumni—Cora Leibig (B.S., S.M., S.M. 1993) and Ted Carnahan (Ph.D. 1991).

Contest organizer Michael Tarkanian (S.B. 2000, S.M. 2003), a technical instructor in materials science and engineering, praised the teams' work.

"They had some really good ideas, and some great prototypes were built," he said. "Everybody should be pleased with the results."

PHOTO / **EDWIN THOMAS**

Members of BioVolt, the team that won the MADMEC contest, and judges for the contest, held Sept. 25, 2007. From left to right, graduate student Gerardo Jose la O', sophomore Andrew Hoy, sophomore John Craven, graduate student Joseph Walish, judge Ted Carnahan of Dow Chemical, judge Cora Leibig of Dow Chemical. Kneeling in front is graduate student Ethan Crumlin.

The contest started in April, when student teams submitted their proposals. Teams spent the summer working on their projects, and six finalists were chosen in August (one team dropped out before the final round).

Thomas is also the founder of the Institute for Soldier Nanotechnologies, which holds a similar contest that has led to development of several start-up companies. Thomas said he hopes this contest will become just as successful.

"If things go well, we want to expand it," he said.

For more information about the contest and the teams, visit the MADMEC web site at dmse.mit.edu/madmec.

PHOTO / **DONNA COVENEY**

PHOTO / **DONNA COVENEY**

Grand opening of MIT Museum addition

Thousands of visitors flocked to the MIT Museum during the weekend of Sept. 29-30 for the grand opening of its new 5,000-square-foot addition, which features the Mark Epstein (S.B. 1963, S.M. 1964) Innovation Gallery.

At left, Epstein, wife Amoretta Hoeber and grandson Emmett Lewis Hoeber share a quiet moment during a reception Sept. 28 to celebrate the opening of the new addition.

At right, Amgen, Inc. Professor of Biology Nancy Hopkins and husband Dinny Adams look at the exhibit of her zebrafish, one of several displays in the new gallery.

Great Glass Pumpkin Patch returns

Lynn Heinemann
Office of the Arts

It's a bumper crop you won't want to bump too hard: More than 1,000 hand-blown glass pumpkins, squashes and gourds in all shapes, sizes, colors and designs will be sold as part of MIT's annual Great Glass Pumpkin Patch.

The Great Glass Pumpkin Patch begins with a preview reception Friday, Oct. 5 from 5 to 8 p.m. on Kresge Oval. The following day, Oct. 6, between 10 a.m. and 3 p.m., shoppers and browsers will be able to purchase their favorite autumnal orb. Prices range from $20 to $200, depending on the piece's size and complexity. Many of the works feature vivid colors, swirls, stripes, spots, curlicues and unusual stems.

The rain date is Oct. 7, from 10 a.m. to 3 p.m.

The glass pumpkins were created by students and instructors in MIT's Glass Lab, where members of the MIT community learn and practice the art of glassblowing. Proceeds from this event benefit the lab, an art program connected with MIT's Department of Materials Science and Engineering. Pumpkin-making is overseen by glass artist Peter Houk, director of the MIT Glass Lab in the Department of Materials Science and Engineering.

The Great Glass Pumpkin Patch came to MIT in 2001 after a residency in the Glass Lab by 14 members of the Bay Area Glass Institute (BAGI). The Bay Area Glass Institute (a nonprofit corporation located in San Jose, Calif.), was founded in 1995 by San Jose State graduate Bobby Bowes and MIT alumnus Mike Binnard.

Every week or so, beginning, intermediate and advanced students work together for a few hours in teams of six or seven to produce pumpkins for the sale. Production for the October event continues steadily throughout the year in order to achieve the goal of 1,000 to 1,200 pumpkins.

For more information, including an illustrated step-by-step description of "How To Make a Pumpkin," see: http://web.mit.edu/glasslab/sales_pumpkin.html, or call (617) 253-5309.

PHOTO / **PHILIP BAILEY**

Creations from MIT's Glass Lab that have sprouted on the Kresge Oval for the Annual Great Glass Pumpkin Patch.

Green Center for Physics dedication this Friday

Event also celebrates completion of PDSI building project

Sarah H. Wright
News Office

The Green Center for Physics, the dynamic cornerstone of a major building and renovation project, will officially open with a dedication ceremony at 2:30 p.m. Friday, Oct. 5.

The community event will also celebrate the completion of the overall major building and renovation program, known as PDSI, for the departments of physics and materials science and engineering, the George R. Harrison Spectroscopy Laboratory and infrastructure renewal enhancements.

Named in honor of Cecil (E.E. 1923) and Ida Green, the center was designed with the goal of fostering new research collaborations. The center occupies the fourth floor of Building 6, the first (atrium), second, third and fourth floors of 6C (a new "infill" structure replacing 6A), and the third floors of Buildings 4, 6 and 8, in which spaces have been significantly improved.

Marc A. Kastner

Building 6C has huge windows, dramatic interior vistas and sleek glass-walled walkways on the second, third and fourth floors that connect it to buildings 4, 6 and 8.

"The Green Center fulfills a decades-long dream—to have a place that faculty and students throughout MIT can identify with the Department of Physics," said Marc A. Kastner, dean of science and Donner Professor of Science.

The department's administrative, academic and some community functions are now in one location, along with educational labs and a reading room. The new center has also brought together MIT's theoretical physicists, housing the Condensed Matter Theory Group and the Virgil Elings Center for Theoretical Physics.

"Theoreticians thrive on explaining their ideas to colleagues and on lively discussions," said Edmund Bertschinger, department head and professor of physics. "The building's design and the new environment provide for that."

Kastner agreed that the center facilitates the kind of collaboration that will help spark new research advances.

"Faculty and students working in these fields have many common interests, and the accidental discussions that will occur because of proximity in the Green Center are sure to lead to great new insights," he said. "People will meet each other frequently when they use the undergraduate or graduate student common rooms or the variety of conference and seminar rooms."

Architect Payette Associates and program planner Imai Keller Moore worked to assure that the new facility would provide both the space and the spirit for spontaneous meetings. The MIT project managers were John Hawes and Milan Pavlinic.

The goals of PDSI, announced in 2002 when the Main Group Master Plan was formulated, included building and renovation projects as well as upgrades for life safety and building services.

The Main Group, Institute shorthand for its historic Bosworth Buildings, were designed by William Welles Bosworth and mostly completed in 1916. They are connected by the Infinite Corridor and include Buildings 1 through 10.

"We are especially grateful that the generosity of the department's friends—especially Cecil and Ida Green, Neil (E.E. 1964) and Jane Pappalardo, Virgil Elings (Ph.D. 1966) and Jim (S.B. 1953, Ph.D. 1957) and Sylvia Earl—has made the Green Center a reality," Kastner said.

The visual centerpiece of the entire PDSI project is the bold design on the U-shaped ground floor atrium, a 7,000-square-foot artwork by renowned American conceptualist Sol LeWitt (1928-2007).

"Bars of Color Within Squares (MIT) 2006," commissioned through MIT's ongoing Percent-for-Art program, consists of squares of vibrantly colored geometric shapes that reflect on the Center's windows and walls.

LeWitt was selected for the project by a committee including Kastner; Samuel Allen, professor of materials science and engineering; Washington Taylor, professor of physics; Virginia Esau, manager, physics space and renovation; Marc Jones, assistant dean, School of Science; Jim Collins of Payette Associates; and Jane Farver, director of the MIT List Visual Arts Center.

The Oct. 5 celebration will include tours of the new and renovated spaces for physics, materials science and engineering, and the Spectroscopy Laboratory.

President Susan Hockfield, Dean of Engineering Subra Suresh, Spectroscopy Laboratory Director Michael Feld, chair of the MIT Corporation Dana Mead and Kastner are scheduled to make remarks.

PHOTO / **GEORGE BOURET**

Dazzling colors reflect from Sol LeWitt's 'Bars of Color Within Squares (MIT), 2006,' onto both the new Building 6C and Building 8, as seen from Building 4.

PHOTO / **GEORGE BOURET**

Walkways between Building 6C and Building 8 foster communication, while LeWitt's atrium floor urges boldness.