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TechTalk
SERVING THE MIT COMMUNITY

Koch gift to chart 'new course' for cancer research

Anne Trafton
News Office

With a $100 million gift from David H. Koch (S.B. 1962, S.M. 1963), one of the largest gifts in Institute history, MIT plans to build a new cancer research center that will bring together scientists and engineers under one roof to develop new and powerful ways to detect, diagnose, treat and manage cancer.

The David H. Koch Institute for Integrative Cancer Research—the cornerstone of a major research initiative comparable to MIT's spearheading the development of radar technology in World War II—will be housed in a new state-of-the-art cancer research facility, scheduled to open in 2010.

The new Koch Institute will build on the pioneering research of MIT's Center for Cancer Research (CCR), founded by Nobel Prize winner Salvador E. Luria in 1974, and will bring to the next level MIT's longstanding commitment to unraveling the molecular core of the disease.

"The David H. Koch Institute for Integrative Cancer Research will harness the power of MIT scientists and engineers to address one of the most pressing challenges to human health: the ultimate eradication of cancer, starting with real improvements in detection, treatment and prevention," said MIT President Susan Hockfield.

"David Koch's extraordinary generosity will make possible a level of collaborative, cross-disciplinary research and training unparalleled in the world. The convergence of life sciences and engineering enabled by his gift will chart a new course for cancer research, for which we are deeply grateful," she said.

The $100 million gift is the fifth largest in MIT's history. Ground will be broken for the new building, which will be located next to the David H. Koch Biology Building and across Main Street from the Broad Institute, in March 2008.

David H. Koch

What makes the new institute unique is the concept of pooling MIT's molecular geneticists and cell biologists with engineers.

"This is a new approach to cancer research with the potential to uncover breakthroughs in therapies and diagnostics," Koch said. "Conquering cancer will require multidisciplined initiatives and MIT is positioned to enable that collaboration. As a cancer survivor, I feel especially fortunate to be able to help advance this effort."

The new institute will house the laboratories of approximately 25 MIT faculty members, including a blend of faculty from the School of Science and the School of Engineering. Among the scientists are Angelika Amon, winner of the Waterman Award from the National Science Foundation as the nation's top young scientist or engineer, and Phillip Sharp, winner of the 1993 Nobel Prize in physiology or medicine.

"The word 'integrative' in the name of the Koch Institute is the key to the vision of its establishment. It speaks volumes about where cancer research is heading, and I'm really excited to be a part of it," said Sharp.

Engineering faculty include Angela Belcher, a MacArthur Award winner who was named Scientific American's Researcher of the Year in 2006. MIT Institute Professor Robert Langer will also conduct his engineering research within the new Koch Institute. Langer's collaborative research efforts have led to numerous patented discoveries and novel ways to improve the clinical management of cancer. He was awarded the 2006 National Medal of Science.

"The Koch Institute will pursue a bold new direction in cancer research, one that holds great promise for our ability to more effectively control this disease," said John E. Niederhuber, director of the National Cancer Institute. "MIT has played a critical role in defining the molecular era of cancer research. With the Koch Institute, MIT is poised to chart a powerful new course in a rapidly developing era that will require the skills of the engineering disciplines, physical sciences, and of mathematics and physics, in addition to the biological sciences."

Building on the advances in traditional areas of cancer exploration such as molecular genetics and cellular biolo-

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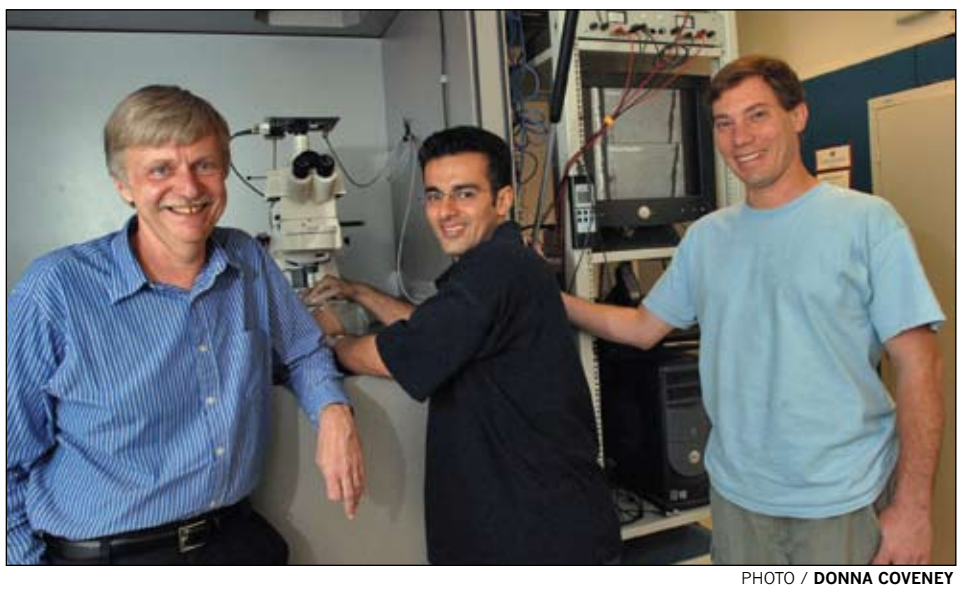

PHOTO / **DONNA COVENEY**

Professor of electrical engineering and computer science Dennis Freeman, left, graduate student Roozbeh Ghaffari and research scientist A.J. Aranyosi in the lab in which they have taken a piece of tectorial membrane from a cochlea and are placing it in a chamber where they can observe a distinct mode of motion from forces applied at audio frequencies.

MIT finds new hearing mechanism

Discovery could lead to improved hearing aids

David Chandler
News Office

MIT researchers have discovered a hearing mechanism that fundamentally changes the current understanding of inner ear function. This new mechanism could help explain the ear's remarkable ability to sense and discriminate between sounds, and its discovery could eventually lead to improved systems for restoring hearing.

The research was described in the Oct. 8 advance online issue of the Proceedings of the National Academy of Sciences.

MIT Professor Dennis M. Freeman, working with graduate student Roozbeh Ghaffari and research scientist Alexander J. Aranyosi, found that the tectorial membrane, a gelatinous structure inside the cochlea of the ear, is much more important to hearing than previously thought. It can selectively pick up and

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State of MIT 'very, very strong,' Hockfield reports

Anne Trafton
News Office

A record number of applications, an all-time high in fundraising and the launch of several new campus-wide and global initiatives helped make the past year a strong one for MIT, President Susan Hockfield reported Tuesday, Oct. 2, at the annual State of the Institute Forum.

Hockfield and other senior administrators spoke at the forum, held at Kresge Auditorium and attended by several hundred members of the MIT community.

Hockfield asked every member of the community to re-commit to the stewardship of MIT and preservation of its core values—personal integrity, taking pleasure in hard work, and commitment to meritocracy.

"It is our responsibility to invent the future, in both research and education," Hockfield said. "I believe very deeply that the world needs MIT as much now as it ever has before."

The state of MIT is "very, very strong" and has grown stronger over the past year, Hockfield reported.

In the past two years, MIT has received record numbers of undergraduate applications, with a 9 percent increase in each of the past two years. This year, MIT accepted 12.3 percent of the record-high 12,443 applicants, and 69 percent of those accepted decided to attend MIT.

"Any way you look at these numbers, it shows a very strong draw for young people to MIT," Hockfield said.

MIT took in a record $332 million in total fundraising, a 37 percent increase over the 2006 total. Hockfield attributed that growth to early success of the Campaign for Students, which was announced in December 2006 with the goal of raising $500 million for undergraduate financial aid, graduate fellowships, new educational initiatives and student life.

Hockfield noted that the senior leadership team has undergone a great transition in the past year, with new deans for the Schools of Engineering and Science and the Sloan School of Management, plus several new vice presidents and other senior administrators.

She also reviewed the many collaborations that MIT has launched or joined in the past year, including the MIT Energy Initiative (MITEI), the Singapore-MIT Alliance for Research and Technol-

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OBITUARIES

Walter Shepherd Owen, professor emeritus, 87

Walter Shepherd Owen, professor emeritus of physical metallurgy at MIT, died Oct. 10 at Massachusetts General Hospital. He was 87.

Owen joined MIT as head of what was to become the Department of Materials Science and Engineering; during his tenure as department head from 1973 to 1982, the department broadened its academic and research focus from metallurgy to include ceramics, polymers, and semiconductors. Controversial at the time, this change created a department that today produces groundbreaking work on lower-emission iron production, rechargeable batteries and lasers used in minimally invasive surgical procedures.

Walter Owen

He received the Bachelor of Engineering in metallurgy (1940), the M.Eng. (1942), and the Ph.D. in metallurgy (1950), all from the University of Liverpool. In 1951, he became a Commonwealth Fund fellow at MIT, where he served as a member of the research staff from 1954 to 1957. Over the course of his career, he held both academic and administrative positions at several universities, including the University of Liverpool, where he was dean of Faculty of Engineering Science, Cornell University, where he directed the Department of Materials Science and Engineering, and Northwestern University, where he was dean of the Technological Institute and vice president for science and research.

He was deeply committed to the education of materials scientists and engineers and to furthering the evolution and development of the field of materials science and engineering, particularly in the areas of conservation, recycling, environmental concerns, public policy, and materials availability.

He is survived by his wife, Geraldine Owen; his daughter, Ruth Owen, her husband, Peter Sherman, and their children, Owen and Dylan Uscher; his stepson, Oren Lieberman, and his wife, Tanya Mergler, and their children, Mattis Lieberman, Nitzan Lieberman and Tyler Moore; and his stepdaughter, Helise Lieberman, and her husband, Yale Reisner.

A memorial service will be held at 5:30 p.m. Nov. 15 in the MIT Chapel. By request of the family, in lieu of flowers, gifts may be made in Professor Owen's memory to MIT for scholarships.

Kenneth G. Fraser

Kenneth G. Fraser, who worked as travel and transportation manager at Lincoln Labs until his retirement in 1990, passed away Sept. 25. He was 84.

He is survived by his wife, Barbara Fraser, of Norwood, Mass., two children and seven grandchildren.

A funeral mass was held Sept. 29 in Norwood.

Yanik wins Packard fellowship for neural microchip work

David Chandler
News Office

Mehmet Fatih Yanik has stopped light in its tracks and created a self-contained biological laboratory, complete with large numbers of living test subjects, on the surface of a microchip. Now he is focusing on learning how to keep nerve cells from degenerating and getting damaged ones to regenerate.

That research just received a big boost. Yanik, 29, was one of 20 young scientists awarded a 2007 David and Lucile Packard fellowship in science and engineering, which carries an unrestricted five-year grant of $625,000.

This award continues a string of recent honors for Yanik. Just last month, he won a New Innovator Award from the director of the National Institutes of Health, which carries a total of $2.5 million in new funding. In August, he was named one of Technology Review magazine's TR35, the world's top innovators under the age of 35.

Yanik, an assistant professor in MIT's Department of Electrical Engineering and Computer Science and the Research Laboratory of Electronics, hopes to use the grants to help his work on developing microchips that can analyze living neurons in action. In some cases, he will observe the nerve cells at work inside a living organism—the nematode C. elegans, widely used in biological research because of its simplicity and fast lifecycle. In others, he will use primary mammalian neurons as well as human neurons produced from laboratory strains of stem cells, and manipulate and monitor them at subcellular resolution.

Mehmet Fatih Yanik

In both cases, the key to the research is producing complex high-throughput micromanipulation systems, or those able to carry out large numbers of tests at once at subcellular precision. This would streamline the research process considerably.

Yanik and his students have already produced microchips designed with a network of tiny channels, complete with branching passages, control valves and vacuum-suction segments, which can be filled with water to carry large numbers of C. elegans at once through identical passageways, yet allowing each to be subjected to different conditions.

In a recent work, he also demonstrated how to conduct very precise laser surgery on the tiny animals using femtosecond laser pulses, which made it possible to sever a single axon, the tiny filament that delivers the output from a nerve cell, inside a living C. elegans. The damaged neurons were able to completely regenerate within 24 hours.

Now, Yanik plans to conduct large numbers of such tests all at once on a single chip, as a way of screening different chemical compounds and genes that might speed regeneration of the damaged neurons or inhibit their degeneration. "These high-throughput technologies could be used for the discovery of new drugs and genetic targets" he says.

A similar technology his group is developing could be used to screen the effects of a variety of potential drugs on primary mammalian neurons as well as human neurons derived from embryonic stem cells. "We can treat them with drug candidates, and then observe how that would affect regeneration or degeneration of the neurons at subcellular resolution" he says.

To produce neurons that more closely resemble those in a living body, Yanik's team is also working on building three-dimensional structures to provide tiny scaffolds for the growth of neurons in the lab.

Earlier in his career, Yanik invented a physical mechanism to bring light to a standstill on a chip then start it moving again as a possible way of storing information.

Given his wide interests, Yanik appreciates the flexibility of the Packard award, which can be applied to other work as his research develops. "I plan to spend it on high-risk, high-impact work," he says.

Rafael Bras to receive AGU's Horton Medal

Denise Brehm
Civil and Environmental Engineering

Edward A. Abdun-Nur Professor Rafael Bras has been named this year's winner of the Robert E. Horton Medal, the highest award given to hydrologists by the American Geophysical Union. An internationally recognized researcher in hydrology and hydroclimatology whose work encompasses many aspects of the Earth's water cycle, Bras is being recognized for his contributions to the geophysical aspects of hydrology.

Bras, who holds appointments in the Department of Civil and Environmental Engineering and in the Department of Earth, Atmospheric and Planetary Sciences, is known for his work in flood forecasting and distributed hydrologic modeling, remote sensing and modeling of precipitation and soil moisture.

"It means a lot to follow so many giants," Bras said upon learning he would receive the Horton medal. "And it means a lot to be recognized by an organization I hold dear to my heart, since it has played such an important role in my life. After 30-plus years, I can honestly say that I never get tired of working in this field, largely because of the people and, in particular, the students."

In addition to being a noted flood forecaster, Bras is also known for his research the fractal organization and geometry of river basins, for his models of the evolution of river basins, for studies of the impact of deforestation in the Amazon River basin and most recently for his work on how vegetation, hydrology, climate and landscapes evolve together.

Since 1995 he has chaired a panel of international experts overseeing the development of a system of barriers being built to protect Venice, Italy, against flooding during unusually high tides. The 4.5 billion euro project is scheduled for completion in 2012.

Bras will formally receive the Horton award in December. Next May, during the Environmental and Water Resources Institute meeting in Hawaii, Bras also will receive the Simon W. Freese Award from the American Society of Civil Engineers (ASCE) "for advancing the theory and practice of hydrologic sciences, including hydrometeorology and hydroclimatology." This is the highest environmental recognition for environmental work by ASCE. At the same he will be presented with an honorary diplomate award from the American Academy of Water Resources Engineers, an honor held by only 14 other individuals, for his "demonstrated advanced expertise in water resources engineering, extensive experience, strong ethics, and commitment to lifelong professional development."

AWARDS AND HONORS

Eric S. Maskin, a former MIT economics professor and a current member of the visiting committee for the Department of Economics, is one of three winners of the 2007 Nobel Prize in Economic Sciences.

Maskin was a member of the MIT economics faculty from 1977 to 1984.

Now a professor at the Institute for Advanced Study at Princeton University, Maskin will share the $1.5 million Nobel prize with fellow economists Leonid Hurwicz of the University of Minnesota and Roger B. Myerson of the University of Chicago.

The Royal Swedish Academy of Sciences awarded the Nobel to the trio for having laid the foundations of mechanism design, which provides tools for distinguishing situations in which markets work well from those in which they do not and for characterizing the optimal institution for any given set of conditions.

Jean Tirole, visiting professor of economics, has been awarded the prestigious 2007 Gold Medal by the Centre National de la Recherche Scientifique, France's national center for scientific research.

Tirole (Ph.D. 1981) works on industrial organization, game theory, banking and finance, and economics and psychology. He is scientific director of the Institut d'économie Industrielle, University of Social Sciences, in Toulouse, and was a professor of economics at MIT from 1984 to 1991.

The MIT student group **SaveTFP** won the Outstanding Youth Organization award as part of the Prevention Leaders honors given by the City of Cambridge Department of Health and Human Services and Cambridge Prevention Coalition, a community-based coalition linking substance abuse prevention to a range of health promotion initiatives. The awards recognize individuals and organizations for their outstanding contributions to the prevention of alcohol abuse and drug use in Cambridge.

SaveTFP members work to reducing stress and facilitating student social activities while increasing health awareness at MIT. In the nomination submitted on behalf of SaveTFP, student members were praised for their efforts to reduce stress and high-risk health behaviors at MIT by providing creative outlets of expression and social opportunities for students such as the Love Your Beaver T-shirt campaign, Spooky Skate, the Tipbook and the Lost and Found web site. The nominations committee said they were impressed by the group's innovative new program called eatTFP, providing pizza and Gatorade to parties across campus during the late night hours. This program provides students with an excellent model for low risk drinking and responsible party hosting.

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An interview with Tyler Jacks on the new David H. Koch Institute for Integrative Cancer Research

Tyler Jacks, who will direct the new David H. Koch Institute for Integrative Cancer Research, is currently the director of MIT's Center for Cancer Research. In this interview with News Office writer Anne Trafton, he discusses his vision for the new center and the cancer research that will take place there.

Q. ***There are many research institutes around the world working on cancer—how will the MIT approach be unique?***

A. The new center will be different both from what it is today and from other cancer centers, in that it brings together scientists and engineers focused on cancer. The real power is in having cancer biologists that are expert in the disease, working on trying to understand the disease at a molecular level, interacting closely with engineering faculty with an interest in solving cancer-related problems. There are other NCI-designated basic science cancer centers besides our own, but none with the composition of interdisciplinary investigators that the Koch Institute will have.

Q. ***What are some example areas where this collaboration between biologists and engineers will be beneficial?***

A. One example is an area that we call systems oriented cancer biology, where we are trying to understand the complex nature of cancer and the kinds of growth control networks that control the behavior of cancer cells. Here we're using methods from engineering, mostly with biological engineering faculty collaborators, to develop mathematical and computational models to explain why cancer cells proliferate abnormally, fail to die when they should or how they respond to therapy.

Another example is in the area of nanotechnology, where we are hoping to develop a new generation of anticancer agents which are more powerful because they can selectively target cancer cells, as opposed to normal cells. That will be enhanced still further in the future by taking advantage of new information from biological studies regarding how to shut off any gene of interest. This takes advantage of a process called RNAi, which has only been discovered in the past 10 years or so. Many members of the science side of the cancer center are actively working on this area with the goal of developing new therapeutic approaches that will really change the range of targets that we can go after. These kinds of collaborations highlight the importance of having scientists who are knowledgeable about the disease and knowledgeable about biology working with engineers who want to develop new tools, new materials, new devices, that can be used to better diagnose or better control the disease.

Q. ***How will the center's physical design help facilitate collaborations between the researchers in the building?***

A. The way we are designing the building is to have each floor have both biologists and engineers. The decision as to which floor would have which engineers and which scientists was determined in part by areas of shared interest among those faculty. We tried to create groupings that would help maximize the likelihood that the laboratories would end up interacting, and those on a given floor will have an even greater chance for interaction. We obviously don't want to limit that to researchers on a given floor, and indeed, we expect the interactions to take place throughout the building. One of purposes of having a building housing all of us is to maximize the opportunities for direct interaction, whether it's formalized, in group meetings and so forth, or informal. By bumping into somebody on the way to the copy machine or in the tea room, you might initiate a new line of investigation or help shed light on an old problem by bringing a new perspective.

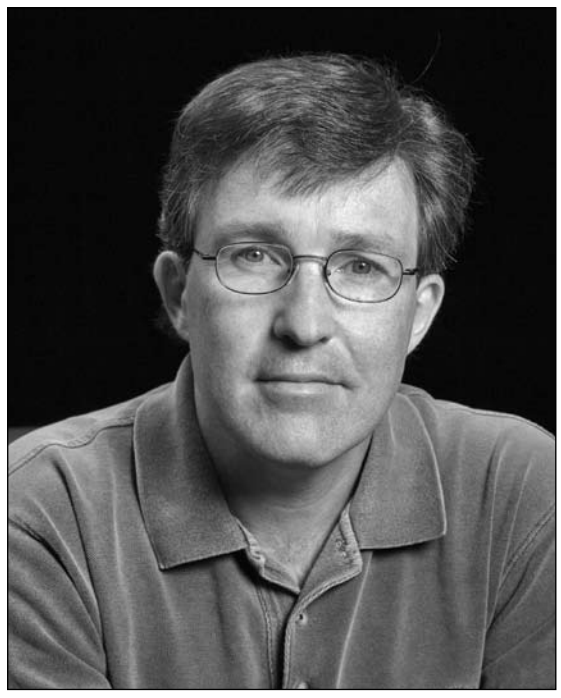

PHOTO / **PAUL FETTERS**

Tyler Jacks

Q. ***Which faculty members will be involved in the groupings?***

A. Let me mention three specific examples, which are just a few of the many interactions that we hope to foster in the new institute. Phil Sharp and Sangeeta Bhatia will be together on the forth floor. They are jointly interested (along with Bob Langer and others) on developing nanotechnology applications for cancer. On the third floor, Forest White will be paired with Michael Yaffe, Richard Hynes and Frank Gertler. They will interact closely on the systems-oriented cancer biology project. Another example is the pairing of Dane Wittrup and Darrel Irvine with Jianzhu Chen. All of these investigators are interested in deploying the immune systems to combat cancer, using a range of methods from protein engineering to improved vaccine strategies to developing more potent cytotoxic T cells.

Q. ***What major advances in cancer research do you foresee in the next 10 to 20 years?***

A. I think in the next 10 to 20 years several important things will happen. First, our knowledge of relevant cancer pathways will become even more complete, and the pace of that process will accelerate dramatically. That will provide us with what we're calling a complete wiring diagram of a cancer cell. That is important because once you understand the full detail of the problem, it allows you to design your best means of attack. The right approach might not be obvious until you have a very complete picture of how things are wired. Such information is not merely important to scientific advance but rather is necessary to allow us to develop even more potent and more effective therapies. Moreover these insights allow us to intervene earlier and earlier in the disease; when caught early cancer is almost always manageable.

Another area is in nanotechnology. We need to create a new generation of anticancer drugs that goes beyond both the conventional agents, which have been around for 50 years or more, and also goes beyond the new class of molecularly targeted anticancer agents. In the near term we imagine the marriage of nanotechnology with RNAi, with which our ability to control cancer cells will be much more effective. To get there, we're going to need to solve some problems, including, importantly, delivery—how to get the RNAi molecule into every cancer cell with very high efficiency. We're going to be relying on our engineering colleagues to solve this problem.

Also, I'm quite convinced that the immune system can be used to control cancer, either in a cancer prevention context or in cancer treatment. Although investigators have tried to create cancer vaccines or use cells in the immune system to fight cancer for some time, this approach has not been very successful to date. It's my opinion that we have to invest more in the basic science to understand the interactions between the immune system and cancer more fully. With our engineering colleagues, we need to design out ways to engineer the immune system to fight cancers more effectively.

The last example I'll mention is the development of devices that will monitor the state of an individual's disease. Let's imagine a cancer patient who is diagnosed and treated, perhaps with surgery or with chemotherapy. The cancer goes into remission, and then it's important to track whether the tumor remains in remission or is undergoing relapse. The way that's done today is with periodic checkups. You go to the doctor and undergo some screening tests. If the test comes back positive the cancer has returned. The problem is that if the test comes back positive, the cancer might have returned in a very aggressive stage or may have returned weeks or months before. So what we're trying to do is develop devices that can be implanted in the body and monitor continuously the presence of tumor cells. The patient would know not year to year but literally minute by minute what's the state of their disease. That information could be transmitted out of the body and directly to their oncologist, so that as soon as a problem became apparent, the treatment could begin. In the most sophisticated incarnation of that idea, the oncologist could actually be cut out of the picture entirely. That is, the device could be so smart that once the cancer cells were detected, a therapeutic agent could be released which could eliminate those cells even before clinical symptoms were apparent. We're not there yet, but you'd be surprised at how many of the component parts of what I just described are in place.

Koch grant puts nanotechnology on front line of prostate cancer battle

A $5 million grant from David H. Koch (S.B. 1962, S.M. 1963) will help researchers from several institutions, including MIT, develop nanotechnology to treat metastatic prostate cancer, for which there is no effective treatment.

The team of researchers from MIT, Brigham and Women's Hospital, Dana-Farber Cancer Institute and the Weill Medical College of Cornell University is investigating how to use tiny nanoparticles to deliver chemotherapy to cancer cells without invading and destroying healthy cells.

Robert Langer

The research team was created by the Prostate Cancer Foundation, and the gift from Koch, a prostate cancer survivor, was announced at the foundation's annual scientific retreat.

Nanotechnology is the field of research that involves materials that are extremely small—the size of atoms or molecules. It holds promise for the detection, diagnosis and treatment of cancer.

"We are exploring if tiny nanoparticles can act as 'Trojan Horses' in the body, delivering medication directly to the cancer cells while bypassing healthy cells," explained MIT Institute Professor Robert Langer, who announced the gift at the Prostate Cancer Foundation retreat and will be one of the leading researchers of the team. "This will permit the administration of drugs that might otherwise be too toxic or dissolve too quickly in the bloodstream."

Other leading researchers of the team are Omid Farokhzad of Brigham and Women's, Philip Kantoff of Dana-Farber and Neil Bander of Weill Medical College.

–Anne Trafton

KOCH

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gy, the state-of-the-art facility will focus on five target areas of research at the intersection of biology and engineering.

Tyler Jacks, the David H. Koch Professor of Biology at MIT and current director of CCR, will serve as the director of the Koch Institute at MIT.

"By housing leading cancer biologists with world-class engineers, we are creating a formidable team motivated to understand cancer and to do something about it. We expect to rapidly deliver important new tools for oncologists and their patients," Jacks said.

"Our goal is to make the David H. Koch Institute for Integrative Cancer Research the gold standard in interdisciplinary disease-focused research. Our organization will build an expanding and highly effective relationship network that also involves other academic oncology centers, industrial partners and cancer-focused foundations. Together we will dramatically expand our research and training efforts and seek to deliver powerful clinical solutions," he said.

The new institute will be equipped with the most sophisticated research tools currently available, including bioinformatics and computing, genomics, proteomics, flow cytometry, large-scale cell and animal facilities for genetic engineering and testing, advanced imaging equipment and nanomaterials characterization labs.

The new institute will be equipped with the most sophisticated research tools currently available.

Koch, who holds bachelor's and master's degrees in chemical engineering from MIT, is an executive vice president and board member of Koch Industries. Koch has personally pledged and contributed more than $400 million to a wide variety of organizations and programs that further cancer research, enhance medical centers and support educational institutions, and sustain arts and cultural institutions. His contributions to MIT have established the David H. Koch School of Chemical Engineering Practice, and he has been honored with the dedication of the David H. Koch Biology Building at the university.

Asteroid work helps understand potential threats

David Chandler
News Office

In research that could aid decisions about future asteroids on a collision course with Earth, MIT scientists have for the first time determined the composition of a near-Earth asteroid that has a very slight possibility of someday hitting our planet.

That information could be useful in planning any future space mission to explore the asteroid, called Apophis. And if the time ever were to come when this object or another turned out to be on its way toward an impact on Earth, knowing what it's made of could be one important factor in deciding what to do about it.

"Basic characterization is the first line of defense," said Richard P. Binzel, professor of planetary sciences in the Department of Earth, Atmospheric and Planetary Sciences (EAPS). "We've got to know the enemy."

Binzel presented the new findings Oct. 9 at the annual meeting of the Division for Planetary Sciences of the American Astronomical Society.

Studying the composition of Apophis has been a useful "practice case," Binzel said, because "you never know when the real one will come along" that is on a collision with the Earth. For determining the composition of a threatening asteroid, Binzel said, "We don't know when the real test will come, but we're ready."

On April 13, 2029, Apophis will come relatively close to Earth (it will miss us by about 22,000 miles). But when it comes by again in 2036, there is a very small possibility—about one chance in 45,000—that it could be on a collision course.

So Binzel, working with EAPS graduate students Cristina Thomas and Francesca DeMeo and others, has been using telescopes on Earth to find out as much as possible about the nature of Apophis and other asteroids. Short of putting together a space mission that would take years and cost hundreds of millions of dollars, such observations are the best way to find out as much as possible about any space rock that might someday be coming our way, Binzel says.

Using the MIT Magellan telescope in Chile and NASA's Infrared Telescope Facility in Hawaii, they have been able to figure out exactly what Apophis is made of. "The composition, I think, is really nailed," he said.

The key to understanding the mineral makeup of an asteroid is to compare it with samples of asteroidal material that have been delivered, free of charge, to the Earth, in the form of the many thousands of meteorites that have been collected over the years.

Spectral analysis—measuring how the meteorites reflect light of different wavelengths—can be used to determine their exact mineral constituents. Similarly, a spectral analysis of the light reflected from a distant asteroid shows the same telltale lines that reveal its composition. By comparing the two kinds of spectra, an asteroid that is just a faraway pinprick of light can be correlated with a piece of a space rock in the laboratory.

Binzel and his students were able to use both visible-light and infrared spectroscopy to show that Apophis is "a good match" for a rare type of meteorite, known as a type LL chondrite. These represent just 7 percent of the known meteorite falls on Earth and are rich in the minerals pyroxene and olivine, which are also common on Earth.

ILLUSTRATION / **SEBASTIAN KAULITZKI**

This illustration shows an asteroid hurtling toward Earth. MIT scientists have for the first time determined the composition of a near-Earth asteroid that has a very slight possibility of someday hitting our planet.

"The beauty of having found a meteorite match for Apophis is that because we have laboratory measurements for the density and strength of these meteorites, we can infer many of the same properties for the asteroid Apophis itself," Binzel said.

An object the size of Apophis (about 270 meters across) could devastate a region as large as France, or produce tsunamis over a wide area if it struck at sea. Many ideas have been proposed for how to deal with such a threat, ranging from using bombs, lasers or spacecraft to nudge it out of the way to blowing it to pieces while it is still far away. The selection of the best course of action may depend of the physical characteristics of the object, including its mineral composition.

This work was sponsored by NASA and the National Science Foundation.

Blood may help us think

Cathryn Delude
McGovern Institute

MIT scientists propose that blood may help us think, in addition to its well-known role as the conveyor of fuel and oxygen to brain cells.

"We hypothesize that blood actively modulates how neurons process information," Christopher Moore, a principal investigator in the McGovern Institute for Brain Research at MIT, explained in an invited review in the October issue of the Journal of Neurophysiology. "Many lines of evidence suggest that blood does something more interesting than just delivering supplies. If it does modulate how neurons relay signals, that changes how we think the brain works."

Christopher Moore

According to Moore's hemo-neural hypothesis, blood is not just a physiological support system but actually helps control brain activity. Specifically, localized changes in blood flow affect the activity of nearby neurons, changing how they transmit signals to each other and hence regulating information flow throughout the brain. Ongoing studies in Moore's laboratory support this view, showing that blood flow does modulate individual neurons.

Moore's theory has implications for understanding brain diseases such as Alzheimer's, schizophrenia, multiple sclerosis and epilepsy. "Many neurological and psychiatric diseases have associated changes in the vasculature," said Moore, who is also an assistant professor in MIT's Department of Brain and Cognitive Sciences.

"Most people assume the symptoms of these diseases are a secondary consequence of damage to the neurons. But we propose that they may also be a causative factor in the disease process, and that insight suggests entirely new treatments." For example, in epilepsy people often have abnormal blood vessels in the brain region where the seizures occur, and the hypothesis suggests this abnormal flow may induce epileptic onset. If so, drugs that affect blood flow may provide an alternative to current therapies.

The hypothesis also has important implications for functional magnetic resonance imaging, or fMRI, a widely used brain scanning method that indicates local changes in blood flow. "Scientists looking at fMRI currently regard blood flow and volume changes as a secondary process that only provides read-out of neural activity," explained Rosa Cao, a graduate student in Moore's lab and co-author of the paper. "If blood flow shapes neural activity and behavior, then fMRI is actually imaging a key contributor to information processing."

Again, studies in Moore's lab support this interpretation. For example, his fMRI studies of the sensory homunculus—the brain's detailed map of body parts like fingers, toes, arms and legs—show that when more blood flows to the area representing the fingertip, people more readily perceive a light tap on the finger. This suggests that blood affects the function of this brain region and that information about blood flow can predict future brain activity. This finding does not undermine prior studies, but adds another, richer layer to their interpretation and makes fMRI an even more useful tool than it already is.

How could blood flow affect brain activity? Blood contains diffusible factors that could leak out of vessels to affect neural activity, and changes to blood volume could affect the concentration of these factors. Also, neurons and support cells called glia may react to the mechanical forces of blood vessels expanding and contracting. In addition, blood influences the temperature of brain tissue, which affects neural activity.

To Moore's knowledge, the hemo-neural hypothesis offers an entirely new way of looking at the brain. "No one ever includes blood flow in models of information processing in the brain," he said. One historical exception is the philosopher Aristotle, who thought the circulatory system was responsible for thoughts and emotions. Perhaps the ancient Greeks were on to something.

This work was funded by Thomas F. Peterson, the Mitsui Foundation and the McGovern Institute for Brain Research at MIT.

MIT links gene to cholesterol

Research could lead to drugs for atherosclerosis, Alzheimer's

Anne Trafton
News Office

MIT researchers have discovered a link between a gene believed to promote long lifespan and a pathway that flushes cholesterol from the body.

The finding could help researchers create drugs that lower the risk of diseases associated with high cholesterol, including atherosclerosis (clogged arteries) and Alzheimer's disease.

The study focused on a gene called SIRT1, which the researchers found prevents cholesterol buildup by activating a cellular pathway that expels cholesterol from the body via HDL (high density lipoprotein or "good cholesterol").

"SIRT1 is an important mediator of cholesterol efflux, and as such it's predicted to play a role in the development of age-associated diseases where cholesterol is a contributing factor," said Leonard Guarente, MIT professor of biology and senior author of a paper on the work published in the Oct. 12 issue of Molecular Cell.

Drugs that enhance the effects of SIRT1 could lower the risk of cholesterol-related diseases, Guarente said. Potential drugs could be based on polyphenols, which are found in red wine and have been shown to enhance SIRT1. However, the quantities naturally found in red wine are not large enough to have a significant impact on cholesterol levels.

The gene SIRT1 was found to prevent cholesterol buildup

In earlier studies, Guarente has shown that high levels of SIRT1 can be achieved with extreme calorie restriction, but that is unappealing for most people.

"If you had a drug that could increase expression of SIRT1, that could replicate the effects of calorie restriction," Guarente said. "This is not going to replace the need for a healthy lifestyle, but it's a supplement that could potentially make you healthier."

SIRT1 is the mammalian homologue to SIR2, a gene that has been shown to slow aging in yeast and roundworms. Researchers have been curious to find out whether SIRT1 has similar effects.

In the new MIT study, researchers found that low SIRT1 levels in mice lead to cholesterol buildup in cells such as macrophages, a type of immune cell, due to reduced activity of a protein called LXR (liver X receptor).

LXR is responsible for transporting cholesterol out of macrophage cells. When full of cholesterol, the macrophages can generate plaques that clog arteries. SIRT1 boosts LXR activity, so that cholesterol is expelled from macrophages and out of the body by HDL.

The lead author of the paper is Xiaoling Li. Other authors are Songwen Zhan;, Gil Blander, visiting scientist in MIT's Department of Biology; Jeanette Tse and Monty Krieger, MIT professor of biology.

The research was funded by the National Institutes of Health.

Faculty meeting

A regular meeting of the faculty will take place Wednesday, Oct. 17, at 3:30 p.m. in Room 32-141. The agenda includes:

- Open discussion on faculty renewal planning
- Update on the recommendations of the Task Force on the Undergraduate Educational Commons
- Strategic planning in the Office of the Dean for Graduate Students
- Remarks from President Susan Hockfield
- Topics arising and questions for the president, the provost and the chancellor

Predicting the future of the past tense

Evolutionary models applied to language

Verbs evolve and homogenize at a rate inversely proportional to their prevalence in the English language, according to a formula developed by MIT and Harvard University mathematicians who have invoked evolutionary principles to study our language over the past 1,200 years.

The team, which reported their findings in the Oct. 11 issue of Nature, conceives of linguistic development as an essentially evolutionary scheme. Just as genes and organisms undergo natural selection, words—specifically, irregular verbs that do not take an "-ed" ending in the past tense—are subject to powerful pressure to "regularize" as the language develops.

"Mathematical analysis of this linguistic evolution reveals that irregular verb conjugations behave in an extremely regular way—one that can yield predictions and insights into the future stages of a verb's evolutionary trajectory," said Erez Lieberman, a graduate student in the Harvard-MIT Division of Health Sciences and Technology and in Harvard's School of Engineering and Applied Sciences. "We measured something no one really thought could be measured, and got a striking and beautiful result."

"We're really on the front lines of developing the mathematical tools to study evolutionary dynamics," said Jean-Baptiste Michel, a graduate student at Harvard Medical School. "Before, language was considered too messy and difficult a system for mathematical study, but now we're able to successfully quantify an aspect of how language changes and develops."

Lieberman, Michel and colleagues built upon previous study of seven competing rules for verb conjugation in Old English, six of which have gradually faded from use over time. They found that the one surviving rule, which adds an "-ed" suffix to simple past and past-participle forms, contributes to the evolutionary decay of irregular English verbs according to a specific mathematical function: It regularizes them at a rate that is inversely proportional to the square root of their usage frequency.

In other words, a verb used 100 times less frequently will evolve 10 times as fast.

To develop this formula, the researchers tracked the status of 177 irregular verbs in Old English through linguistic changes in Middle English and then modern English. Of these 177 verbs that were irregular 1,200 years ago, 145 stayed irregular in Middle English and just 98 remain irregular today, following the regularization over the centuries of such verbs as help, laugh, reach, walk and work.

The group computed the "half-lives" of the surviving irregular verbs to predict how long they will take to regularize. The most common ones, such as "be" and "think," have such long half-lives (38,800 years and 14,400 years, respectively) that they will effectively never become regular. Irregular verbs with lower frequencies of use—such as "shrive" and "smite," with half-lives of 300 and 700 years, respectively—are much more likely to succumb to regularization.

They project that the next word to regularize will likely be "wed."

"Now may be your last chance to be a 'newly wed'," they quipped in the Nature paper. "The married couples of the future can only hope for 'wedded' bliss."

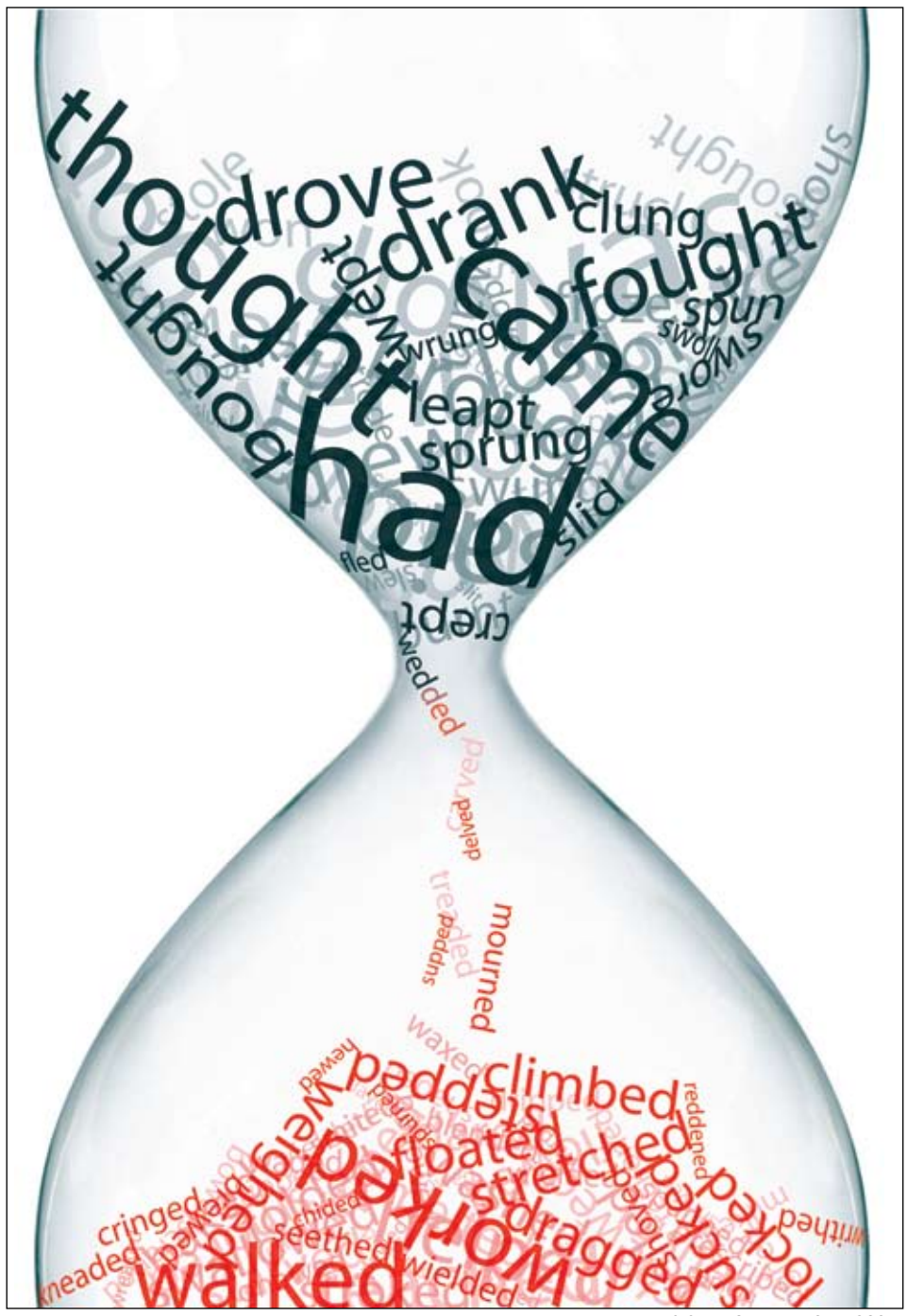
Extant irregular verbs represent the vestiges of long-abandoned rules of conjugation; new verbs entering English, such as "google," are universally regular. Although fewer than 3 percent of modern English verbs are irregular, this number includes the 10 most common verbs: be, have, do, go, say, can, will, see, take, and get. The researchers expect that some 15 of the 98 modern irregular verbs they studied—although likely none of these top 10—will regularize in the next 500 years.

Their Nature paper makes a quantitative, astonishingly precise description of something linguists have suspected for a long time: The most frequently used irregular verbs are repeated so often that they are unlikely to ever go extinct.

"Irregular verbs are fossils that reveal how linguistic rules, and perhaps social rules, are born and die," Michel said.

"If you apply the right mathematical structure to your data, you find that the math also organizes your thinking about the entire process," said Lieberman, whose unorthodox projects as a graduate student have ranged from genomics to bioastronautics. "The data hasn't changed, but suddenly you're able to make powerful predictions about the future."

Lieberman and Michel's co-authors on the Nature paper are from Harvard. The work was sponsored by the John Templeton Foundation, the National Science Foundation, and the National Institutes of Health.



DESIGN / **JONATHAN SARAGOSTI**

This illustration is a visual representation of data by MIT and Harvard scientists on how irregular verbs regularize over time. Verb size in the image corresponds to usage frequency. Large verbs tend to stay sequestered at the top, while smaller verbs tend to fall through to the bottom. The paper predicts that 'wed' is the next verb to regularize, so it teeters on the brink.

Biofuels report, co-authored by CEE's Entekhabi, warns of strain on water resources

Denise Brehm
Civil and Environmental Engineering

Boosting ethanol production by growing more corn in the United States without considering the quality and availability of water by region could put a significant strain on water resources in some parts of the country, a committee of the National Research Council said in a report released last week.

The report's authors, who include Professor Dara Entekhabi of MIT's Department of Civil and Environmental Engineering, recommend that conversion of U.S. agriculture to biofuel cultivation should only be undertaken in tandem with regional water assessments, the adoption of environmentally sound farming practices, and consideration of the full life cycle of biofuel production.

"Agricultural shifts to growing corn and expanding biofuel crops into regions with little agriculture, especially dry areas, could change current irrigation practices and greatly increase pressure on water resources in many parts of the United States," the committee said in its report, released Oct. 10. "The amount of rainfall and other hydroclimate conditions from region to region causes significant variations in the water requirement for the same crop."

The report also urged big agriculture to adopt new technologies that can increase crop yield while conserving water and reducing negative environmental impacts, such as soil erosion and runoff pollution.

"We must recognize that the current state of the U.S. agroecosystem is not sustainable," said Entekhabi, a hydrologist who studies land-atmosphere processes and is director of MIT's Parsons Laboratory for Environmental Science and Engineering. "The use of energy-intensive and industrially produced fertilizers and pesticides are finding their way into water and food supplies for humans and animals. Soil erosion and loss of soil fertility is continuing unabated. U.S. agriculture needs to shift to more ecologically sound and sustainable conditions."

Corn ethanol production in the U.S. is ramping up, in part due to President George W. Bush's call for a dramatic increase in the production of ethanol over the next decade. The National Research Council convened the committee to look at the effect energy crops would have on the nation's agriculture and water management, as well as the long-term sustainability of meeting the president's demand that by 2017, 15 percent of the nation's liquid fuel be biofuel.

Other recommendations of the committee include looking at the possibility that biofuel crops could be irrigated with wastewater that is biologically and chemically unsuitable for use with food crops; the development of water-efficient genetically modified crops for biofuels production; and the minimization of erosion by producing biofuels from perennial crops such as switchgrass, which hold soil and nutrients in place better than most row crops.

The National Academies' press release and full text of the report can be found at http://national-academies.org. The McKnight Foundation, the Energy Foundation, the National Science Foundation, the U.S. Environmental Protection Agency, and the National Research Council Day Fund sponsored the study.

PHOTO / **DEREK RAMSEY**

Young stalks of corn begin to emerge on a farm in Lancaster County, Pa. A committee of the National Research Council released a report last week saying that boosting ethanol production by growing more corn in the United States could strain water resources in some parts of the country.

MIT uncovers key protein in iron metabolism

Discovery could lead to new therapeutics for certain blood diseases

Elizabeth Dougherty
Harvard-MIT Division of
Health Sciences and Technology

MIT scientists have uncovered a protein that plays a key role in the recycling of iron from blood.

Their work, described in the Oct. 11 Journal of Clinical Investigation, could lead to new therapies for certain inherited blood disorders such as beta-thalassemia, a condition that causes chronic anemia. The team is led by Jane-Jane Chen, a principal research scientist in the Harvard-MIT Division of Health Sciences and Technology (HST).

Two years ago, Chen and colleagues showed that a protein, heme-regulated eukaryotic translational initiation factor 2 a-subunit (eIF2-alpha) kinase, or HRI for short, keeps mice with beta-thalassemia alive. This protein minimizes an abnormal and toxic imbalance of globin chains, the protein base for the hemoglobin found in red blood cells. Hemoglobin carries oxygen to our organs and carts away carbon dioxide waste.

In the new work, the team has found that HRI also plays a key role in the body's iron recycling process. Chen observed that this process falters in mice lacking HRI. As a result, less iron was available for use in the creation of new red blood cells.

A closer look revealed that HRI influences two mechanisms in this recycling process. First, a lack of HRI reduces levels of another protein called hepcidin. Hepcidin, recently discovered to be the master regulator of the iron cycle, releases iron from stores in the body and makes it available to be processed into hemoglobin. Without hepcidin, the body retains iron but never puts it to work.

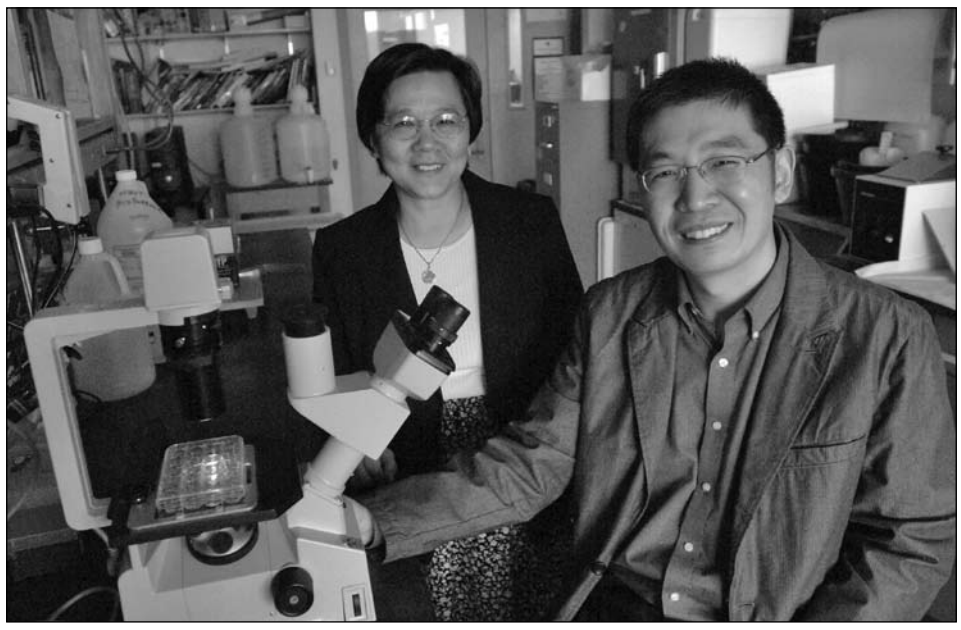


PHOTO / **DONNA COVENEY**

Dr. Jane-Jane Chen and post-doc Sijin Liu have identified a key protein that regulates iron recycling and could become a target for therapeutic drugs for certain blood diseases.

The team also found that HRI, which is expressed predominantly in the precursors of red blood cells, is expressed in macrophages. Macrophages are cells that literally reach out and grab dying red blood cells and eat them, digesting them and releasing the iron from their hemoglobin back into the system.

A lack of HRI causes these macrophages to lose their appetite, gobbling down fewer red blood cells. Instead of being digested and recycled, the red blood cells die and end up excreted through the kidneys. The result is a net loss of iron from the body.

With this new understanding of HRI's dual role in iron recycling—that it both keeps iron in the body and puts it to work—Chen is conducting a search for small molecules that might modulate the HRI signaling pathway. In turn, these compounds could potentially help diseased precursors of red blood cells survive and boost the iron recycling process.

"Perhaps we will find a compound that could help patients with beta-thelassemia or other diseases where HRI plays a role," said Chen. Such conditions include a genetic disorder called erythropoietic protoporphyria (EPP), which causes photosensitivity and liver disease, as well as a condition called the anemia of inflammation in which the iron recycling process breaks down under the influence of stress, chronic disease, aging or cancer.

In addition to Chen, the research team includes first author Sijin Liu, an HST postdoctoral fellow; Fudi Wang and Nancy Andrews of Harvard Medical School; Rajasekhar N.V.S. Suragani and Anping Han, both HST postdoctoral fellows; and Wanting Zhao, an HST technical assistant.

The work was funded by the National Institutes of Health and the Cooley's Anemia Foundation.

Institute of Medicine elects Emery Brown

Emery N. Brown, M.D., a professor in the Harvard-MIT Division of Health Sciences and Technology and in the Department of Brain and Cognitive Sciences, has been elected to the Institute of Medicine.

He is among 65 new members of the Washington, D.C.-based institute, raising its total active membership to 1,538.

The Institute of Medicine is one of the four national academies, along with the National Academy of Sciences, the National Academy of Engineering and the National Research Council. It serves as a national resource for independent, scientifically informed analysis and recommendations on human health issues.

A primary focus of Brown's research is the development of statistical methods and signal-processing algorithms for neuroscience data analysis. A new research direction in his laboratory is to use a systems neuroscience approach to study how the state of general anesthesia is induced and maintained. The long-term goal of this research is to establish a neurophysiological definition of anesthesia, and to develop safer, site-specific anesthetic drugs and neurophysiologically based methods for measuring the depth of anesthesia.

Brown is also affiliated with Massachusetts General Hospital.

–Elizabeth A. Thomson

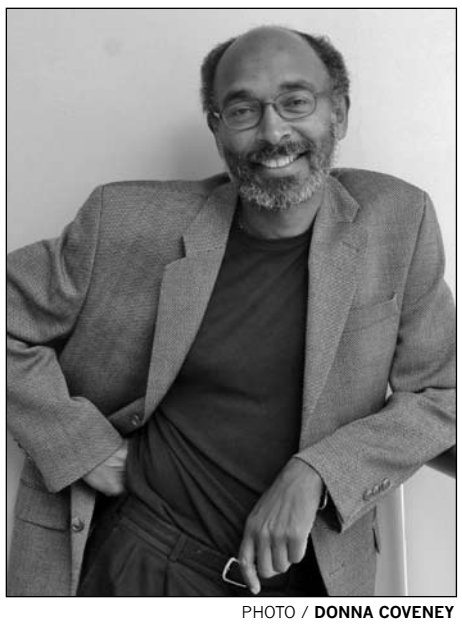


PHOTO / **DONNA COVENEY**

Emery N. Brown

MIT

Continued from Page 1

ogy (SMART), the Legatum Center for Development and Entrepreneurship, the Boston Area Autism Consortium and the Stanley Center for Psychiatric Disease.

MITEI, a campus-wide initiative to help transform the global energy system to meet future needs, has made great strides in the past year, Hockfield said. At the forum, she announced that four inaugural sponsors have signed on to support MITEI programs: BP (coal conversion), Ford (automotive technology), Ormat Technologies (geothermal power) and Phil Rettger (solar power). More energy partners will be announced in the coming weeks, she said.

With funds provided by the sponsors, MITEI has set up a seed fund and issued a call for proposals for energy-related research. Hockfield encouraged faculty, especially junior faculty, to apply for the funding. She also announced that over the next five years, MITEI will support 100 energy fellows, who will undertake research in a range of energy topics, from engineering to policy to economics.

Hockfield talked about the need for MIT to remain a "talent magnet," especially in recruiting a diverse faculty and student body.

"We really want MIT to be seen by people as the place you have to be if you want to be at the cutting edge," she said. "To be the best, you have to recruit the best."

That means accelerating the progress MIT has made in recruiting and retaining minority faculty and students, Hockfield said. The Institute has done well in that area, she said, "but we have to get even better."

After Hockfield spoke, Provost L. Rafael Reif outlined his goals for this year, which include increasing collaboration among MIT's five schools, assessing the strengths and weaknesses of each school, increasing diversity of faculty and students, and promoting general Institute initiatives such as MITEI.

Chancellor Phillip Clay discussed the new fundraising Campaign for Students and the Task Force on the Undergraduate Educational Commons. Clay said he is committed to implementing the task force recommendations that don't need to wait for a faculty vote, such as improving undergraduate advising and promoting greater participation in international programs.

Theresa Stone, executive vice president and treasurer, reported that MIT's finances are in good shape. The Institute's total assets are $12.7 billion, and its endowment is $10 billion. Last year's endowment rate of return was 22.1 percent.

Stone also reported that several new building and renovation projects are underway or recently completed—PDSI, Whitaker College renovation, Media Lab/School of Architecture addition, new Sloan School building, new cancer research facility, Vassar West streetscape and the 600 Memorial Drive renovation.

HEARING

Continued from Page 1

transmit energy to different parts of the cochlea via a kind of wave that is different from that commonly associated with hearing.

Ghaffari, the lead author of the paper, is in the Harvard-MIT Division of Health Sciences and Technology, as is Freeman. All three researchers are in MIT's Research Laboratory of Electronics. Freeman is also in MIT's Department of Electrical Engineering and Computer Science and the Massachusetts Eye and Ear Infirmary.

It has been known for over half a century that inside the cochlea sound waves are translated into up-and-down waves that travel along a structure called the basilar membrane. But the team has now found that a different kind of wave, a traveling wave that moves from side to side, can also carry sound energy. This wave moves along the tectorial membrane, which is situated directly above the sensory hair cells that transmit sounds to the brain. This second wave mechanism is poised to play a crucial role in delivering sound signals to these hair cells.

In short, the ear can mechanically translate sounds into two different kinds of wave motion at once. These waves can interact to excite the hair cells and enhance their sensitivity, "which may help explain how we hear sounds as quiet as whispers," said Aranyosi. The interactions between these two wave mechanisms may be a key part of how we are able to hear with such fidelity—for example, knowing when a single instrument in an orchestra is out of tune.

"We know the ear is enormously sensitive" in its ability to discriminate between different kinds of sound, Freeman said. "We don't know the mechanism that lets it do that." The new work has revealed "a whole new mechanism that nobody had thought of. It's really a very different way of looking at things."

The tectorial membrane is difficult to study because it is small (the entire length could fit inside a one-inch piece of human hair), fragile (it is 97 percent water, with a consistency similar to that of a jellyfish), and nearly transparent. In addition, sound vibrations cause nanometer-scale displacements of cochlear structures at audio frequencies. "We had to develop an entirely new class of measurement tools for the nanoscale regime," Ghaffari said.

The team learned about the new wave mechanism by suspending an isolated piece of tectorial membrane between two supports, one fixed and one moveable. They launched waves at audio frequencies along the membrane and watched how it responded by using a stroboscopic imaging system developed in Freeman's lab. That system can measure nanometer-scale displacements at frequencies up to a million cycles per second.

The team's discovery has implications for how we model cochlear mechanisms. "In the long run, this could affect the design of hearing aids and cochlear implants," said Ghaffari. The research also has implications for inherited forms of hearing loss that affect the tectorial membrane. Previous measurements of cochlear function in mouse models of these diseases "are consistent with disruptions of this second wave," Aranyosi added.

Because the tectorial membrane is so tiny and so fragile, people "tend to think of it as something that's wimpy and not important," Freeman said. "Well, it's not wimpy at all." The new discovery "that it can transport energy throughout the cochlea is very significant, and it's not something that's intuitive."

This research was funded by the National Institutes of Health.

PHOTO / **LINDA OLSON**

MIT retirees honored at dinner

At a dinner last month, Vice President of Institute Affairs and Secretary of the Corporation Kirk D. Kolenbrander and Vice President of Human Resources Alison Alden presented certificates of appreciation to 137 recent MIT retirees who spent a combined 3,887 years at the Institute. Among those being honored was new retiree Margaret Pellegrino (MIT Medical), shown in above photo with her spouse, John Pellegrino Jr., formerly of the Department of Facilities. Below, recent retiree Robert Norton (Department of Facilities) is shown with spouse Eileen Norton.

Also participating in the celebration were Bob Blake, Dick Dolbec and Jim Coleman, advisory committee members of the Association of MIT Retirees. For more information about the association and its activities, e-mail retirees.assoc@mit.edu or call 617-253-7910.

PHOTO / **RANDALL WARNIERS**

MIT, HST co-host Boston-India public health symposium

Elizabeth Dougherty
Harvard-MIT Division of
Health Sciences and Technology

MIT and HST will co-host a unique event next week that brings together leading academics, innovators and key government stakeholders from Boston and India to discuss collaborative ways of meeting the South Asian nation's public health challenges.

The Boston–India Symposium on Essential Interfaces in Public Health, which is also being hosted by Boston University, Harvard University and Tufts University, comes at a time when India is focused on revitalizing its public health education programs and building up its public health workforce.

Public health in India has steadily improved since the country gained independence 60 years ago. Life expectancy rates have doubled, the infant mortality rate has been halved and there has been a sharp drop in the prevalence of severe malnutrition. A new health care system has succeeded in eradicating smallpox and guinea worm and has dramatically reduced the number of people infected with leprosy, malaria and poliomyelitis.

Nonetheless, with India's population at more than 1.1 billion and with persistent poverty, especially in rural areas, the health care system has not been able to keep pace with the challenges. As a result, India still lags many neighboring countries in Asia with respect to a variety of measures of health. In response, India is striving to build a public health system that can emphasize prevention and population-based interventions.

By facilitating connections between U.S. academic institutions and colleagues in India, the symposium aims to promote the application of public health knowledge and help U.S. academics learn from their colleagues in India about ways to make their work more relevant to India's problems in public health.

Speakers from India and the host institutions will present talks and participate in panel discussions focused on public health research, policy, product development and management. HST Director Martha Gray will chair a session titled "The Interface of Knowledge and Product Development."

The exchange of ideas in these sessions will serve to identify opportunities for new collaborative projects between Boston- and India-based institutions that will improve public health outcomes in India.

Faculty and students from schools of public health, medicine, engineering, business, communications, government and international relations interested in advancing public health in India are invited to register, as are business and foundation leaders seeking insights into the impact of public health on development and opportunities for growth.

The symposium will take place Oct. 22 and 23 at the Westin Copley Place Hotel. Registration is free but limited to the first 150 applicants: To obtain a registration form, please e-mail registrations@fmr.com or call Lindsay LeClair at 617-392-0993.

Faculty and students working on collaborative public health projects with institutions in India are encouraged to submit posters. Four poster prizes will be awarded (one per institution).

For information regarding the poster session, e-mail Heather Dawes at heather.dawes@fmr.com (include "poster session" in the subject line) or call her at 617-563-0121.

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.

VEHICLES

1992 Saab 900 hatchback, manual, 148K, one owner, well maintained, runs well, always starts, excellent in snow, plus 4 Michelin snows on rims. $900 or BO.

HOUSING

Sunny 2BR, living, dining, family rooms & renovated kitchen. Large yard/porch. Bus connects to Orient Heights T stop. 15 min to Cambridge. $1400/month. No utilities or pets. Call Marty at 617-455-7697.

Arlington: Luxury 2BR condo. Rent $1650. 6th floor, full 2 BA, renovated kitchen, garage parking, exercise room, laundry, storage, 77, 79 bus to Harvard, Alewife St. Contact 339-368-1588 or bongkim@mit.edu.

East Boston: Newly renovated 2BR apt. Walk to Blue Line. $995/month. Contact cleadyhse@comcast.net or 781-439-4146.

MISCELLANEOUS

Translator needed to translate 20 pages of medical regulatory documents from Chinese into English. Must be fluent in both Chinese and English. Pay rate TBD. For more information e-mail pjsiska@mit.edu.

Personal chef/baker. Order your holiday baked goods. Homemade and custom breads, pies, cookies. Call 617-957-0087 or e-mail is on website at http://ChefRoar.com. References.

Healthy, playful, loving cat, 9 years old, needs new home. Beautiful black and white tabby, great companion or addition to the family. Contact Paige at paigeparis@yahoo.com.

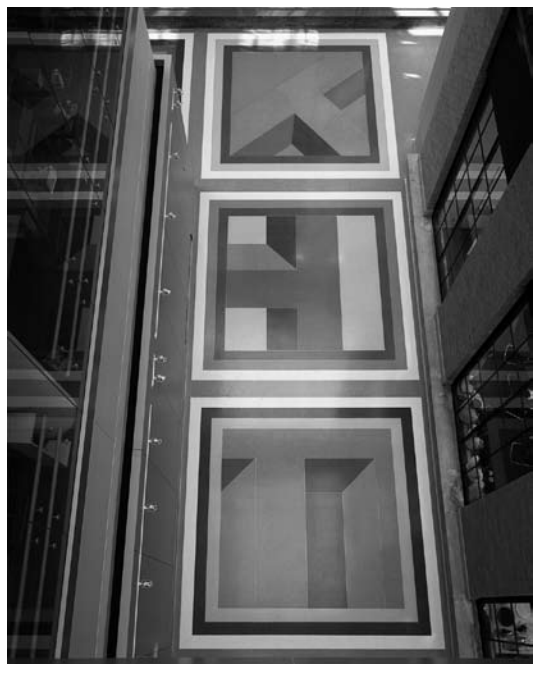
NEWS YOU CAN USE

Community Giving at MIT Used Book Fair

Community Giving at MIT will kick off this year's effort with a Used Book Fair from 9 a.m. to 5 p.m. Monday, Oct. 22, in Lobby 10 and in the Bush Room, 10-105. Please drop off your gently used or new books by Friday, Oct. 19, at the following locations: Information Center, Public Service Center, Copy Tech, Community Services Office, and the Sloan School of Management. You can also drop books off Oct. 22 in the Bush Room. Proceeds from sales will benefit the MIT Community Service Fund and United Way of Massachusetts Bay and Merrimack Valley. For more info, please visit: web.mit.edu/community-giving.

Dedication of Sol LeWitt's "Bars of Color within Squares"

A dedication ceremony inaugurating the late Sol LeWitt's "Bars of Color within Squares" will take place from 4 p.m. to 6 p.m. Friday, Oct. 19, in Building 4. The new work by LeWitt, who passed away in April, is a major feature of the PDSI building project. The design consists of 15 large squares of vibrantly colored geometric patterns, set off by bands of white and gray, that shift ambiguously between flatness and the illusion of depth. Each block is approximately 18 feet square, and the work's bold colors are realized in glass and epoxy terrazzo that was poured in place. For more information, please contact Mark Linga at mlinga@mit.edu, 617-452-3586.



Health records study

MIT faculty, staff and students may be eligible to participate in a study of a new technology that lets users control their health and medical information using a highly secure web-based lifelong health record model. The technology, called IndivoHealth, is being deployed at MIT under a U.S. Centers for Disease Control and Prevention health promotion project and is being evaluated by investigators from Boston Children's Hospital and Harvard Medical School. Participants in the study will be entered into drawings for gift certificates to Best Buy. To learn more about this study and about eligibility, visit mit.indivohealth.org or contact Maryanne Kirkbride at 617-253-5240 with questions.

Professional & Executive Diversity Job Fair

MIT is co-sponsoring the Professional & Executive Diversity Job Fair from 10 a.m. to 4 p.m. Wednesday, Oct. 24 at the Marriott Copley Place Hotel. The career fair is free and open to everyone with a four-year degree or above. Participants will have the chance to meet face-to-face with recruiters and hiring managers from more than 40 local and national employers, and speak candidly with industry leaders about opportunities in their fields. For more information, contact Kristen Morreale at 617-452-4158 or morreale@mit.edu.

Housing planned for those who can't get enough of MIT

Sarah H. Wright
News Office

Members of the Institute community who plan to stay involved in life at MIT after they retire have a new housing option, the University Residential Communities at MIT, located just blocks from the main campus.

Tunney Lee, senior lecturer and professor of city planning, emeritus, and Jack Dennis (S.B. 1953, S.M. 1954, Sc.D. 1958), professor of computer science and engineering, emeritus, are among 36 people who have already reserved units in the Kendall Square residence, known as URC.

Lee came to MIT in 1971 and retired in 1992. A specialist in urban planning for high-density settings, he taught in Hong Kong, then returned in 1999 to MIT, where he continues to teach two courses a year.

> *We are at the beginning of establishing a unique community that…will serve the larger MIT community for generations.*
>
> **Robert Simha**
> Former MIT Director of Planning

Lee says he wants to remain close to what he calls an intellectually stimulating and challenging environment, one that has yielded many strong bonds of friendship.

"MIT has been a supportive community for me," Lee says, explaining why he has signed on to URC. "The administration, my department, colleagues and students have become life-long friends."

For Dennis, being involved in research projects at MIT is the greatest source of satisfaction in his life, he says.

Living near MIT's main campus will offer the "possibility of following progress and contributing to advances in fields of interest to me: computer science, biology and neurophysiology, brain science, music and the arts," Dennis says.

Plans to develop URC began four years ago, when Paul Gray (S.B. 1954, S.M. 1955, Sc.D. 1960), MIT president, emeritus, Priscilla Gray and O. Robert Simha (M.C.P. 1957) met with two retired faculty of the Harvard School of Design to discuss the creation of housing near Harvard or MIT for faculty and staff.

IMAGE COURTESY / **CETRA/RUDDY**

An artist's rendering of the University Residential Communities, as seen from the north. The planned complex at 303 Third Street in Cambridge will represent a new housing alternative for members of the Institute community who want to stay involved in life at MIT after they retire.

The convener of the meeting, the late architect Paul Grayson, had long championed the idea of aging in place—living in residences that provided support services on an as-needed basis, with the goal of lifelong satisfaction, as Gray explains it.

From this little meeting, a mighty search began. A group of nine Harvard and MIT people formed URC and, in the spring of 2006, focused on a development at 303 Third Street in Cambridge, a location within easy walking distance of MIT.

The URC building will contain 168 apartment-style units on eight floors and common rooms for conversations, performances and other gatherings on the first floor. There are also plans for a private dining facility at the street level on Third Street. URC will be fully ready for occupancy in December 2008.

Planned as a multigenerational residence with no age restrictions, URC has accommodations for older residents including single-level apartments with wider doors and walk-in showers. The building will also house a pool, fitness center, an on-site medical exam room, a media room and underground parking.

Twenty-two of the residential units are reserved by the City of Cambridge for sale to those with incomes 60 to 120 percent of the Boston median income, or between $40,000 and $80,000 for a two-person family, notes Simha.

Except for the 22 Cambridge units, only those with affiliations to MIT, Harvard or Massachusetts General Hospital are eligible to reserve URC units.

MIT has no financial or other formal ties to URC. Residents will form a cooperative ownership structure after 50 percent of the units have been sold, according to Gray. At this time, about 25 percent of the total units had been reserved.

The construction and sales phases are overseen by three members of URC, all of whom will live in the building. Simha, former director of planning at MIT, serves as executive director. Gray is the nominal chair. The third member of the URC team is Neil Harper (Sc.D. 1959), former associate partner at Skidmore, Owings, and Merrill, the architectural firm.

"My URC colleagues and I firmly believe that we are at the beginning of establishing a unique community that will provide a warm and stimulating environment and will serve the larger MIT community for generations," Simha says.

To learn more about URC, please go to web.mit.edu/303third.

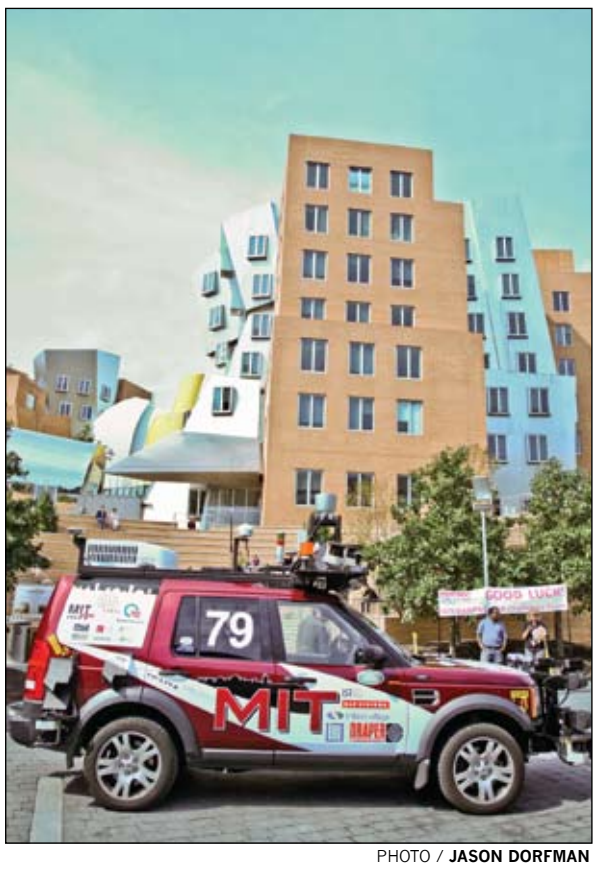


PHOTO / **JASON DORFMAN**

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A good luck send-off for 'Robocar'

In above photo at right, CSAIL Director Victor Zue makes remarks at a send-off barbeque lunch in early October for MIT's self-driving "Robocar" as associate professors Seth Teller, center, and John Leonard, left, look on. The MIT vehicle (shown at left parked in front of the Stata Center) will compete as one of three dozen semifinalists later this month in this year's DARPA Urban Challenge, a competition for cars and trucks that run without human help.