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TechTalk
SERVING THE MIT COMMUNITY

# A 'micropharmacy' inside

## Implantable film can deliver drugs

**Anne Trafton**
News Office

A new thin-film coating developed at MIT can deliver controlled drug doses to specific targets in the body following implantation, essentially serving as a "micropharmacy."

The film could eventually be used to deliver drugs for cancer, epilepsy, diabetes and other diseases. It is among the first drug-delivery coatings that can be remotely activated by applying a small electric field.

"You can mete out what is needed, exactly when it's needed, in a systematic fashion," said Paula Hammond, the Bayer Professor of Chemical Engineering and senior author of a paper on the work appearing in the Feb. 11 issue of the Proceedings of the National Academy of Sciences.

The film, which is typically about 150 nanometers (billionths of a meter) thick, can be implanted in specific parts of the body.

The films are made from alternating layers of two materials: a negatively charged pigment and a positively charged drug molecule, or a neutral drug wrapped in a positively charged molecule.

The pigment, called Prussian Blue, sandwiches the drug molecules and holds them in place. (Part of the reason the researchers chose to work with Prussian Blue is that the FDA has already found it safe for use in humans.)

When an electrical potential is applied to the film, the Prussian Blue loses its negative charge, which causes the film to disintegrate, releasing the drugs. The amount of drug delivered and the timing of the dose can be precisely controlled by turning the voltage on and off.

The electrical signal can be remotely administered (for example, by a physician) using radio signals or other techniques that have already been developed for other biomedical devices.

The films can carry discrete packets of drugs that can be released separately, which could be especially beneficial for chemotherapy. The research team is now working on loading the films with different cancer drugs.

Eventually, devices could be designed that can automatically deliver drugs after sensing that they're needed. For example, they could release chemotherapy agents if a tumor starts to return, or deliver insulin if a diabetic patient has high blood sugar.

"You could eventually have a signaling system with biosensors coupled with the drug delivery component," said Daniel Schmidt, a graduate student in chemical engineering and one of the lead authors of the paper.

PHOTO / **DONNA COVENEY**

From left, Broad Institute postdoctoral associate Kris Wood, Bayer Professor of Chemical Engineering Paula Hammond and chemical engineering graduate student Dan Schmidt show the thin film they have developed. The film releases drugs and other chemical agents upon application of a small electrical field.

Other lead authors are recent MIT PhD recipients Kris Wood, now a postdoctoral associate at the Broad Institute of MIT and Harvard, and Nicole Zacharia, now a postdoctoral associate at the University of Toronto.

Because the films are built layer by layer, it is easy to control their composition. They can coat a surface of any size or shape, which offers more design flexibility than other drug-delivery devices that have to be microfabricated.

"The drawback to microfabricated devices is that it's hard to coat the drug over a large surface area or over an area

See **DRUGS**
Page 7

# Tour de force

PHOTO / **ROCCO CICCOLINI**

Professor Jeff Tester cycling toward Teton Pass, near the border between Idaho and Wyoming.

**Anne Trafton**
News Office

It's not unusual for MIT professors and their students to socialize outside the laboratory. But here's a word of warning to would-be members of Jeff Tester's lab: You might want to think about getting in shape.

Every spring, Tester leads a group of people, mostly his students and members of his lab, on a 65-mile bike trip along the Connecticut River from Lancaster, N.H., through Vermont and then into the Great North Woods of New Hampshire, near Canada. Some riders tack on an extra trip to the Canadian border at Fourth Lake that brings the round-trip total to about 100 miles.

Tester and his wife, Sue, started making the trip, which includes an overnight stay at a former hunting-and-fishing lodge called the Glen, in Pittsburg, N.H., more than 25 years ago. After a few years, students started asking if they could join the trek through the breathtaking scenery of northern New England.

"We decided to take whoever wanted to go," says Tester, the H.P. Meissner Professor of Chemical Engineering and an avid cyclist. "For some of the students it becomes sort of a rite of passage. It becomes a great achievement for them to make it to the Glen."

Over the years, more than 100 students and spouses have gone on the

See **CYCLE**
Page 6

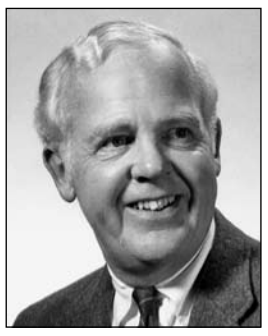
## OBITUARIES

### Louis Menand III, political scientist and former key administrator, 85

**Sarah H. Wright**
News Office

Louis Menand III, a celebrated teacher and political scientist who served three consecutive MIT administrations in senior leadership roles, died Jan. 30 of complications from cardiac surgery. He was 85.

Menand came to MIT in 1968 as assistant to the provost under MIT President Howard Johnson; later, he was special assistant to provosts under former president Jerome Wiesner and Paul Gray, president emeritus and professor emeritus of electrical engineering and computer science.



Louis Menand

"Louis fell in love with this special place even as the Institute embraced him. An erudite, cosmopolitan, engaging individual with a fine sense of humor, he will be remembered with respect and much affection by his students, his colleagues across the Institute and by me," said Gray.

In addition to his administrative responsibilities, Menand was a senior lecturer in the political science department where he taught American politics, winning the Everett Moore Baker Memorial Award for Excellence in Undergraduate Teaching in 1988. He was well known for a course he developed, The Supreme Court and Constitutional Processes.

Profesor of Economics Jonathan Gruber SB '87, a former student of Menand, said, "He was nothing less than an intellectual giant. Louis provided me with a moral compass for thinking about the world and policy issues in the world. There is no way I would be where I am today without his incredible influence. I will miss him dearly."

Menand's career reflected his commitment to personal and public standards of living a good life, one that provides centering and satisfaction with one's own accomplishments, according to his wife, Catherine.

Outside of MIT, Menand was a consultant on higher education and a member the American Civil Liberties Union, where he served as vice chair of the Academic Freedom Committee.

An unabashed Democrat, Menand was an advocate for civil rights throughout his life. His personal passions were music, especially opera, and the natural environment. He loved mountains both as scenery and as ski slopes. He was a member of the St. Botolph Club in Boston.

Menand was a native of Menands, N.Y., a town named for his great-grandfather. He received his BA in political science from Middlebury College in 1944 and his PhD from the Maxwell School of Public Administration of Syracuse University in 1952. In 1943, at the age of 20, he enlisted in the U.S. Navy; he spent two years in the Pacific commanding a landing craft and participating in eight invasions before leaving the service in 1946 as a lieutenant, junior grade.

Before coming to MIT, Menand was a Washington-based consultant to the Office of Economic Opportunity for Upward Bound, a federal program to help disadvantaged high school students prepare for college. He was dean of Bradford College from 1956 to 1966. He also held faculty positions at Dartmouth College and Vassar College.

Menand is survived by his wife, Catherine (Shults), of Boston; a son, Louis, of Cambridge and New York City; a daughter, Constance Margowsky of Somersworth, N.H.; a son, Nicholas Brock of Hammonton, N.J.; and four grandchildren.

In lieu of flowers, donations may be sent to Tutoring Plus of Cambridge, a community program assisting local high school students, where Menand had served as president of the board of directors.

### John Meyer, nuclear engineer, 76

MIT Professor Emeritus John Meyer, a nuclear engineer who spent more than 25 years at MIT until his retirement in 2001, passed away Jan. 11. He was 76.

An expert in numerical methods in engineering analysis of nuclear power systems, Meyer introduced models for transient analysis of coolant flow in reactors that could be handled by the limited computer capability emerging in the late 1950s and early 1960s.

Meyer joined MIT's Department of Nuclear Science and Engineering in 1975 to research mechanical analysis of nuclear plant components. He helped develop quick simulation models of pressurized water reactors and boiling water reactors that reflected the effects of many important flow and power variables, and could be used to study a variety of normal and near-normal operating conditions.

During his time at MIT, he also helped develop an automated control logic for operation of the MIT reactors.

Meyer is survived by his wife, Grace, four children and 13 grandchildren.

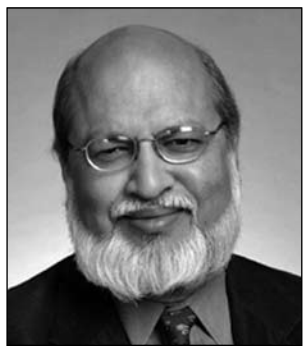
# Suresh to receive 2008 Eringen Medal of the Society of Engineering Science

The Society of Engineering Science has chosen Subra Suresh, Dean of the School of Engineering and Ford Professor of Engineering, to receive the A.C. Eringen Medal for 2008, one of the highest and most distinguished prizes awarded in recognition of "sustained outstanding achievements in engineering science." In its annual meeting to be held this fall at the University of Illinois at Urbana, Champaign, Suresh will receive a medal, a cash prize and lifetime membership in the society. In Suresh's honor, the society also plans to organize a special symposium devoted to the science and applications of advanced material, cell and molecular biomechanics, and nanotechnology, to which Suresh has made pioneering contributions. The list of recipients of the Eringen Medal in recent years includes the late Nobel laureate Pierre de Gennes.

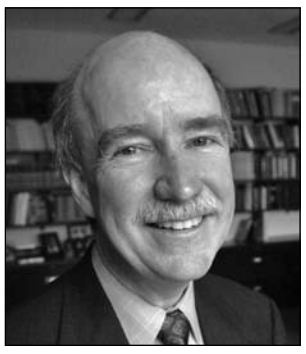
Subra Suresh

## AWARDS AND HONORS

**John C. Cox**, the Nomura Professor of Finance, has been elected as an American Finance Association (AFA) Fellow. The purpose of the AFA Society of Fellows is to recognize those members who have made a distinguished contribution to the field of finance. No more than five candidates are nominated each year, and current fellows elect a maximum of two new fellows. Cox was the sole recipient of this honor in the most recent election.



Arvind



Robert Armstrong

**Elfatih Eltahir**, professor of civil and environmental engineering, and **Samuel Bowring**, Robert R. Shrock Professor of Earth and Planetary Sciences, have been elected Fellows of the American Geophysical Union (AGU). Fellows are elected based on their acknowledged eminence in the Earth and space sciences, their contributions to the scientific community and the advancement of the public's understanding. This honor is bestowed on only 0.1 percent of the AGU membership in any given year.

**Arvind** and **Robert C. Armstrong** have been elected to the National Academy of Engineering. Academy membership honors those who have made outstanding contributions to "engineering research, practice or education," and to the "pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education."

Arvind, the Charles W. and Jennifer C. Johnson Professor of Electrical Engineering and Computer Science, was honored for "contributions to data flow and multi-thread computing and the development of tools for the high-level synthesis of hardware."

Armstrong, the Chevron Professor of Chemical Engineering, was honored for "conducting outstanding research on non-Newtonian fluid mechanics, co-authoring landmark textbooks and providing leadership in chemical engineering education."

Principal Research Scientist **Victor W. Wong** has been granted fellow status by SAE International, a leading membership society dedicated to advancing mobility engineering worldwide. Wong, manager of the Sloan Automotive Laboratory, was honored for "significant contributions to the field of engine power cylinder lubrication, helping to bridge the gap between classic tribological studies in engine component dynamics and development." One of a select few who have won the SAE Lubricants Award twice, Wong was recognized with the Arch T. Colwell Merit Award in 1994.

MIT graduate students **Karima Nigmatulina** and **Michael Metzger** recently received first- and second-place honors at a poster session sponsored by the National Academies. Karima's first-place poster focused on government and community interventions for stopping pandemic flu. Metzger earned second place for his poster, which outlined the use of decision modeling to mitigate risks and damage in hurricane emergencies. Both students are research assistants in the Center for Engineering Systems Fundamentals within MIT's Engineering Systems Division.

PHOTO / **DONNA COVENEY**

Given all the time people spend staring into computer screens these days, it's understandable to sometimes ask whether the machines are looking back. These computer monitors on the fourth floor of Building 3 appear to provide the answer...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# Inclusiveness, optimism among strengths of HST's Gray

**Elizabeth Dougherty**
Harvard-MIT Division of Health Sciences

Last winter, Harvard-MIT Health Sciences and Technology Director Martha Gray invited friends to join her for a Billy Collins poetry dinner. The evening would be styled after the famed haggis- and scotch-infused Robert Burns parties, she wrote in her invitation, only, like Collins' poetry, more "hospitable."

"Come step into the canoe with us," the invitation read, alluding to a quote from the former poet laureate: "Stepping from the title to the first line is like stepping into a canoe. A lot of things can go wrong."

**Martha Gray**

True. But as Gray well knows, a lot of things can go right, too. In fact, it is her emphasis on what can go right that draws so many people to her. Her optimism is why, on an exceptionally snowy night in March, dozens of people flocked to her home to read poetry and to enjoy the chance meetings—an MIT student from the 1980s reunited with an engineering professor, a linguist learning the ins and outs of eBay, a physician, an artist and a writer chatting about osso bucco—that few other hosts can conjure.

This ability to bring people together has been a defining strength for Gray, who is also the Edward Hood Taplin Professor of Medical Engineering and Electrical Engineering at MIT. During her 12 years of leadership at the Harvard-MIT Division of Health Sciences and Technology (HST), which will come to a close July 1, the division has undergone fundamental transformations, almost all of which hinged on the strength of her relationships.

For instance, she turned a small, voluntary faculty into a structured and defined community of more than 60 dedicated and bona-fide HST faculty members. She expanded HST's academic programs to include novel approaches to educating biomedical innovators. And she widened HST's community by guiding the creation of HST's BioMatrix mentoring program, its alumni association, and its advisory board and council.

These accomplishments, says MIT Vice President for Research and Associate Provost Claude Canizares, "together with Martha's leadership in expanding outreach, resource development and the globalization of HST, have created a lasting legacy." Canizares has formed a search committee for the next HST director, chaired by Emery N. Brown, who has appointments at MIT and Harvard and is an anesthesiologist at Massachusetts General Hospital.

Gray's success stems from her almost innate understanding of HST. After all, Gray has been connected with HST ever since she started her career as a student in HST's Medical Engineering and Medical Physics (MEMP) doctoral program.

In 1987, she became one of the earliest HST faculty members. Her research—which contributed not just a new understanding of cartilage and how it wears, but also a new method for clinical diagnosis using functional magnetic resonance imaging—is emblematic of HST's mission. Further, when she assumed the role of HST co-director in 1995, she became the first woman to lead an academic science or engineering department at MIT.

But beyond this immersion, Gray herself personifies HST's philosophy, which puts all professions and disciplines, as she says, "on equal footing." She recognizes and fosters unexpected connections—among physicians, engineers, students, business leaders and even government officials—because of their potential to open doors to new ideas that translate into real advancements in health.

"Martha has enthusiasm, vision and a positive outlook," says Richard Mitchell, associate director of HST, "and is able to, by the strength of her personality, build relationships."

While building many new connections, Gray has also remained firmly focused on building them to better serve HST's students. "Because our students are so inspiring, I have always been motivated to do my very best to provide them with the most opportunities, the best resources and the most cutting-edge programs," says Gray.

Her efforts resulted in the doubling of the MEMP program during her tenure, as well as the addition of several new programs. The Biomedical Enterprise Program, for instance, is a first-of-its-kind, three-year master's program that trains experts in management and imbues in them a solid foundation in medical science.

"Martha supported the notion of driving translational research from the bench to the bedside and to business and back well before it became the mantra of many others," says Joseph Bonventre, the Robert H. Ebert Professor of Medicine and HST at Harvard Medical School (HMS), and Gray's co-director from 1995 until 2007.

The introduction of these novel academic programs has created a new kind of classroom environment in HST. That environment, according to Mitchell, "mixes MD students, who are comfortable with the fuzzy logic of biology, engineers, who are accustomed to equations and principles you can derive from, and business students, who wonder, 'How can I turn this into a business plan?'" The result? "Terrific cross-fertilization," says Mitchell.

Similarly, Gray created a new kind of faculty for HST that includes members from MIT, Harvard and the Harvard teaching hospitals. Their diversity adds dimension to the opportunities HST can provide to its students. Plus, says Mitchell, they send students the message: "You can do this too. You can be a PhD engineer in a hospital. You can be an MD doing full-time basic science research."

More recently, Gray has continued to expand HST's reach. In November 2007, Gray signed an agreement with the Indian government to establish a Translational Health Sciences and Technology Institute in India. HST expects its first faculty fellows from India to arrive in the fall of 2008.

HST's co-director, David Cohen, associate professor of medicine and health sciences and technology at HMS and Brigham and Women's Hospital, expects to continue to build on these foundations and to leverage the HST community to help its students put what they learn into practice. "Translational research is the way of the future," says Cohen. "HST is a paradigm for how to do it properly, for how to build relationships that will ultimately be the most beneficial to patients."

Moving forward, Gray maintains her enthusiasm for what's to come: "I'm excited about a future where collaboration is the norm and where it is commonplace for physicians, scientists, engineers and businesspeople to work together to tackle and solve our most challenging medical problems."

MIT in the world

## Saving the rainforest with ... toys?

**David Chandler**
News Office

Villagers in tiny communities including Guayabo, Sawacito and Mahor, in the rainforest of northeastern Honduras, used to take part in the rampant illegal trade in mahogany, but recently they have formed a cooperative and learned to harvest the prized wood in sustainable ways. Now, they mostly use trees that have fallen naturally or harvest them in a sustainable way from around the fringes of the nearby Rio Platano Biosphere Reserve, and remove planks from the forest, first on their backs, then on muleback to avoid the disruption caused by heavy machinery.

They are working on getting certification for their wood from the Rainforest Alliance, and they have one big customer, the U.S. guitar company Gibson. Thanks to their new way of doing business, dealing directly with the customer, they are earning 40 times more per board-foot of lumber than they were before.

But they still have a problem: Gibson doesn't need enough of the wood to sustain the cooperative. In order to continue their sustainable logging, they need new customers. And that's where MIT Sloan School master's student Craig Doescher comes in.

Doescher has joined a group of U.S. business and financial partners to help launch a new business based in Honduras, called Tegu Toyworks, that will manufacture wooden toys for export to stores in the United States and Europe. They hope to employ local Honduran craftspeople at the factory and to use the output of the forest cooperative as their primary material, providing them with a major new customer.

"They're trying to preserve the rainforest and use it in a sustainable way, but there isn't a sufficient market for it yet," Doescher says. "We're trying to fill that void." And because the toys don't require the use of familiar woods like mahogany, they will be able to use—and help build demand for—lesser-known species, such as huesito, San Juan areno and selillon wood.

The toys will be high-end, innovative creations, whose designs are being finalized now. While many Honduran craftspeople already make hand-carved wooden pieces, these have tended to be relatively simple pieces designed for the local tourist market. These toys, designed for more lucrative markets, will enable the company to pay premium wages to their employees.

Doescher, who had prior experience working in a manufacturing plant, came to MIT specifically to develop his interest in combining entrepreneurial skills with work in the developing world. He joined a team that had already been developing the toy-company plan, brothers Chris and Will Haughey and their partner John Herbold, all of whom have experience in consulting or finance (Chris left a job with Boston Consulting Group to work full-time for the new company). Chris Haughey also had experience as a Christian missionary in Honduras, where he assisted a home to get boys off the street of the capital city, Tegucigalpa.

"We see this great opportunity and potential," says Doescher, especially at a time when inexpensive, imported toys have been the subject of massive, widely reported recalls for problems including lead paint.

"The U.S. market is moving toward more-natural, more-sustainable products," he says. "That helps to build our business case."

Tegu Toyworks hopes to have its first factory in operation, in the outskirts of Tegucigalpa, by early next year—although if things go really well, they'd like to move faster and have some products ready for this year's holiday season. "We're working on some pretty innovative designs," Doescher says. "Our goal is not to have a me-too kind of product."

One challenge in finalizing plans for the factory is to determine "the right mix of automation versus hand labor," Chris Haughey says. Using his own experience in manufacturing, Doescher hopes to introduce some of the efficiencies of modern, automated factory systems to the process, including computer numerical control systems for initial shaping of pieces, while also making use of local skills for such tasks as finish-sanding by hand. Initially, the labor will be local Hondurans, but as quickly as possible the team hopes to train locals to take over much of the factory's management as well. The U.S. team would continue to use their expertise in the areas of design, advertising and distribution.

In the longer term, they hope the business will serve "as an incubator for Honduran entrepreneurs, as people gain a sense of what they can do," says Chris Haughey. Doescher adds that "one of the most important things will be to find the right management down there. Most likely, these people will end up with some ownership" of the company.

Doescher, who is entering the Tegu Toyworks project in MIT's 100K Business Plan Competition, visited Honduras this January thanks to a small grant from the Legatum Center to help lay the groundwork for the project. He hopes that over time the company can "migrate as much of the value added as possible to Honduras. If we can ultimately transition the marketing and design to Honduras, that would be a home run for us."

*In the World is a new column that explores the ways people from MIT are using technology—from the appropriately simple to the cutting edge—to help meet the needs of local people in places around the planet. If you know of a good example and would like the News Office to write about it, please e-mail dlc1@mit.edu.*

PHOTO COURTESY / **GTZ (GERMAN AGENCY FOR TECHNICAL COOPERATION)**

A member of the Honduran woodcutting cooperative at work in the Biosphere Rio Platano, where they have been logging in a sustainable way under the guidance of the Rainforest Alliance and the State Forestry Administration.

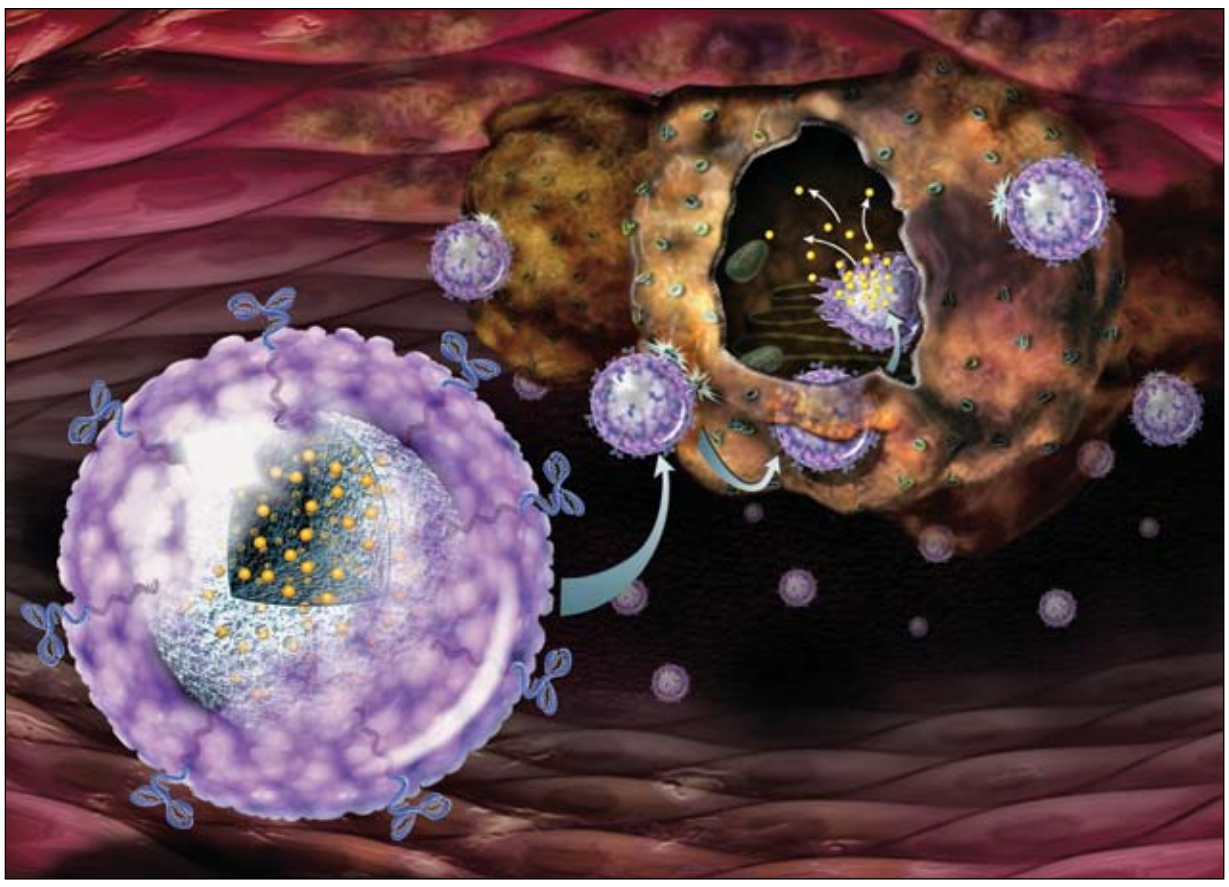

IMAGE / **NICOLLE RAGER FULLER, SAYO-ART**

**Fantastic voyage**

In this image, targeted nanoparticles—each about 1/100th the size of a human cell and engineered to be stealthy within the body—deliver high doses of chemotherapy to cancer cells. A team of researchers led by Omid Farokhzad at Brigham and Women's Hospital and MIT Institute Professor Robert Langer has demonstrated the precision required to engineer a nanoparticle that is effective in targeted drug delivery. Details of their work were published in the January issue of the Proceedings of the National Academy of Science.

# River plants may play major role in health of ocean coastal waters

**Denise Brehm**
Civil and Environmental Engineering

Aquatic plants in rivers and streams may play a major role in the health of large areas of ocean coastal waters, according to recent research from MIT's Department of Civil and Environmental Engineering.

This work, which appeared in the Dec. 25 issue of the Journal of Fluid Mechanics (JFM), describes the physics of water flow around aquatic plants and demonstrates the importance of basic research to environmental engineering. This new understanding can be used to guide restoration work in rivers, wetlands and coastal zones by helping ecologists determine the vegetation patch length and planting density necessary to damp storm surge, lower nutrient levels, or promote sediment accumulation and make the new patch stable against erosion.

Professor Heidi Nepf, a MacVicar Faculty Fellow, was principal investigator on the research. Brian White, a former graduate student at MIT who is now an assistant professor at the University of North Carolina, was co-author with Nepf of the JFM paper. Marco Ghisalberti, a postdoctoral associate at the University of Western Australia, worked with Nepf on some aspects of this research when he was an MIT graduate student. This work was supported by grants from the National Science Foundation.

Traditionally, people have removed vegetation growing along rivers to speed the passage of waters and prevent flooding, but that practice has changed in recent years. Ecologists now advocate replanting, because vegetation provides important habitat. In addition, aquatic plants and the microbial populations they support remove excess nutrients from the water. The removal of too many plants contributes to nutrient overload in rivers, which can subsequently lead to coastal dead zones—oxygen-deprived areas of coastal water where nothing can survive. One well-documented dead zone in the Gulf of Mexico, fed by nutrient pollution from the Mississippi River, grows to be as large as the state of New Jersey every summer.

Nepf's work, which describes how water flows into and through a plant canopy and how long it remains within the canopy, can be used to find the right balance between canopy and flow in a river.

Vegetation generates resistance to flow, so the velocity within a canopy is much less than the velocity above it. This spatial gradient of velocity, or shear, produces a coherent swirl of water motion, called a vortex. Using scaled physical models, Nepf and Ghisalberti described the dynamic nature of these vortices and developed predictive models for canopy flushing that fit available field observations. The team showed that vortices control the flushing of canopies by controlling the exchange of fluid between the canopy and overflowing water. Similar vortices also form at the edge of a vegetated channel, setting the exchange between the channel and the vegetation.

The structure and density of the canopy controls the extent to which flow is reduced in the canopy and also the water-renewal time, which ranges from minutes to hours for typical submerged canopies. These timescales are comparable to those measured in much-studied underground hyporheic zones, suggesting that channel vegetation could play a role similar to these zones in nutrient retention. In dense canopies, the larger vortices cannot penetrate the full canopy height. Water renewal in the lower canopy is controlled by much smaller turbulence generated by individual stems and branches.

"We now understand more precisely how water moves through and around aquatic canopies, and know that the vortices control the water renewal and momentum exchange," said Nepf. "Knowing the timescale over which water is renewed in a bed, and knowing the degree to which currents are reduced within the beds, helps researchers determine how the size and shape of a canopy will impact stream restoration."

PHOTO / **DONNA COVENEY**

Professor Heidi Nepf of civil and environmental engineering investigates how balancing the needs of flood reduction with the ecologic benefits of vegetation requires a precise understanding of how plants impact water flow.

# MIT applies engineering approach to studying biological pathways

**Anne Trafton**
News Office

An MIT team has used an engineering approach to show that complex biological systems can be studied with simple models developed by measuring what goes into and out of the system.

Such an approach can give researchers an alternative way to look at the inner workings of a complicated biological system—such as a pathway in a cell—and allow them to study systems in their natural state.

The MIT researchers focused on a pathway in yeast that controls cells' response to a specific change in the environment. The resulting model is "the simplest model you can ever reduce these systems to," said Alexander van Oudenaarden, W.M. Keck Career Development Professor in Biomedical Engineering and Associate Professor of Physics and senior author of a paper describing the work in the Jan. 25 issue of Science.

Quantitative modeling of a biological pathway normally involves intense computer simulations to crunch all available data on the dozens of relevant reactions in the pathway, producing a detailed interaction map.

"These simulations are difficult to perform and interpret because many model parameters are not or cannot be experimentally measured. Moreover, because there are so many interconnected components in the network, it is difficult to make reliable predictions," said van Oudenaarden.

Alternatively, a complex system can be treated as a "black box," where you don't know what's happening inside but can figure it out by analyzing the system's response to periodic inputs. This approach is widely used in the engineering disciplines but has rarely been applied to analyze biological pathways. The technique is very general and could be used to study any cellular pathway with measurable inputs and outputs, van Oudenaarden said.

"You don't want to open the box, but you want to shake it a little," he said. "Comparing the response when you shake it fast to when you shake it slowly reveals important information about which chemical reactions in the pathway dominate the response."

In the new study, the "black box" is a pathway involving at least 50 reactions. The pathway is activated when yeast cells are exposed to a change in the osmotic pressure of their environment, for example, when salt is added to their growth media.

The researchers controlled the inputs (bursts of salt) and measured output (activity of Hog1 kinase, an enzyme with a pivotal role in the yeast salt-stress response).

They exposed the cells to salt bursts of varying frequency, then compared those inputs with the resulting Hog1 activity.

Using that data and standard methods from systems engineering, they came up with two differential equations that describe the three major feedback loops in the pathway: one that takes action almost immediately and is independent of the kinase Hog1, and two feedbacks (one fast and one slow acting) that are controlled by Hog1.

The fast feedbacks prevent the yeast cell from shriveling up as water rushes out of the cell into the saltier environment. That is accomplished by increasing the cellular concentration of glycerol, a byproduct of many cell reactions. The presence of glycerol inside the cell balances the extra salt outside the cell so water is no longer under osmotic pressure to leave the cell.

In the short term, glycerol concentration is immediately increased by blocking the steady stream of glycerol that normally exits the cell. In the long-term feedback loop, Hog1 goes to the nucleus and activates a pathway that induces transcription of genes that produce enzymes that synthesize more glycerol. This process takes at least 15 minutes.

During the salt shocks, the short-term response kicks in right away, but the cells also initiate the longer-term responses.

Other authors of the paper are Jerome Mettetal, a recent MIT PhD recipient; Dale Muzzey, a graduate student in biophysics at Harvard; and Carlos Gomez-Uribe, a graduate student in the Harvard-MIT Division of Health Sciences and Technology.

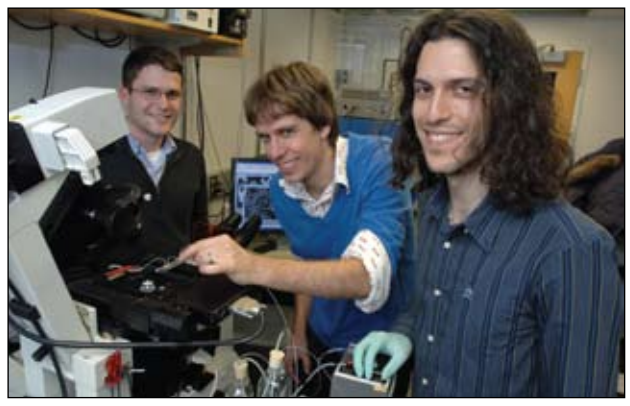

PHOTO / **DONNA COVENEY**

From left, graduate student Jerome Mettetal, Professor Alexander van Oudenaarden and Harvard graduate student Dale Muzzey report insights on how cells respond to external stimuli.

# MIT reveals superconducting surprise

## A better understanding of material could bring 'endless applications'

**Anne Trafton**
News Office

MIT physicists have taken a step toward understanding the puzzling nature of high-temperature superconductors, materials that conduct electricity with no resistance at temperatures well above absolute zero.

If superconductors could be made to work at temperatures as high as room temperature, they could have potentially limitless applications. But first, scientists need to learn much more about how such materials work.

Using a new method, the MIT team made a surprising discovery that may overturn theories about the state of matter in which superconducting materials exist just before they start to superconduct. The findings are reported in the February issue of Nature Physics.

Understanding high-temperature superconductors is one of the biggest challenges in physics today, according to Eric Hudson, MIT assistant professor of physics and senior author of the paper.

Most superconductors only superconduct at temperatures near absolute zero, but about 20 years ago, it was discovered that some ceramics can superconduct at higher temperatures (but usually still below 100 Kelvin, or -173 Celsius).

Such high-temperature superconductors are now beginning to be used for many applications, including cell-phone base stations and a demo magnetic-levitation train. But their potential applications could be much broader.

"If you could make superconductors work at room temperature, then the applications are endless," said Hudson.

Superconductors are superior to ordinary metal conductors such as copper because current doesn't lose energy as wasteful heat as it flows through them, thus allowing larger current densities. Once a current is set in motion in a closed loop of superconducting material, it will flow forever.

In the Nature Physics study, the MIT researchers looked at a state of matter that superconductors inhabit just above the temperature at which they start to superconduct.

When a material is in a superconducting state, all electrons are at the same energy level. The range of surrounding, unavailable electron energy levels is called the superconducting gap. It is a critical component of superconduction, because it prevents electrons from scattering, thus eliminating resistance and allowing the unimpeded flow of current.

Just above the transition temperature when a material starts to superconduct is a state called the pseudogap. This state of matter is not at all well understood, said Hudson.

The researchers decided to investigate the nature of the pseudogap state by studying the properties of electron states that were believed to be defined by the characteristics of superconductors: the states surrounding impurities in the material.

It had already been shown that natural impurities in a superconducting material, such as a missing or replaced atom, allow electrons to reach energy levels that are normally within the superconducting gap, so they can scatter. This can be observed using scanning tunneling microscopy (STM).

The new MIT study shows that scattering by impurities occurs in the pseudogap state as well as the superconducting state. That finding challenges the theory that the pseudogap is only a precursor state to the superconductive state, and offers evidence that the two states may coexist.

This method of comparing the pseudogap and superconducting state using STM could help physicists understand why certain materials are able to superconduct at such relatively high temperatures, said Hudson.

"Trying to understand what the pseudogap state is is a major outstanding question," he said.

Lead author of the paper is Kamalesh Chatterjee, a graduate student in physics. MIT physics graduate students Michael Boyer and William Wise are also authors of the paper, along with Takeshi Kondo of the Ames Laboratory at Iowa State University and T. Takeuchi and H. Ikuta of Nagoya University, Japan.

The research was funded by the National Science Foundation and the Research Corporation.

PHOTO / **DONNA COVENEY**

Assistant Professor of Physics Eric Hudson transfers liquid helium to cool the scanning tunneling microscope he is using in his research on high-temperature superconductivity.

# Gene research may help explain autistic savants

**Deborah Halber**
Picower Institute of Learning and Memory at MIT

Mice lacking a certain brain protein learn some tasks better but also forget faster, according to new research from MIT that may explain the phenomenon of autistic savants in humans. The work could also result in future treatments for autism and other brain development disorders.

Researchers at the Picower Institute for Learning and Memory at MIT report in the Feb. 13 issue of the Journal of Neuroscience that mice genetically engineered to lack a key protein used for building synapses—the junctions through which brain cells communicate—actually learned a spatial memory task faster and better than normal mice. But when tested weeks later, they couldn't remember what they had learned as well as normal mice, and they had trouble remembering contexts that should have provoked fear.

"These opposite effects on different types of learning are reminiscent of the mixed features of autistic patients, who may be disabled in some cognitive areas but show enhanced abilities in others," said Albert Y. Hung, a postdoctoral associate at the Picower Institute, staff neurologist at Massachusetts General Hospital and co-author of the study. "The superior learning ability of these mutant mice in a specific realm is reminiscent of human autistic savants."

Autism is one of a group of developmental disabilities known as autism spectrum disorders (ASDs), in which a person's ability to communicate and interact with others is impaired. The Centers for Disease Control and Prevention estimate that one in 150 American children have an ASD. Occasionally, an autistic person has an outstanding skill, such as an incredible rote memory or musical ability. Such individuals—like the character Dustin Hoffman played in the film "Rain Man"—may be referred to as autistic savants.

Hung said that while it seems counterintuitive that loss of an important synaptic scaffold protein would result in improved learning among the mice in this study, the absence of this protein may "trap" the mice's synapses in a more plastic state, which means the synapses are ready to respond to input but not maintain it in long-term memory.

Aberrant synapse development and faulty structure of dendritic spines—tiny protrusions on the surface of neurons that receive messages from other neurons—are often associated with neurodevelopmental disorders, including autism, in humans.

Morgan H. Sheng, the Menicon Professor of Neuroscience, Hung and colleagues investigated the role in brain development and cognitive function of a protein called Shank1. Shank1 is one member of a family of proteins that act as structural scaffolds linking together different components of the synapse. In humans, mutations in the closely related protein Shank3 have been linked to the autism spectrum of disorders characterized by impaired social interaction, absent or delayed language development and repetitive behaviors.

The mice in the study had smaller dendritic spines and weaker brain synapses. Their enhanced spatial learning is similar to that of mice engineered to have a mutation in another protein—neuroligin3—that binds directly to Shank1 and is also associated with autism. "We speculate that enhanced spatial learning might be a common feature of mouse models of autism, and that it might reflect a pathological elevation of brain plasticity in the human disease," Hung and Sheng wrote.

In addition to Hung and Sheng, a Howard Hughes Medical Institute (HHMI) investigator, MIT authors are Picower Institute research scientist Kensuke Futai; MIT biology graduate student Jubin Ryu; Mollie A. Woodworth '06; Picower Institute postdoctoral fellow Fleur L. Kidd; Picower Institute research assistant Clifford Sung; and Mark F. Bear, Picower Professor of Neuroscience, HHMI investigator and director of the Picower Institute. Additional authors are from the University of Milan, the University of North Carolina at Chapel Hill, and Fujita Health University in Japan.

This work was supported by the RIKEN-MIT Neuroscience Research Center, the National Institutes of Health and HHMI.

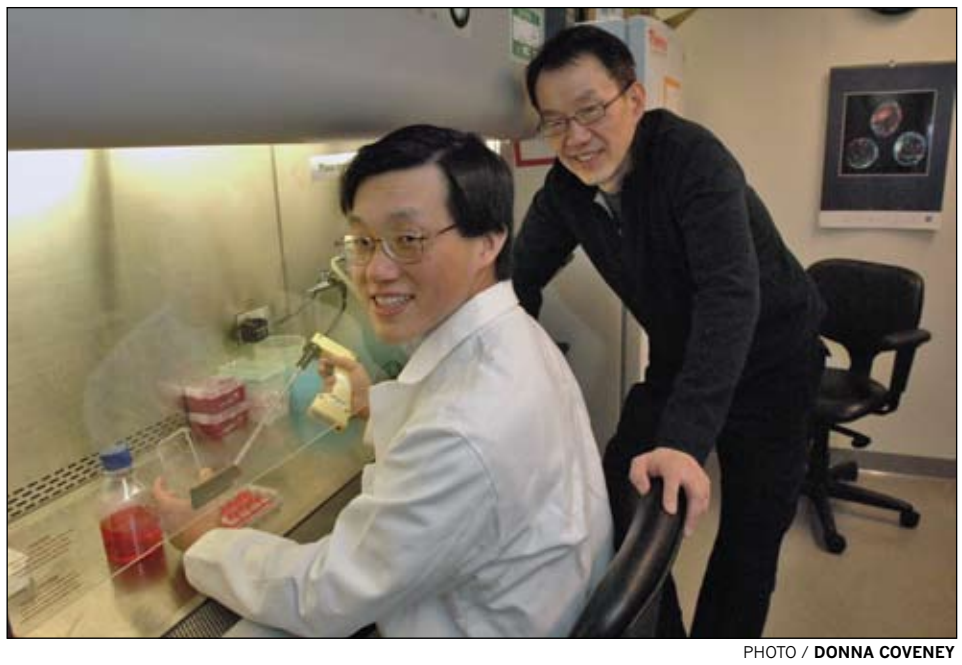

PHOTO / **DONNA COVENEY**

From left, postdoctoral associate Albert Y. Hung and Menicon Professor of Neuroscience Morgan H. Sheng report gene research that may explain the phenomenon of autistic savants.

# CYCLE

Continued from **Page 1**

trip, which serves to build team spirit among members of the lab, according to Rocco Ciccolini, one of Tester's graduate students.

"Much like the focus within our group, cycling with Jeff has truly taught me how to persevere through tough times and has really led me to appreciate group interaction," says Ciccolini. "We're a team. We all look out for each other. Whether it's venting to each other about reactor leaks, riding a shift in the support van, making carb-loaded sandwiches to fuel the team, or being in charge of photo taking for the trip, all of our contributions are important and complementary."

Ciccolini and other students whose appetites for cycling are whetted by the northern New England trip often join Tester for an even greater challenge: pedaling across the United States.

Tester, who took up cycling in 1978 after hurting his knee playing basketball, has already traversed the continent once and is working on his second cross-country trip.

The first trip took Tester and his companions from Puget Sound, Wash., to Hingham, Mass., over four summers. After that trek, they decided they were up for more.

### Cross-country

In 2004, they embarked on another cross-country trip, this time traveling north to south along the Continental Divide. The group started the first of four legs in Eureka, Mont., near the Canadian border, and finished the third leg last summer in Los Alamos, N.M.

"We figured that if we could do west to east, we can certainly go from north to south. But it's not as easy as you would think. There are a lot of ups and downs," says Tester.

Cycling across the continent has also allowed Tester, who studies geothermal energy, to see hot springs in action firsthand—especially on his many trips through Yellowstone National Park.

Tester and a few friends started the first cross-country trip in 1998 and traveled across Washington, Idaho, Montana, North Dakota, Minnesota, Wisconsin, Michigan, Ontario, New York, Vermont, New Hampshire and Massachusetts over four summers. They roughly followed a cycling route known as the "Northern Tier," mapped out by the Adventure Cycling Association.

The route takes the riders through vast wilderness, farmland and river valleys, mostly along paved roads and up and down many hills. Along the way, cyclists encounter some of the most scenic parts of the United States.

In Tester's office hangs a photograph he took of Logan Pass, which is on the Continental Divide, in Glacier National Park, Mont., near the intersection of the two cross-country routes. "It's absolutely gorgeous, and not a lot of people go there," he says.

During one leg of the trip, Tester and two of his graduate students who wanted to see the United States took a side trip through Glacier National Park but wound up stranded for two days after an unexpected 15-inch snowfall in June.

That was followed by one of the highlights of the trip, a ride along Route 2 across Montana and North Dakota to Fargo. "We had terrific roads, the people were friendly, there was no traffic and minimal encounters with expected headwinds," Tester said.

Tester and his cycling companions hope to finish the fourth and final leg of their north-south trip this year but haven't set a date yet. They usually ride in the summer, but that could be difficult because they will be riding through desert from Los Alamos to their final destination at the New Mexico-Mexico border.

In the meantime, the annual trip to the Glen will go on as usual. Tester and his wife have become close friends with Betty Falton, who for more than 30 years has operated the lodge at First Connecticut Lake, located in an area that supplied pulpwood to many paper mills. Now that most of the mills are shut down, the area is near-total wilderness.

"It's pretty much just us, the loons and the moose," Tester said.


PHOTO / **JIM HALE**

From left, Professor Jeff Tester, grad student Andy Peterson, former grad student Phil Marrone and grad student Rocco Ciccolini take a break at the Idaho border.

## No Tech Talk next week

In honor of Presidents' Day, there will be no Tech Talk on Wednesday, Feb. 20. The next Tech Talk will be published on Feb. 27. For ongoing MIT news updates, please go to the News Office web site, web.mit.edu/newsoffice/.

## IT'S A FACT!

- Technicolor was developed in 1921 by an MIT alumnus, Herbert T. Kalmus '03, who named the process in honor of his alma mater, often called Tech by its early graduates.
- MIT's first foreign student was a Canadian who enrolled with the second class in the fall of 1865. There have been international students ever since. In fall 2007, 2,883 foreign students, representing more than 110 countries, were enrolled at MIT.
- According to the National Collegiate Athletic Association, MIT ties Harvard in sponsoring the broadest intercollegiate athletics program in the country, with 41 varsity teams (21 for men, 17 for women, three coeducational).
- MIT paid or generated more than $25.3 million in real estate taxes in the 2007 fiscal year, making it Cambridge's largest taxpayer.

PHOTO / **DONNA COVENEY**

## Grand pram

Architecture graduate student Sofia Ponte relaxes in Dreaming Lounge, which she built and designed.

Resembling a baby carriage for grown-ups, Ponte's Dreaming Lounge offers a way to center the student who has gotten off-balance: Settle in, pull the wooden handle back and the canopy lifts over your head.

"Dreaming Lounge is a bubble of air, a way to breathe and access inner categories of knowledge, like ethics and dreams. It's a place to combine the rational and the irrational," says Ponte.

Dreaming Lounge is on display in Barker Engineering Library through Feb. 15.

# DDCF $2 million grant to fund MIT energy tech innovation review

A two-year, $2-million grant from the Doris Duke Charitable Foundation (DDCF) will enable researchers at the MIT Industrial Performance Center to conduct a comprehensive assessment of the energy technology innovation system in the United States.

Using the DDCF grant, MIT researchers will assess the strengths and weaknesses of this system, and will consider the entire complex of incentives, regulations, markets, and public and private institutions within which the development, demonstration, adoption and diffusion of new energy technologies takes place. Their work will eventually lead to recommendations for improvements to federal and state research, development and demonstration policies, as well as mechanisms for early adoption and large-scale deployment of supply- and demand-side innovations.

Richard Lester, professor of nuclear science and engineering and director of the MIT Industrial Performance Center, is the principal investigator on the project. He said there is an urgent need to think creatively and rigorously about how to improve the way in which new energy technologies are developed and rolled out.

"Massive changes in the way energy is supplied and used will be needed over the next few decades if the world is to have a realistic chance of avoiding the worst environmental and economic consequences of global climate change," Lester said. "The U.S. role will be critical. While technological ingenuity will be essential, it will be equally important to have an institutional setup capable of supporting commercial demonstration, early adoption and large-scale deployment of new energy technologies and services."

The grant is part of DDCF's $100-million Climate Change Initiative, launched last year with the goal of building a clean-energy economy. The initial round of grants from the Climate Change Initiative, announced last summer, focused on ways to speed the adoption of existing clean-energy technologies, including the design of optimal domestic and international pricing policies for carbon dioxide and other greenhouse gases. In that round, MIT received a two-year, $500,000 grant to enable researchers at MIT's Center for Energy and Environmental Policy Research to conduct research and analysis that will help inform the U.S. policy process on climate change.

## DIGITALK: Where IT's at

### Watch out for spear-phishing

Information Services and Technology (IS&T) asks all MIT faculty, staff and students to be on guard against spear-phishing attacks made through MIT's e-mail system. Spear-phishing refers to attempts to steal personal information from a targeted group by sending an official-looking message that is actually a scam. In a recent attack at MIT, e-mail that appeared to come from an account on campus requested that you send your password and other personal information in a reply e-mail—or else have your e-mail address deactivated from the MIT database.

IS&T will never ask members of the MIT community to send their login name or password by e-mail. You should never reply to such messages. When IS&T learns of e-mail scams that target MIT, it posts alerts on the 3DOWN web page at 3down.mit.edu.

IS&T also recommends that you never share your password with anyone, including IT support staff. Contact the IS&T Computing Help Desk at computing-help@mit.edu if you have questions or concerns. To learn more about IT security topics, see web.mit.edu/ist/topics/security.

### Support for iPhone

IS&T now provides limited support for MIT e-mail and MIT's Wi-Fi setup on the Apple iPhone. This mobile device offers several breakthrough technologies, including full web-browsing capability, a robust e-mail client and a multitouch user interface.

However, as is often true for first-generation devices, the iPhone also needs improvement in several areas. At this time, it does not recognize personal certificates or synchronize calendar data wirelessly (though the latter is expected to be addressed when Apple releases the iPhone software development kit). In addition, because iPhone service is available only through AT&T, iPhone network coverage at MIT is limited. You can find a full list of known issues at itinfo.mit.edu/article.php?id=8740.

If you have questions about using the Apple iPhone at MIT, visit itinfo.mit.edu/product.php?vid=780 or contact the iPhone Release Project Team at mobile-release@mit.edu.

### VMware licensed for use at MIT

IS&T has signed an agreement with VMware to license its virtualization software for use at MIT. The agreement covers VMware Lab Manager, VMware Infrastructure Enterprise and VMware desktop products.

Virtualization software enables the creation of multiple independent operating systems ("virtual machines") running simultaneously on a single machine. Through virtualization, professors can deliver specialized software to students in a course, or individuals can run a second operating system on their computers. Virtualization software can also be used in data centers for server consolidation and effective management of IT resources.

The VMware desktop products (Fusion for Macintosh and Workstation for Windows/Linux) are available to early adopters for download at web.mit.edu/vmware. These products can be installed and used by all MIT faculty, staff and students on MIT- and personally owned computers. For VMware Infrastructure Enterprise and Lab Manager, send your requests to ist-vmware@mit.edu.

A team is being created this month to explore how to best provide support for virtualization at MIT, with a goal of offering support in the first quarter of FY09. IS&T recommends that only early adopters—who are able to support themselves and their users—should download and use VMware Fusion or Workstation.

### New group for network professionals

MIT's new NetPartners group taps into the great pool of network architecture, engineering and management knowledge in the MIT community. The group meets on the third Tuesday of every month to discuss issues that affect the networking community—construction planning, monitoring and management, support for high-performance computing, 10GB options and layer 4-7 enhancements, to name a few.

The group also hosts a mailing list for exchanging ideas and noting opportunities of interest to networking professionals on campus. To join the NetPartners mailing list, go to mailman.mit.edu/mailman/listinfo/netpartners. For a list of all user groups at MIT, visit web.mit.edu/ist/usergroups.

*Digitalk is compiled by Information Services and Technology.*

# Sports, innovation share stage at Sloan event

**Stephanie Schorow**
News Office Correspondent

A love of sports can lead to exultation and heartbreak. But it can also lead to technical innovation, a point emphasized in one of the panels during the second annual MIT Sloan Sports Business Conference, held Feb. 9.

The sports conference, which brought together major figures in the sports industry for in-depth, often contentious, discussions, covered topics ranging from baseball and football analytics to managing high expectations for a team.

A panel discussion on sports technology, moderated by Kim Blair, director of MIT's Center for Sports Innovation, featured speakers from businesses that serve niche markets within the sports industry.

The startup Yoonew—a kind of stock market for sports tickets—came about when founder Gerry Wilson MBA '04 went to Fenway Park to try to get Red Sox tickets and came away empty-handed. "He started thinking, Wouldn't it be cool if there were insurance for tickets?" said Wilson's partner, Hagos Mehreteab MBA '06.

The Yoonew web site lets fans bid on tickets for "team fantasies" such as the Patriots getting into the Super Bowl and "fantasy matches," such as a future Patriots-Giants match, Mehreteab said. The company "brings what's traditionally found in financial market to the ticket market."

Ellen Brockley, co-founder and vice president of Motus Corporation (which was founded by MIT alumni) said co-founder Satayan Mahajan had noticed his golf game was always better when he played with a partner who was on the golf team. Being at MIT, he sought an "engineering solution." This became a low-cost, wireless three-dimensional motion-capturing vest that can be used for fitness training. The company is now moving into medical applications.

"If you can tell how an object moves, you have all sorts of applications," Brockley said.

Determining "who won" can be a technical challenge. Douglas J. DeAngelis, founder and president of Lynx System Developers, described how the combination of high-speed digital cameras and computers created a "photo finish" system in 1992. The system is now widely used in sports from track events to NASCAR races.

The relationship between star players and ticket sales is one of the aspects of StatBridge, a software firm founded in 1999 by Matthew Marolda that specialized in data visualization and analysis.

Dave Scarborough, executive vice president of Ticketmaster, described a future when fans come to events "without tickets," just as today passengers can fly on airlines without a physical ticket.

Asked what advice the panelists had for budding sports entrepreneurs, Brockley said, "Make sure your market is ready for the technology."

# DRUGS

Continued from **Page 1**

that is not planar," said Wood.

Another advantage to the films is that they are easy to mass-produce using a variety of techniques, said Hammond. These thin-film systems can be directly applied or patterned onto 3-D surfaces such as medical implants.

Stefani Wrightman, a 2006 MIT graduate, and Brian Andaya, a recent graduate of the University of Rochester and summer intern at the MIT Materials Processing Center, are also authors on the paper. The research was funded by the National Science Foundation, the Office of Naval Research and MIT's Institute for Soldier Nanotechnologies.

# Bustani lectures to feature Boutros-Ghali, Avishai

The Emile Bustani Middle East Seminar at MIT, now in its 22nd year, will present two lectures this spring on contemporary Middle Eastern affairs.

On Feb. 25, Egyptian Finance Minister Youssef Boutros-Ghali PhD '80 will deliver a lecture titled "Building a Smart Economy: The Egyptian Experience." On April 1, author Bernard Avishai will deliver a lecture titled "Globalized Israel: Why Olmert's Center Government Is the Last—and Best—Chance for a Peace Deal."

The seminar is funded by the Bustani family of Beirut, Lebanon, in memory of the late Emile Bustani, who received the SB in civil engineering in 1933. The Bustani Middle East Seminar is sponsored by the Center for International Studies.

The Feb. 25 session is co-sponsored by the MIT Department of Economics and will begin at 4:30 p.m. in Room E51-315; the April 1 session will begin at 4:30 p.m. in Room E51-095. Both sessions are open to the public.

## 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

Hardwood coffee table by Nichols and Stone in excellent condition. Simple, classic design. Convenient drawer on one end for napkins, coasters. Dimensions 36"x36". $125.00. Contact Peggy at peggyp@mit.edu. Photo available.

Men's jacket: Size large, brown-leather look, below hip length, warm fleece lining throughout. Made in Italy. New, $35. Call Rosalie at 781-391-1307.

### HOUSING

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

Mature MIT Admin. Staff looking to stay in Boston area for summer while I rent my home to vacationers. Summer &/or fall sublet or house-sitting/pet-sitting wanted. Flex. dates poss. x3-9432 or 617-699-6893.

PHOTO / **DONNA COVENEY**

Recipient of a Bringing Out the Best award, Coach Paul Dill leads his volleyball players to victory on the court but also prepares them to succeed in their lives after MIT.

# Profiles in excellence

## Nineteen to receive Excellence Awards

**Anne Trafton**
News Office

MIT is known for bringing out the best in its students academically, but that ambition also applies to athletics.

MIT's men's and women's volleyball teams have achieved stellar success in recent years, and much of the credit goes to Coach Paul Dill, who will receive a 2008 Excellence Award for Bringing Out the Best.

"MIT Volleyball wouldn't be the high-quality program it is today without the tireless effort of Coach Dill," said MIT senior Ryan Dean, a team member who nominated Dill for the award.

The annual Excellence Awards, part of MIT's Rewards and Recognition program, acknowledge innovation, leadership, collaboration, dedication, outreach, inclusiveness, service and results. The program is designed to recognize individuals and teams for their exceptional contributions to their office, department or school—or to the Institute as a whole.

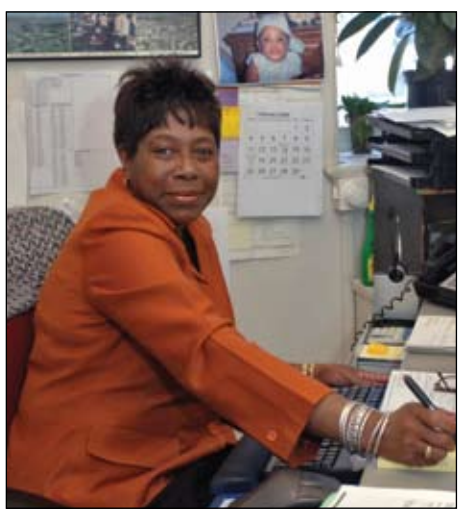

PHOTO / **DONNA COVENEY**

Coordinator of Registration Services Shirley Thompson will be honored with a Serving the Client award.

Dill, who has coached the women's team for 12 years and men's team for five years, teaches his players to set goals, take personal responsibility and become leaders. To his players, he is more than just a coach. According to Dean, "He is also a source of inspiration, a person to go to for advice and someone all his players can depend on."

Dill's teams often end the season with a national ranking, but according to Stephen Immerman, who also nominated Dill, his success is not all about winning. Though his teams post winning records, his real achievement is giving his players the skills they need to succeed in their post-MIT careers.

"He agrees winning is nice, but he knows that students at MIT don't come here to become professional athletes. They come to achieve great things personally and academically—to excel. He knows his role in athletics is to give students tools they take with them after they leave MIT, tools they can [use to] achieve their dreams, become leaders and succeed in whatever they choose to pursue," said Immerman, senior associate dean for student development, who recently served as interim head of the Department of Athletics, Physical Education and Recreation.

Shirley Thompson, coordinator of registration services in the Registrar's Office, will also be honored with an Excellence Award, in the Serving the Client category.

Thompson processes grades, registration forms and add-drop forms, and handles cross-registration with Harvard. Despite that huge volume of work, she is always cheerfully available to help with any registration or other academic issue, according to colleagues who nominated her for the award.

"Shirley is a very humble person who is unfailingly courteous to students, faculty and staff and can always be counted on to answer everyone's questions without hesitation in person, by phone or by e-mail," said Gary King, undergraduate administrator in the Department of Economics.

Even during high-stress times such as Reg Day, Thompson is always ready and willing to help anyone who needs assistance with complicated problems.

"She is dependable, warm and friendly under all circumstances, even the most distressed. She clearly puts the needs of those she serves over her own needs again and again, and with unfailing good cheer. And she's always right," said Shannon Larkin, graduate administrator for the program in writing and humanistic studies.

"I was extremely impressed that on fall term Reg Day this year, I must have called Shirley 20 times. If you can believe it, in the midst of this chaotic day, Shirley answered her phone every time, was never aggravated or agitated. She provided me and my students excellent service that day, as she does every day," said Janet Fischer, graduate administrator in the Department of Electrical Engineering and Computer Science.

The Excellence Awards ceremony will be held Feb. 26 in Kresge Auditorium, with opening remarks from President Susan Hockfield and a keynote address from Deborah Fitzgerald, dean of the School of Humanities, Arts, and Social Sciences. Refreshments will be served beginning at 11:30 a.m., and the awards presentation will start at noon, followed by a reception at 1 p.m.

**Fostering Community**: Ronald J. Legere, technical staff, Tactical Defense Systems, Lincoln Laboratory; Anthony Pelletier, office assistant I, Department of Mathematics, School of Science.

**Serving the Client**: Theresa Benevento, administrative assistant II, Department of Economics, School of Humanities, Arts, and Social Sciences; Doris Lannoy Inslee, human resources professional, Laboratory for Information and Decision Systems, School of Engineering; M. Jennifer Walsh, senior human resources officer, Labor and Employee Relations, Human Resources Department; Shirley Thompson, coordinator of registration services, Registrar's Office, Dean for Undergraduate Education; Visitor Reception Services Team: Karen Allen, administrative staff, Dollina Borella, security coordinator, Roslyn Wesley, administrative staff, Thomas J. Zech, administrative staff, Security Services Department, Lincoln Laboratory.

**Creating Connections**: Theresa A. Tobin, head librarian, Humanities Library, MIT Libraries; Joshua Schuler, executive director, Lemelson/MIT Program, School of Engineering.

**Innovative Solutions**: Margarita Hiett, associate staff, Space Systems Analysis, Lincoln Laboratory; Alison Hynd, IDEAS competition and fellowship coordinator, Public Service Center, Division of Student Life,

**Bringing Out the Best**: Paul Dill, Varsity volleyball coach, DAPER Intercollegiate Sports, Division of Student Life; Ellen W. Faran, director, MIT Press.

**Unsung Hero**: James M. Daley, project technician, Research Laboratory of Electronics; James Dunn, technical staff, Tactical Defense Systems, Lincoln Laboratory; Gary A. Hackett, administrative staff, Human Resources Department, Lincoln Laboratory.