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TechTalk
SERVING THE MIT COMMUNITY

MIT alumni win Nobel prizes in physics and in physiology

Astrophysicists' work supports Big Bang theory

Elizabeth Thomson
News Office

MIT alumnus George F. Smoot has been awarded the 2006 Nobel Prize in physics, together with John C. Mather, for work that looks back into the infancy of the universe and attempts to gain some understanding of the origin of galaxies and stars.

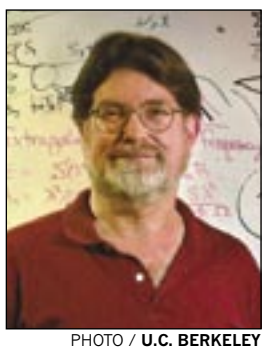

PHOTO / **U.C. BERKELEY**

George Smoot

The work, based on measurements of the cosmic microwave background radiation made with NASA's COBE satellite, provides increased support for the Big Bang theory of the origin of the universe. The COBE (Cosmic Background Explorer) measurements also mark the inception of cosmology as a precise science. For the first time, cosmological calculations could be compared with data from real measurements.

According to the Big Bang scenario, the cosmic microwave background radiation is a relic of the earliest phase of the universe. Immediately after the Big Bang itself, the universe can be compared to a glowing body emitting radiation at a temperature of almost 3,000 degrees Celsius.

Since then, the radiation has cooled as the universe has expanded. The background radiation we can measure today corresponds to a temperature that is barely 2.7 degrees above absolute zero. The new Nobel laureates were able to calculate this temperature thanks to the COBE measurements.

COBE also had the task of seeking small variations of temperature in the cosmic background radiation in different directions. Extremely small differences of this kind—in the range of a hundred-thousandth of a degree—offer an important clue to how the galaxies came into being. The variations in temperature measured by COBE show us how the matter in the universe began to "aggregate." This was necessary if the galaxies, stars and, ultimately, life forms like us were to be able to develop.

Smoot received B.S. degrees in mathematics and in physics in 1966 from MIT. He also received the Ph.D. in physics in 1970 from the Institute working with the late Professor David Frisch, who was on the MIT faculty for some 40 years. Smoot is currently a professor at the University of

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Colleagues discovered gene regulator RNAi

Elizabeth Thomson
News Office

Andrew Z. Fire, who received the Ph.D. from MIT in 1983 while working with Nobel laureate Phillip Sharp, has been awarded the Nobel Prize in physiology or medicine for 2006. Fire and Craig C. Mello shared the prize for their discovery of RNA interference (RNAi), a fundamental mechanism for controlling the flow of genetic information.

"This is an absolutely revolutionary discovery, as indicated by the fact that (it) was made in 1998 and is being recognized with this prize only eight years later," said Sharp, an MIT Institute Professor.

In December 2002 Sharp called RNAi "the most important and exciting breakthrough of the last decade, perhaps multiple decades," when the phenomenon was named "breakthrough of the year" by Science magazine. Fire and Mello "have changed the future of biological science by providing insights into the ability of RNA to regulate gene expression," Sharp said at the time.

PHOTO / **STANFORD UNIV.**

Andrew Z. Fire

The genome operates by sending instructions for the manufacture of proteins from DNA in the nucleus of the cell to the protein-making machinery in the cytoplasm. These instructions are conveyed by messenger RNA (mRNA).

In 1998 Fire, now a professor at Stanford University's School of Medicine, and Mello, a professor at the University of Massachusetts Medical School in Worcester, published their discovery of a mechanism that can degrade mRNA from a specific gene. This mechanism, RNAi, is activated when RNA molecules occur as double-stranded pairs in the cell. Double-stranded RNA activates biochemical machinery that degrades those mRNA molecules that carry a genetic code identical to that of the double-stranded RNA. When such mRNA molecules disappear, the corresponding gene is silenced and no protein of the encoded type is made.

RNAi, which occurs in plants and animals, including humans, is key in regulating gene expression. It protects against RNA virus infections, especially in plants and invertebrate animals, and secures

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PHOTO / **DONNA COVENEY**

Walking tall

Architecture Professor Wendy Jacobs, left, graduate student Hope Ginsburg and sophomore Adelaide Fuller cross Mass. Ave. on stilts they designed and built for Jacobs' Center for Advanced Visual Studies course.

Voting experts will explore registration, security

Stephanie Schorow
News Office Correspondent

The web is awash with conspiracy theories about voting machine hacks and trickery. And with the midterm elections approaching, even many mainstream politicians are voicing concern about ensuring that every ballot will be counted correctly on Election Day.

But, as an upcoming conference at MIT will show, efforts to ensure the integrity of the American electoral system must begin long before the polls open.

The Voter Identification/Registration Conference, sponsored by the Caltech/MIT Voting Technology Project, to be held Oct. 5-6 at MIT, will delve into the crucial issue of how to effectively register and/or identify voters so they will be able to walk into their polling places and cast ballots efficiently and securely.

A host of nationally recognized experts, academics and researchers are scheduled to participate, including Paul S. DeGregorio, chair of the U.S. Election Assistance Commission, who will give the keynote address; and Marc Rotenberg, executive director of the Electronic Privacy Information Center in Washington, D.C. MIT President Emeritus Charles Vest will welcome participants.

"In the 2000 election, we found that two to three times as many errors were caused by registration than by any other problem," said Ted Selker, MIT Media Lab associate professor and co-director of the Caltech/MIT Voting Technology Project, which was launched in December 2000 to promote new technology for elections. "Two to three million voters were lost in 2000 because of registration issues."

Indeed, key sections of the Help America Vote Act of 2002 focused on registration reforms, Selker said. For example, as of Jan. 1, 2006, all states were required to have a statewide registration database available. The goal, purportedly, is to help local election officials ensure a person is not registered more than once or that someone who

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OBITUARY

Arthur Jones, former News Office director, dies at 61

Arthur Jones, a former deputy White House press secretary who served as director of the MIT News Office, died on Oct. 2 at Brigham and Women's Hospital following complications from treatment he was receiving for leukemia. He was 61 and had lived in Newton.

Arthur Jones

Kathryn Willmore, who recently retired as a vice president at MIT, said, "We were very fortunate to have attracted someone of Arthur's caliber to MIT, where he brought an extraordinary depth of experience in many areas."

Willmore described Jones as "exceptional in building relations with faculty, staff, students and administration, as well as his colleagues in the media. When Arthur Jones called, it wasn't just MIT calling, it was Arthur. And people knew they could count on him to tell the truth."

A native of Baltimore, Jones was an award-winning journalist in both television and print media. He worked at the Boston Globe, sharing a team Pulitzer Prize in 1975 for meritorious public service, and he received a New England Television Emmy Award in 1980 while he was news manager at WBZ-TV in Boston.

Jones served as director of communications for the city of Boston in the administration of Mayor Raymond L. Flynn and before that, as assistant press secretary to Gov. Michael S. Dukakis.

As a spokesman for politicians, Mr. Jones was a calm presence, Dukakis told the Boston Globe. "He was just a solid, thoughtful guy. The press loved him."

According to the Globe, Jones met Karen Anderson while they were both working at Boston City Hall. They married 13 years ago.

Jones moved to Washington, D.C., in 1993 to serve in former President Bill Clinton's press office and later as director of public affairs for the court-appointed receiver of the District of Columbia Housing Authority.

When he was appointed MIT News Office director, Jones said, "After several years in public service, it is an honor to join a traditional leader in service to the nation and the world—a voice of authority in science and technology."

Jones served as News Office director from 2003 until his illness.

He is survived by his wife, Karen, ; his mother, Ruth Stokes of Detroit; two daughters, Kofi of Wilmington and Keely of Los Angeles; a sister, Rita Dady of Oakland; a brother, Frizelle of Hudson; a stepbrother, Eric Stokes of Detroit; and a granddaughter.

A memorial service is planned at MIT for a later date.

Hispanic Heritage winner sets sights high

Sasha Brown
News Office

Setting high goals and achieving them is crucial, says Freshman Eletha Flores of Maryland, the recipient of the 2006 Hispanic Heritage Foundation's National Youth Award for Engineering and Mathematics.

More than 13,000 high school students from across the country applied for the awards. Only nine students were selected in the various categories. MIT freshman Luis Flores (no relation) also received one of the awards in the sports category. The award winners receive $8,000 plus a laptop computer.

Eletha Flores' commitment to excellence started early. "Either I go all the way or I don't do it," said Flores, who set her sights on MIT at the beginning of her high school career. "I knew it was the top engineering school in the country."

Throughout high school, Flores maintained a 4.2 grade point average and consistently challenged herself with summer programs such as MIT's Minority Introduction to Engineering and Science (MITES) and an internship in space robotics at NASA.

As the middle child between two brothers and a child of divorce, her time at home was not always easy, Flores said, adding that her high school was not as challenging as she might have wished. Still, she found hardship motivating. "It gave me such a perspective on what life could be."

PHOTO / **MICHAEL MALYSKO**

Eletha Flores

Flores' Mexican heritage has also provided motivation, she said. As a very young child, she attended a Spanish immersion school, but after the family moved to Maryland, her mother was unable to find one. She lost some of her skill in speaking Spanish, which is something she said she plans to get back while she is at MIT.

Flores' love of engineering and mathematics started early when she was enrolled in programs for academically gifted students. Still, she made a conscious decision to pursue her goals with unusual fervor. "I asked myself: 'Do I want to let life just happen to me?'" Flores said. "Without a strict plan of what you want to do, you end up where it takes you."

In recent years, she has found inspiration from her older brother, an engineering student at Texas A&M University. "He is very creative and has really inspired me to be more into engineering," she said. "He taught me not just to enjoy the cell phone but to actually take it apart and see how I might make one."

One of her older brother's most valuable lessons was teaching her to drive a car with standard transmission. "Not many girls can do that," she said. "It means a lot to me."

Through the years, Flores kept her sights set on MIT. "It was always at the end of my tunnel," she said. When she received the MIT acceptance letter earlier this year, she was thrilled. "I felt like MIT was inviting me to come help make a difference in the world."

While she is at MIT, Flores said, she hopes to dance—"especially Latin dancing," she said. She also wants to study Japanese and go to Japan. "Japan just feels right to me," Flores said. Eventually, she wants to go to graduate school and earn a Ph.D. in electrical engineering. "I am extremely excited to be at MIT."

This year, MIT was named the fourth-best engineering school for Hispanics by Hispanic Business Magazine.

PHOTO / **PHILLIP SHARP LABORATORY**

Andrew Fire, right, who earned his Ph.D. from MIT in 1983, won the Nobel Prize in physiology or medicine for 2006. This photo was taken around 1980, when Fire was a graduate student in the laboratory of MIT Institute Professor and Nobel Laureate Phillip Sharp. At left is MIT graduate student Mark Samuels.

FIRE

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genome stability by keeping mobile elements silent.

Today, double-stranded RNA is used as a powerful tool to experimentally elucidate the function of essentially any gene in a cell. The discovery of RNAi has already had an immense impact on biomedical research and will most likely lead to novel medical applications in the future.

Soon after learning of the prize at "one something" in the morning California time, Fire talked to Adam Smith, editor in chief of the Nobel web site.

"The most immediate benefit (of RNAi) is going to be doing experiments that teach us things," Fire told Smith. "It's a basic research tool with some windows into potential therapeutics. I'll be as excited as anybody when it all pans out."

How did Fire and Mello get into the field? "We were led to it pretty much by our experimental noses," Fire told Smith. "I get drawn to unsolved questions that don't make any sense."

Sharp recalled that Fire entered MIT's Ph.D. program in biology at the age of 19 after earning a bachelor's degree in mathematics from the University of California at Berkeley. "He's a wonderful, highly principled scientist" who is "a wonderful example for young scientists," said Sharp.

MEMORIALS

William Dickson

A memorial service for William R. Dickson, retired senior vice president, will be held Friday, Oct. 6 at 3 p.m. in Kirsch Auditorium in the Stata Center.

Elizabeth Whittaker

A remembrance service for Elizabeth "Betty" Whittaker, retired associate secretary of the MIT Corporation, will be held Wednesday, Oct. 11 at 2 p.m. in Killian Hall (Room 14W-111). A reception will immediately follow. Inquiries may be directed to the MIT Chairman's Office at x3-4661.

SMOOT

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California at Berkeley. Co-winner Mather is currently at NASA's Goddard Space Flight Center.

George Smoot is a distant relative of another Smoot in MIT lore. In 1958 that Smoot, Oliver R., was rolled head over heels by his fraternity brothers across the Harvard Bridge to measure the span in body lengths. That distance was found to be exactly 364.4 smoots plus an ear.

The stunt became so famous that the new Nobel laureate was often confused with his predecessor. George Smoot wrote about the experience in a short digest on the web.

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17 faculty members promoted

The Executive Committee of the MIT Corporation has approved promotion for 17 faculty members to the rank of full professor. All appointments were effective July 1.

David W. Miller

Aeronautics and Astronautics
Education: S.B. 1982, S.M. 1985, Sc.D. 1988 (all from MIT)
Joined MIT faculty: 1997
Tenured: 2002

Miller is an internationally recognized leader in the development of technologies, processes and tools required to produce cost-effective designs of space telescope missions. His work has significantly increased the resolving power of telescopes and led to replacement of thrusters with electromagnets to control spacecraft.

Paula T. Hammond

Chemical Engineering
Education: S.B. 1984 (MIT), M.S. 1988 (Georgia Tech), Ph.D. 1993 (MIT)
Joined MIT faculty: 1995
Tenured: 2002

Hammond is a world-renowned expert in the synthesis of tailored, functional materials. Her work is characterized by interesting chemical synthesis, careful understanding of the fundamental secondary interactions that guide polymer self-assembly, development of novel processes and the choice of important problems.

Frank B. Gertler

Biology
Education: B.S. 1985, Ph.D. 1992 (both from University of Wisconsin at Madison)
Joined MIT faculty: 1997
Tenured: 2003

Gertler is a leader in the field of cell motility. His major contribution has been to decipher a fundamental new mechanism by which signaling pathways that control remodeling of actin cytoskeleton can have profound effects on cell motility and morphology.

Mitchel J. Resnick

Media Arts and Sciences
Education: B.A. 1978 (Princeton), M.S. 1988, Ph.D. 1992 (both from MIT)
Joined MIT faculty: 1992
Tenured: 1999

Resnick's research focuses upon rethinking learning and education in the context of new computational technologies. He has concentrated particularly on development of new educational technologies that encourage and support learning through designing and experimenting.

Alexandre Megretski

Electrical Engineering and Computer Science
Education: M.S. 1985, Ph.D. 1988 (both from Leningrad University)
Joined MIT faculty: 1996
Tenured: 2001

Megretski has established himself as one of the world's top researchers in systems and control theory. He is well known for his work on Integral Quadratic Constraints (IQC), a methodology for the analysis and design of feedback systems with nonlinearity, time-variation and uncertainty.

Daniela Rus

Electrical Engineering and Computer Science
Education: B.S. 1985 (University of Iowa), M.S. 1990, Ph.D. 1992 (both from Cornell University)
Joined MIT faculty: 2004
Tenured: 2004

Rus is a world leader in the area of self-organizing systems, which may be comprised of mobile robots, mobile or stationary sensors and actuators. She has built novel hardware devices, invented new algorithms and developed many of the first reconfiguring robots.

Martin Rinard

Electrical Engineering and Computer Science
Education: Sc.B. 1984 (Brown University), Ph.D. 1994 (Stanford University)
Joined MIT faculty: 1997
Tenured: 2002

Rinard is one of the top researchers in three areas: program analysis, compiler design and programming language design. In recent years, he has made significant intellectual contributions to formal analysis of programs, object-oriented programming and computer security. His recent work on failure-oblivious computing is a novel way of improving the reliability and security of computing systems.

Diane E. Henderson

Literature
Education: B.A. 1979 (College of William and Mary), M.A. 1980, M.Phil. 1983, Ph.D. 1989 (Columbia University)
Joined MIT faculty: 1995
Tenured: 1999

Henderson, a scholar in Shakespeare and Renaissance studies, will soon publish a book considering reworkings of Shakespearean plays and situations in fiction and film from the early 19th century to contemporary times. Henderson also regularly edits and contributes to edited volumes, new editions of Shakespeare texts and encyclopedias.

Janet Sonenberg

Music and Theater Arts
Education: B.A. 1971 (Tufts University), M.F.A. 1978 (New York University)
Joined MIT faculty: 1992
Tenured: 1999

Sonenberg focuses on hands-on work in the theater. She has developed an original method that directly engages with the actor's imagination and offers a rich alternative to the necessity of drawing upon firsthand experience to convey character and emotional depth. Her method has since been adopted by the Royal Shakespeare Company in England.

Michael Greenstone

Economics
Education: B.A. 1991 (Swarthmore College), Ph.D. 1998 (Princeton University)
Joined MIT faculty: 2003
Tenured: 2003

Greenstone is a leader in the field of environmental economics. He is best known for his empirical research on topics related to air pollution policy, including the Clean Air Act, and he has made important contributions to the economic analysis of pollution policy, household risk tolerance and the health effects of varying pollution levels.

Elizabeth A. Wood

History
Education: A.B. 1980 (Harvard), M.A. 1986, Ph.D. 1991 (both from University of Michigan)
Joined MIT faculty: 1990
Tenured: 1998

Wood is at the forefront of an emerging new generation in the field of Soviet history. She aims to go beyond sterile ideological debates and pursue intensive empirical research made possible by the recent opening of the Soviet archives. She also focuses on the experience of ordinary people and on how language shapes social identity.

Gigliola Staffilani

Mathematics
Education: B.S. 1989 (Università di Bologna), S.M. 1991, Ph.D. 1995 (both from University of Chicago)
Joined MIT faculty: 2002
Tenured: 2002

Staffilani is among the leading young analysts in the study of dispersive nonlinear wave pde's, used for modeling wave phenomena. Two of her recent advances include proof of the symplectic nonsqueezing of the Korteweg-de-Vries flow and proof of global well-posedness for the critical nonlinear Schrödinger equation in 3-D.

Dennis Freeman

Electrical Engineering and Computer Science
Education: B.S. 1973 (Pennsylvania State University), S.M. 1976, Ph.D. 1986 (both from MIT)
Joined MIT faculty: 1995
Tenured: 2002

In his research, Freeman has overcome longstanding challenges in the hearing field, generating breakthrough understanding of the electrical, mechanical and biological workings of the inner ear. In particular, he has developed and applied new metrology techniques to study the motions of sensory receptor hair bundles, and to study properties of the tectorial membrane.

Franz-Joseph Ulm

Civil and Environmental Engineering
Education: Diplôme-Ingénieur 1990 (TU Munich/ENPC), Docteur-Ingénieur 1994 (ENPC, Paris), Habilitation 1998 (ENS de Cachan)
Joined MIT faculty: 1999
Tenured: 2003

Ulm is the world leader of his generation in the research of cement-based materials. He has made important innovations in both theory and experiments, including developing the nano-indentation tests to provide basic information on the smallest scale, and extending the mathematical technique of multiple-scale homogenization to predict the behavior of concrete on the macro scale.

Anne E.C. McCants

History
Education: A.B. 1984 (Mount Holyoke College), M.A. 1985 (UCLA), Ph.D. 1991 (University of California at Berkeley)
Joined MIT faculty: 1991
Tenured: 1998

McCants is an early modern European economic historian. Her research, which focuses on consumption patterns, global trade, and the life of the poor in the early modern period, have established her as an internationally recognized contributor to the fields of economic history, world history, demography, and women's and family history.

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Nanoparticles brighten brain imaging

Cathryn M. Delude
News Office Correspondent

If you want to see precisely what the 10 billion neurons in a person's brain are doing, a good way to start is to track calcium as it flows into neurons when they fire.

To that end, Alan Jasanoff at the McGovern Institute for Brain Research at MIT has developed a new nano-sized calcium-sensing contrast agent that is detectable by magnetic resonance imaging (MRI) scanners, machines that can be used for detailed noninvasive brain imaging.

The work is reported in the early online edition of the Proceedings of the National Academy of Sciences the week of Sept. 25 to 29.

In an application known as functional MRI (fMRI), MRI machines are already increasingly used to observe brain functions as people—or animals—undertake various activities like reading or learning. But Jasanoff notes that current fMRI technology has limitations.

"Using conventional fMRI to study the brain is like trying to understand how a computer works by feeling which parts of it are hot because of energy dissipation in different components," said Jasanoff, who also holds appointments as an assistant professor in MIT's Department of Nuclear Science and Engineering, Department of Brain and Cognitive Sciences, and Biological Engineering Division.

The analogy is apt, because fMRI indirectly measures neural activity by detecting changes in blood flow to brain regions with increased energy requirements. But these hemodynamic changes occur several seconds after the neurons actually fire, too slow to study precise neural activity. Further, the spacing of tiny blood vessels limits the spatial resolution of the technique to volumes containing at least 1,000 neurons, too coarse for discrimination of highly specialized functional areas within a brain region.

Calcium, however, provides a direct measure of neural activity because calcium almost instantly enters neurons when they fire, and the faster the rate of firing, the higher the calcium level. Thus, tracking calcium levels in the brain actually follows information flow through the brain's circuitry.

MRI detects changes in magnetic properties, so to be visible to MRI, a calcium contrast agent must include a magnetically active "paramagnetic" component.

So Jasanoff designed the new sensor to incorporate so-called "superparamagnetic nanoparticles"—extra-strength molecular-sized magnets previously designed for ultrasensitive tumor imaging. They produce large MRI contrast changes capable of producing very high-resolution images.

Jasanoff's sensor is actually made from two similar types of superparamagnetic nanoparticles that stick to each other like Velcro-coated balls when calcium levels rise. This aggregation is reversible, which allows the sensor to indicate the temporal dynamics of calcium-related neural activity, such as the sequence in which populations of cells become active, or the synchronization of neurons during certain behaviors.

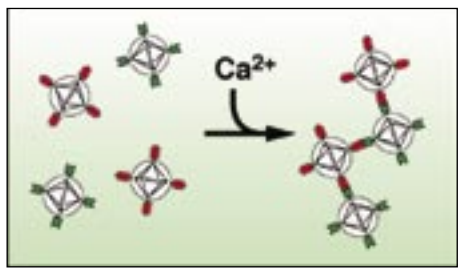

PHOTO / **ALAN JASANOFF**

Nanoparticles coated with two proteins (red and green) form mixed aggregates when calcium levels rise. MRI machines can detect the aggregates, allowing researchers to monitor calcium levels in neurons.

Graduate student Tatjana Atanasijevic of nuclear science and engineering, the lead author of the paper, is working on methods to apply the calcium sensor in living brain cells.

The contrast sensors Jasanoff is developing "will be tools for making the shift from imaging gross functional properties of the brain through its hemodynamic changes to a fine-tuned analysis based on information flow involving cells and circuits," he said. "There are many potential applications for studying learning, memory and behavior, and we need the new tools to get to the applications."

This research is supported by the Raymond & Beverly Sackler Foundation, the National Institute of Biomedical Imaging and Bioengineering and a McKnight Foundation Technological Innovations in Neuroscience award.

Data mining helps predict crystal structures

The same computer methods used by online sales sites to suggest books to customers can help predict the crystal structures of materials, an MIT team has found.

These structures are key to designing new materials and improving existing ones, which means that everything from batteries to airplane wings could be influenced by the new method.

The scientists report their findings in a recent online edition of Nature Materials.

Using a technique called data mining, the MIT team preloaded the entire body of historical knowledge of crystal structures into a computer algorithm, or program, which they had designed to make correlations among the data based on the underlying rules of physics.

Harnessing this knowledge, the program then delivers a list of possible crystal structures for any mixture of elements whose structure is unknown. The team can then run that list of possibilities through a second algorithm that uses quantum mechanics to calculate precisely which structure is the most stable energetically—a standard technique in the computer modeling of materials.

"We had at our disposal all of what is known about nature," said Professor Gerbrand Ceder of the Department of Materials Science and Engineering, leader of the research team. Ceder compared the database of crystal structures to the user database of an online bookseller, which can make correlations among millions of customers with similar interests. "If you tell me you've read these 10 books in the last year and you rate them, can I make some prediction about the next book you're going to like?"

The data-mining algorithm captures the physics of crystal structures in nature (provided by the preloaded database) and makes sophisticated correlations to generate an informed list of candidate structures based on historical knowledge. These candidate structures were previously assembled by scientists manually in a time-consuming and subjective process that often amounted to guesswork. The new algorithm, combined with a quantum mechanics algorithm, forms a two-pronged strategy that will make the process faster and more accurate.

Ceder's team of computational modelers can already determine, in the space of just a few days, atomic structures that might take months or even years to elucidate in the lab. In testing on known structures of just two elements, Ceder's group found the new algorithm could select five structures from 3,000-4,000 possibilities with a 90 percent chance of having the true structure among the five.

"It's all about probability and correlations," Ceder said. "Our algorithm gives us the crystal structure with a certain probability. The key was realizing we didn't need more than that. With a short list of candidate structures, I can solve the problem precisely with quantum mechanics."

According to Ceder, the new technique will enable a big leap forward in true computational design of materials with specific properties. For example, "If somebody wants to know whether a material is going to have the right bandgap to be a solar cell, I can't calculate the bandgap if I don't know the structure," he said. (Bandgap determines many properties such as electrical conductivity.) "And if I calculate the bandgap using the wrong structure, I may have a totally irrelevant answer. Properties depend on structure."

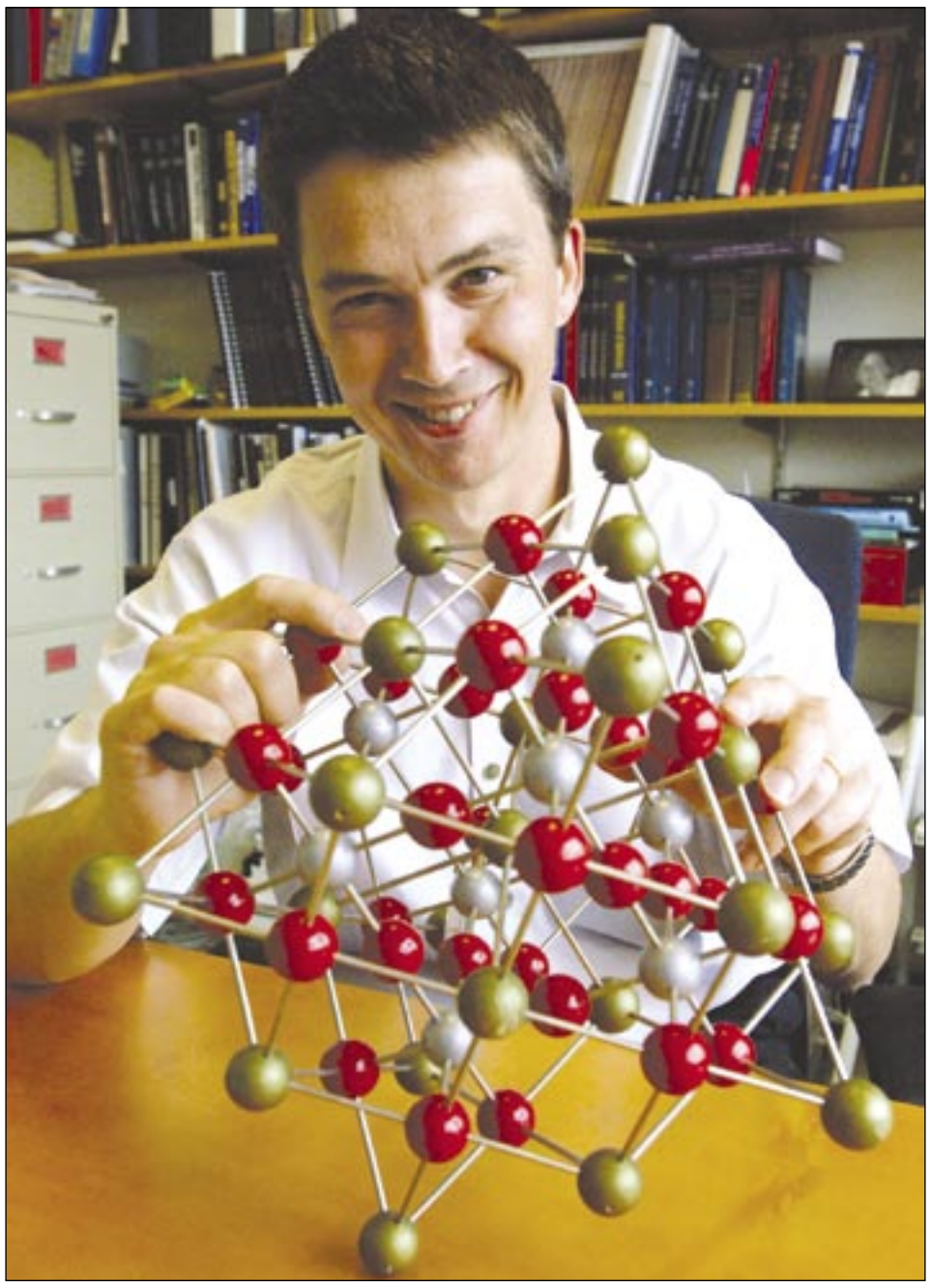

PHOTO / **DONNA COVENEY**

Professor Gerbrand Ceder holds up a model of a perovskite crystal. Ceder and his team of researchers have used data about such crystals to come up with a method for predicting the structure of materials.

Contributing to the work were graduate students Christopher Fischer and Kevin Tibbetts, both of materials science and engineering, and former postdoctoral associate Dane Morgan, now at the University of Wisconsin at Madison.

This work was funded by the National Science Foundation and the Institute for Soldier Nanotechnologies.

Generator could spark energy savings

Sasha Brown
News Office

An innovative residential generator that can produce both heat and electricity could spark a revolution in energy efficiency, said Eric Guyer (S.M. 1974, Sc.D. 1977), the CEO of Climate Energy, during a recent MIT Energy Club talk.

Guyer described Climate Energy's micro-combined heat and power unit (micro-CHP) to the crowd gathered in the Tang Center as "hopefully, the next big thing in energy."

Guyer's talk was part of the Energy Club's lecture and discussion series, sponsored by the Graduate Student Council. These biweekly events occur year-round and feature lecturers or student-led discussions on important energy topics.

The idea for combined heat and power (CHP) is nothing new, Guyer said. "Thomas Edison's first power plant was combined," he explained. Still, the idea of generating both heat and energy in a way that is not only affordable but also quiet enough for use in a private home is a more recent development.

"On an industrial scale, CHP is used all the time," Guyer said. A natural gas-powered micro-CHP unit has the potential to save the consumer money by using the same fuel they buy anyway to generate both heat and electricity with greater efficiency.

The micro-CHP systems are driven by heat demand, delivering electricity as the byproduct. "This is all about providing thermal comfort to homeowners," Guyer said.

The unit is composed of two parts, one that acts as the generator and another that acts as a traditional air-handler or furnace, blowing hot air into the home.

Currently being used in close to 30,000 homes in Japan and 20 beta test spots around Massachusetts and New York, the micro-CHPs have been very well received. Although the initial cost is more than double that of a traditional furnace, the micro-CHPs can save users up to $700 a year in electric bills, Guyer said. They even come with a backup power supply if the electricity goes out for any reason.

The machines also have the advantage of being far superior at conservation, Guyer said. "Two-thirds of the power in a central station is thrown away," he explained. The micro-CHP utilizes more than 85 percent. "Micro-CHP in the home is one of the biggest things someone could do to reduce their carbon footprint."

Outside the Tang Center, a truck from Guyer's company, Climate Energy, was running free demonstrations of its micro-CHP unit, which will be available this fall. "So far people seem very happy," Guyer said.

"Many were surprised to see how quiet the generator was and how much heat it produced that could be used for space heating," said graduate student Derek Supple of the MIT Energy Club. "The talk was just as we intended: relevant to a broad group of disciplines and exciting due to the innovative nature of this residential-scale technology."

PHOTO COURTESY / **NASA**

Heidemarie Stefanyshyn-Piper

1st alumna walks in space

John Tylko
News Office Correspondent

NASA astronaut Heidemarie M. Stefanyshyn-Piper became the first MIT alumna to walk in space during the successful STS-115 space shuttle mission, Sept. 9 through Sept. 21.

Stefanyshyn-Piper spent more than 13 hours on two extravehicular activities (EVAs) outside of space shuttle Atlantis while it was docked with the International Space Station. She was responsible for assembling a major truss segment, which includes a new set of photovoltaic solar arrays that provide power to the space station.

Stefanyshyn-Piper and fellow astronaut Joseph Tanner were also the first EVA crew to spend the night in the space station's Quest airlock module as part of a new procedure to help purge nitrogen from their bloodstreams. This procedure helps prevent decompression sickness, commonly referred to as the "bends," when the astronauts perform space walks in a spacesuit that is pressurized at a significantly lower pressure than the space station.

"One of the things about doing EVAs in space is you have the opposite effect of going diving," she said in a recent interview. "When you go diving, you go from the Earth's atmosphere to a higher atmosphere and so when you come back up you have to decompress. Well, the same thing happens when you go out on a spacewalk because you're inside the space station at 14.7 psi nominally, and when you go out on your spacewalks, you're only at 4.3 psi."

Stefanyshyn-Piper was also the prime operator of the space station's robotic arm and was the overall lead for transferring supplies from the shuttle's cargo module to the space station.

Stefanyshyn-Piper received an S.B. in mechanical engineering in 1984 and an M.S. in mechanical engineering in 1985. As an MIT undergraduate, she was a member of the women's varsity crew team and received its Most Valuable Player Award in 1982.

Stefanyshyn-Piper participated in MIT's Navy ROTC Program and received her commission as a U.S. Navy officer upon graduation in June 1985. She gained extensive experience as a diver and salvage officer and currently holds the rank of captain in the U.S. Navy.

She was chosen as a NASA astronaut in May 1996 and trained for more than a decade for her first mission into space. The STS-115 crew was selected in February 2002, one year before the Columbia accident, and spent more than four years training for its mission.

Only six other women astronauts and one woman cosmonaut have walked in space. Since the space station assembly effort began in 1998, a total of 72 EVAs have been conducted by 63 astronauts and cosmonauts from six different countries. Stefanyshyn-Piper is only the fifth woman astronaut to walk in space in support of the space station assembly effort.

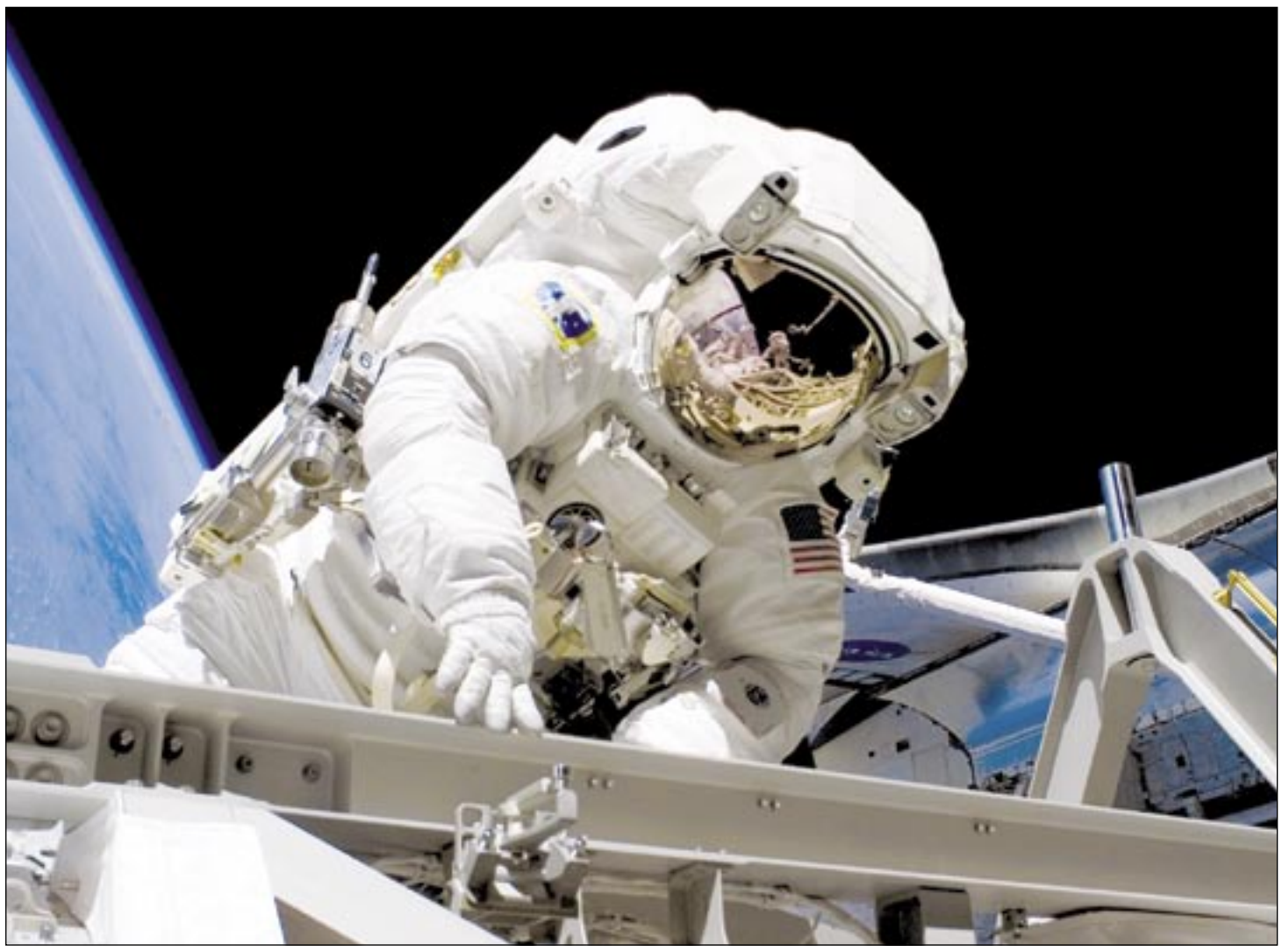

PHOTO COURTESY / **NASA**

NASA mission specialist Heidemarie Stefanyshyn-Piper pauses for a moment during her Sept. 12 spacewalk, during which she assembled a major truss segment of the International Space Station.

MIT logs 40 years of flight

NASA astronaut Buzz Aldrin (Sc.D. in aeronautics and astronautics, 1963) became the first MIT graduate to walk in space during the Gemini 12 mission in 1966. Three years later, on July 20, 1969, Aldrin and fellow astronaut Neil Armstrong conducted the first extra-vehicular activity (EVA) on the lunar surface during the Apollo 11 mission.

Three other MIT graduates, David Scott (S.M. and E.A.A. in aeronautics and astronautics, 1962), Charles Duke (S.M. in aeronautics and astronautics, 1964), and Edgar Mitchell (Sc.D. in aeronautics and astronautics, 1964) conducted a total of nine more lunar surface EVAs during the Apollo program. Russell Schweickart (B.S. and M.S. in aeronautics and astronautics, 1963) conducted the first EVA in the Apollo program in 1969.

During the space shuttle program, seven other MIT graduates completed a total of 21 EVAs including Franklin Chang-Diaz (Sc.D. in nuclear engineering, 1977), Mark Lee (S.M. in mechanical engineering, 1980), Jay Apt (Ph.D. in physics, 1976), John Grunsfeld (S.B. in physics, 1980), Edward Fincke (S.B. in aeronautics and astronautics and S.B. in earth, atmospheric and planetary sciences, 1989), Michael Massimino (S.M. in 1988, M.E. in 1990 and Ph.D. in mechanical engineering, 1992, and S.M. in technology and policy in 1988), and Daniel Tani (S.B. in 1984 and S.M. in mechanical engineering, 1988).

MIT professor and former NASA astronaut Jeffrey A. Hoffman completed four spacewalks, including the first EVAs to service the Hubble Space Telescope on a space shuttle mission in 1993.

Genetic 'roadmap' charts links between drugs and human disease

Nicole Davis
Broad Institute

A research team led by scientists at the Broad Institute of MIT and Harvard has developed a new kind of genetic "roadmap" that can connect human diseases with potential drugs to treat them, as well as predict how new drugs work in human cells.

Called the "Connectivity Map," the new tool and its uses are described in the Sept. 29 issue of Science and in separate papers in the Sept. 28 early edition of Cancer Cell.

The three papers show the map's ability to accurately predict the molecular actions of novel therapeutic compounds and to suggest new applications for existing drugs. Based on these initial results, the researchers propose a public project to expand the Connectivity Map—in the spirit of the Human Genome Project—to accelerate the search for new drugs to treat disease.

"The Connectivity Map works much like a Google search to discover connections among drugs and diseases," said senior author Todd Golub, the director of the Broad Institute's cancer program, an investigator at the Dana-Farber Cancer Institute, an associate professor of pediatrics at Harvard Medical School, and an investigator at the Howard Hughes Medical Institute. "These connections are notoriously difficult to find, in part because drugs and diseases are characterized in completely different scientific languages."

A key challenge in biomedicine is to connect each human disease with drugs that effectively treat it while understanding the molecular basis for the drugs' effects. To solve this problem systematically, the scientists described the effects of drugs and diseases in the common language of "genomic signatures," meaning the full complement of genes that the drugs turn on and off.

To create a first-generation Connectivity Map, the scientists measured the genomic signatures of more than 160 drugs and other biologically active compounds. They next developed a computer program to compare the signatures of the drugs with each other and also with the signatures seen in diseases. In this way they were able to discover the mechanisms underlying a novel drug candidate for prostate cancer, and that a drug currently used to treat one disease may be useful in another.

"This is a powerful discovery tool for the scientific community," said Justin Lamb, the lead author of the Science paper and a senior scientist at the Broad. "By analyzing just a small fraction of available drugs, we have already confirmed several biological connections between drugs and human disease, and made entirely new ones, too."

Like other scientific databases, the true value of the Connectivity Map lies in its capacity to be queried by nearly any researcher with a computer. The genomic signature of a particular disease, drug or other aspect of human biology serves as the "search word." Potential functional connections are revealed through a rank-ordered list of reference compounds in the database that have matching signatures.

One of the surprising results to emerge from the Connectivity Map involves gedunin, a plant derivative that, despite a long history of medicinal use, is not well understood molecularly. The researchers identified gedunin as a molecule that disrupts hormone signals in prostate cancer cells. They then used the Connectivity Map to help uncover its precise molecular action. As confirmed through additional work, gedunin disrupts a key quality control mechanism in the cell.

Another key finding suggests a new way to overcome drug resistance in cancer. Using the Connectivity Map, a team led by Scott Armstrong, an assistant professor at Harvard Medical School and Children's Hospital Boston and an investigator at the Dana-Farber Cancer Institute, identified the FDA-approved immunosuppressant drug, sirolimus (also known as rapamycin), as a therapeutic candidate for overcoming drug resistance in a form of human leukemia.

"Although this first version of the Connectivity Map is limited mainly to drugs, the same concepts could be applied universally across all facets of human biology," said Eric Lander, an author of the Science paper, director of the Broad Institute and MIT professor of biology. "Expanding this initial map to encompass all aspects of human biology would provide a valuable public resource for the scientific community. Such an effort would parallel the sequencing of the human genome, both in its scope and in its potential to accelerate the pace of biomedical research."

Data from this work are publicly available at www.broad.mit.edu/cmap. A web-based tool for scientists to perform their own analyses using the Connectivity Map is also freely available at this site.

IS&T gets eco-friendly with hybrid van

Diana Hughes
Information Services and Technology

In cooperation with the Ford-MIT Alliance, MIT Information Services and Technology (IS&T) has acquired a 2006 Ford Escape Hybrid as the first step in replacing all IS&T vehicles with more fuel-efficient and "environmentally friendly" cars and vans over the next several years. The Escape Hybrid replaces a 1997 Ford Econoline cargo van. The Escape Hybrid has an Environmental Protection Agency (EPA) city mileage rating of 36 miles per gallon versus 14 mpg for a new Econoline van.

In keeping with President Susan Hockfield's vision of MIT's leadership in the energy research and conservation fields, IS&T has been evaluating alternatives to standard cars and vans as it goes through the normal cycle of vehicle maintenance and replacement. IS&T examined several options for "green" vehicles including biodiesel, electric, compressed natural gas, hydrogen and hybrid technology. Hybrid technology has the advantage of being available commercially and offering both increased gas mileage and reduced pollution.

One of the challenges in purchasing an alternative-energy vehicle is the high cost of the technology. After reviewing the driving profile for IS&T use (vehicles are used by network, telephone and customer support staff to deliver computers, respond to service calls and perform other related activities), IS&T determined the savings in per mile costs from the hybrid technology would not offset the added cost of acquiring the hybrid vehicle for several years. While there were significant environmental advantages associated with the hybrid, there also would be increased costs.

IS&T's commitment to being at the forefront of energy conservation led it to work in partnership with MIT's Industrial Liaison Program to find a corporate partner to assist in the purchase of a hybrid vehicle. Kyle Pope, manager of the IS&T Departmental Information Technology Resource Team (DITR), worked to gain the sponsorship of Chancellor Philip Clay, and Simon Pitts and Joe Saleh, co-executive directors of the Ford-MIT Alliance, to assist in the purchase of the Ford Escape Hybrid. The Ford-MIT Alliance contributed funds to cover the difference in purchase price between a hybrid and nonhybrid vehicle. This contribution allowed IS&T to pass the initial cost hurdle of hybrid ownership and focus on the fuel savings and benefits to the environment.

If the Econoline van had been replaced with a new van of similar type, IS&T could expect EPA gas mileage ratings of around 14 mpg in the city, where the majority of the department's driving is done. The Escape Hybrid's gas mileage rating is 36 mpg in the city. This means with an expected driving profile of 5,000 miles per year, the Escape Hybrid will emit only 28 percent as much carbon dioxide as the Econoline van, with a similar reduction when compared to a new cargo van.

The Ford Escape Hybrid has been designated a U.S. EPA-certified SmartWay vehicle. The SmartWay label is given to those vehicles that score six or better on both the Air Pollution and Greenhouse Gas Scores, and have a total score of 13 or better when adding the two together. Vehicles that receive this designation are very good environmental performers relative to other vehicles, according to the Green Vehicle Guide, www.epa.gov/greenvehicles.

The Ford Escape Hybrid vehicle is a shared vehicle between IS&T DITR and PC Services. Further purchases of hybrid or other new technology vehicles will be reviewed as each vehicle comes up for replacement.

FACULTY

Continued from **Page 3**

Hari Balakrishnan

Electrical Engineering and Computer Science
Education: B.Tech. 1993 (Indian Institute of Technology, Madras), M.S. 1995, Ph.D. 1998 (both from University of California at Berkeley)
Joined MIT faculty: 1998
Tenured: 2003

Balakrishnan is a world leader in three distinct areas: computer networking, mobile systems and databases. In computer networking his new contributions include verifiable Internet routing, and in mobile systems his contributions include energy-efficient wireless protocols. He has recently become a force in the database community due to his research in streaming databases.

Alexander Byrne

Linguistics and Philosophy
Education: B.A. 1988 (Birkbeck College, London University), M.A. 1989 (King's College, London University), M.A. 1991, Ph.D. 1994 (both from Princeton University)
Joined MIT faculty: 1994
Tenured: 2002

Byrne's main research interests are color, perception and self-knowledge. He has achieved influential status in these areas partly through having co-edited the canonical sourcebook on the philosophy of color, and partly through his defense of a scientifically informed realism about perceptual conciousness and its objects.

VOTING

Continued from **Page 1**

should not be registered is kept off the rolls.

However, Selker said, improvements may actually disenfranchise some people, deliberately or by bureaucratic bungling. Selker cited a recent case in California in which people who had recently moved were in danger of being kicked off the rolls because of differences in their addresses between voting databases and motor vehicle license records.

The first day of the two-day conference will focus on such registration issues; speakers include Alexander Keyssar, professor of history and social policy at Harvard's John F. Kennedy School of Government; Jonathan Nagler, professor of politics at New York University; and Stephen Ansolabehere, MIT professor of political science.

"Voting has to be addressed in a multidisciplinary way," said Ronald L. Rivest, the MIT Andrew and Erna Viterbi Professor of Electrical Engineering and Computer Science, who will moderate several conference panels. "Voting is not a simple problem. The constraints and the requirements of voting are tough. You're trying to make sure the votes are actually private but that the voter can verify that (his or) her vote really is accounted for in the final tally—really contradictory requirements."

Of special interest are "poll books," or portable information databases brought into polling places, and how they would be used. "We hope we will help the Election Assistance Commission think about what would be a good direction forward in a world where registration has in some sense gotten more systematized and how to look at unintended consequences of the new laws on registration and what should be done in future, especially considering other changes to technology," Selker said. "The biggest one I'm thinking about is poll books, that is, having access to registration databases as opposed to just having a list, a page, a piece of paper."

The second day of the MIT conference will focus on whether a system of voter identification, such as a voter ID card, can or should be adopted, as some have proposed.

Ted Selker

"A lot of people in this country are worried about that because it's very costly and it can be used in various ways," Selker said. "For example, I just spoke with the Pakistani government last week; they said fake IDs account for 5 to 10 percent of the voting in Pakistan. That's pretty bad. So it can go either way, as a lot of these things can."

Speakers on voter ID include Jonathan Katz, professor of political science at Caltech, and Eric Fisher, senior specialist in science and technology at the Library of Congress. Dan Greenwood, MIT Media Lab lecturer, will speak on "Real ID," a "hugely controversial" proposal that all Americans get identity cards, Selker said. "We're all intrigued."

The last panel of the conference will feature Ross Underwood of Diebold and Howard Cramer of Sequoia Voting Systems. Voting-machine makers—Diebold in particular—have come under scrutiny over security issues.

While voting machines may be the latest wrinkle in election concerns, registration and voter eligibility have been issues throughout U.S. history, as debates raged over whether the right to vote should be determined by property ownership, race, sex or competency. While America wishes to be a beacon of democracy, this country has the world's most complex voting process, Selker said. "We are not the example of the best voting practice."

Rivest welcomed voting controversy as a way to open debate on improvements.

"One realizes that the voting system we have in this country is full of vulnerabilities and we need to pay more attention to improve the quality," Rivest said.

For information on the Oct. 5-6 Voter Identification/ Registration Conference, go to www.vote.caltech.edu.

CLASSIFIED ADS

Tech Talk runs classified ads in the first issue of each month. Members of the MIT community may submit one classified ad per month. 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

Travel Trailor, 1994, 13' 9", trails easily, low mileage/use, great shape! Sleeps 4, 12,000 BTU furnace, quick recovery water heater, stove, 2 way refrigerator, shower/Porta Potti, skylight, rubber roof. Call 339-237-0960 or e-mail bwyoung@mit.edu.

2002 Dodge Ram 2500, quad cab, 41K, loaded. Excellent condition $16,500. Pictures avail. E-mail kweisse@adelphia.net.

Minivan for quick sale - $800. 1996 Ford Windstar LX, quad seating, 114K. Crack on the windshield, starts every day, engine sounds strong. For more information or to test drive, call 617-258-3458 days, 978-535-0270 nights.

1992 Honda Civic, 4D, 5 speed, AC, AM/FM cassette, 165K, has rust but runs great, > 35 mpg highway. $1000. E-mail jync@mit.edu.

1994 Oldsmobile Delta 88, good condition, 97K miles, $2500/bst. Call 781-724-3343.

FOR SALE

Old spruce top bass, $1,500. Not plywood, bass can be seen in Cambridge. Has gig bag, bow needs re-hair.

Wood kitchen table w/ 5 chairs, fold out leaf, natural color tabletop, blue legs on table & chairs, $150/bst. HP Pavilion computer system, Pentium II 166 mhz running W98, HP 600 printer, Hitachi 17" monitor, loads of software, $50/ bst. E-mail drs@haystack.mit.edu or call 781-981-5407 8 to 4, M-F.

New Ralph Lauren black strappy simple dress, $50. Falls below the knee; size 6-8. Perfect condition. Pics avail. Contact forsale@media.mit.edu or x2-5687.

Wonder Horse (spring rocking horse), free with pickup in Acton. About 25 yrs old, used but loved. Ginny Siggia, siggia@mit.edu (e-mail only please).

Futon w/ yellow cover $45, file cabinets, wood, each $50; mahogany small chest, four drawers, new condition $200. No reasonable offers on the furniture rejected. Oriental rugs, $150 and up.

Girls bicycle, Made by Jeter, Reactor & Manufacturing, double hand breaks, adjustable reflectors, lug frame, high ten tubing, in very good condition, asking $30. Contact 781-893-3377 or k1cei@comcast.net.

Moving sale: organ (Minnet 544, built-in speaker), bed, microwave oven, fridge (medium), table, chairs, lamps, carpets, kitchen items. Call x8-7372 or e-mail bongkim@mit.edu.

HOUSING

3BR apt. in pristine condition, Arlington Heights, walk to bus, nice town and school. $1850/ month. E-mail chihlueh@gmail.com.

3BR, 2 bath in top floor, three-story condo. Very close to Cleveland Circle (Green line). Belongs to Runkle School's area. Exceptional neighborhood. Very quiet, great sunlight in the afternoon. Call 617-713-0982, 617-595-6908, e-mail danteanzolini@yahoo.com.

For sale: pristine renovated Colonial in Jamaica Plain's Bourne neighborhood, designed for indoor/outdoor entertaining. 6 rooms, 3 BR, 1 1/2 baths. Updated systems include exterior paint, heat, roof, central air. Lorna Gibson 3-2503.

Lexington, 6 rm contemporized cape, $649,000, master BR suite, study, 2 BR's & bath upstairs, skylights, hdwd flrs, AC, 2 car gar. 781-981-2671.

Paris. Marais 2BR apt. Spacious, sunny, attractive. Fully furnished & equipped. Elevator. Minimum five months. Available 2007. $2500/ month. Call 617-247-2922.

MISCELLANEOUS

Balloons for holiday office parties avail. on campus. I am an experienced (10 years), creative balloon artist, avail. for holiday parties. Centerpieces, arches, balloon trees. Contact Jen at 452-3522 or jfield@mit.edu.

Do you need an assistant, help with research, data entry, typing notes or getting organized? I'm an MIT administrative assistant available for weekend and after 5 p.m. work. Email at brendar@mit.edu.

2 cats need new home. Adult domestic short hairs, brown & white, friendly, cuddly, good health. Must go b/c of allergies. Pics avail. Must go to healthy, good home. E-mail kculver@mit.edu.

VACATION

For sale: Deeded, life-long time-share week, early May. 5-star Westgate Resorts, Kissimmee, Fla. Modern, fully-furnished, ground floor villa, 2 BR, sleeps 6, hot tub, health club. Call Joe at 617-436-5663.

Hilltop Cabins, 2,000' above sea level, 56 acres, 10,000 acres state wildlife area, fully-equipped 3 BR, hiking, biking, fishing, hunting, foliage views. $450/wk. Other rates av. Call Joe 781-893-5224 days.

STUDENT EMPLOYMENT

Positions for students with work-study eligibility

Cambridge Community Center is searching for someone to come in 1-2 times/week to teach science to after school students grades 3-8. Hours between 3:30-5:30 but are flexible. Wage can be discussed. Requirements: 18 years of age or older, pass a CORI background check, motivated & enjoy working w/ children. Contact brendanccc@hotmail.com.

Public and Community Affairs Dept. of Federal Reserve Bank of Boston seeks research intern for fall 2006. Intern provides support to senior staff on current research activities. Responsibilities include: search/obtain data, present data in charts, prepare written summaries, proofread, others as required. Qualifications: strong analytical, communication and organization skiils. Prior research assistant experience prefered. Junior or senior w/ course work in community development, economics, finance or related fields. $18/ hr. Contact anna.steiger@bob.frb.org.

Composer Child offers insights on music

New work to premiere at Kresge Oct. 15

Mary Haller
Office of the Arts

"Punkie Night," a Halloween-like custom in parts of England, is the inspiration for a new piece with the same name by British-born Professor of Music Peter Child. The piece will receive its world premiere by the New England Philharmonic Orchestra under the baton of music director Richard Pittman on Oct. 15 at 3 p.m. in Kresge Auditorium.

The recipient of numerous prizes and commissions, Child recently returned from an artist's residency in Alaska, where his commissioned work, "Promenade," received its world premiere at the Cross-Sound Music Festival.

He is currently the "Music Alive" composer-in-residence with the Albany Symphony Orchestra, which will premiere another of his works in spring 2007. Other upcoming premieres this season include commissions by two local ensembles, Boston Musica Viva and Winsor Music.

Mary Haller of the Office of the Arts recently asked Child about "Punkie Night," his music and his MIT teaching.

Q: Tell me a little about "Punkie Night."

A: This is very much an audience-friendly piece. It belongs in a genre of other orchestral works that depict the Gothic and the supernatural—including, famously, Berlioz's Symphonie Fantastique, which will also be performed at the October 15 concert. It is spooky and—hopefully—fun to listen to.

Q: What do you say when you're asked to describe your music?

A: There is a pronounced tendency toward transparency and directness in my recent music, both in terms of its form and its emotional rhetoric. I have also become very interested in folk themes and incorporating these into my pieces. I think that in both of these respects I am influenced by my English upbringing.

Q: Do you consider the audience when you're working on a composition?

A: Very much so. I see composing as a communication process among composer, performer and listener—and not just a one-way communication either. I am attentive to how players and audiences respond to my music and what those responses can tell me about my own music.

Q: Do you have suggestions about how to listen to new music?

A: Listen with an open mind and an open heart. Be curious. Accept some disappointments in the service of those moments in listening that will give you unexpected pleasure, provoke unexpected thoughts.

Q: What is some of the advice you give to your composition students?

A: First, that "form" is a verb, not just a noun: Think of musical form as a process that has to be reinvented every time, rather than as a mold into which you pour your ideas. And, second, a composition is never completed until it is performed.

Q: Are there aspects of the MIT environment that contribute to your work as a composer?

A: The entrepreneurial and creative atmosphere is contagious. I find it liberating.

Q: What do you learn from your students?

A: Because they are generally so inquisitive, intelligent and challenging, what I mostly learn is how to rethink the fundamental principles that I teach them. MIT is a special place, of course, and I do enjoy those moments that happen frequently to me—as an artist teaching at a preeminent science and engineering school—when the roles of teacher and student are reversed, when they share their knowledge and expertise about biology or computer science, etc., with me.

Tickets for the Oct. 15 concert are free to the MIT community with ID and are available at the door. Regular prices are $25, $20 senior citizens, $15 students. For more information, call 617-868-1222.

HST professor explores anesthesia

Lora Maurer
Harvard-MIT Division of Health Sciences and Technology

Raise your hand if you are more afraid of the prospect of general anesthesia than of surgery itself. If you raised your hand, you are not alone, according to Dr. Emery N. Brown, a faculty member at the Harvard-MIT Division of Health Sciences and Technology (HST).

A professor of health sciences and technology and of computational neuroscience in the Department of Brain and Cognitive Sciences (BCS), Brown explores what happens to the brain during anesthesia.

"We say we induce anesthesia and then 'wake up' the patient," Brown said. "But in French the patient is réanimé, or brought back to life. We haven't yet begun to think precisely about what we do, however. Anesthesia is not like sleep. It's not the same process."

Brown added, "Under anesthesia, one is insensitive to pain. If you were asleep, you would wake up if you had pain. Anesthesia has four aspects: loss of consciousness, analgesia, amnesia and loss of movement—all while remaining hemodynamically stable, i.e., alive."

These are the basic principles behind Brown's investigation into what happens in the brain as it undergoes anesthesia and later is "reanimated."

"We have a vast array of questions," Brown said. "The way we give anesthesia now, it is a bit like dumping it into the whole brain so it acts everywhere in the brain. But if we can pinpoint the areas of the brain that are affected or need to be affected to free us from pain, we could conceivably think about designing a drug or a way to administer a drug that, for example,

See **ANESTHESIA**
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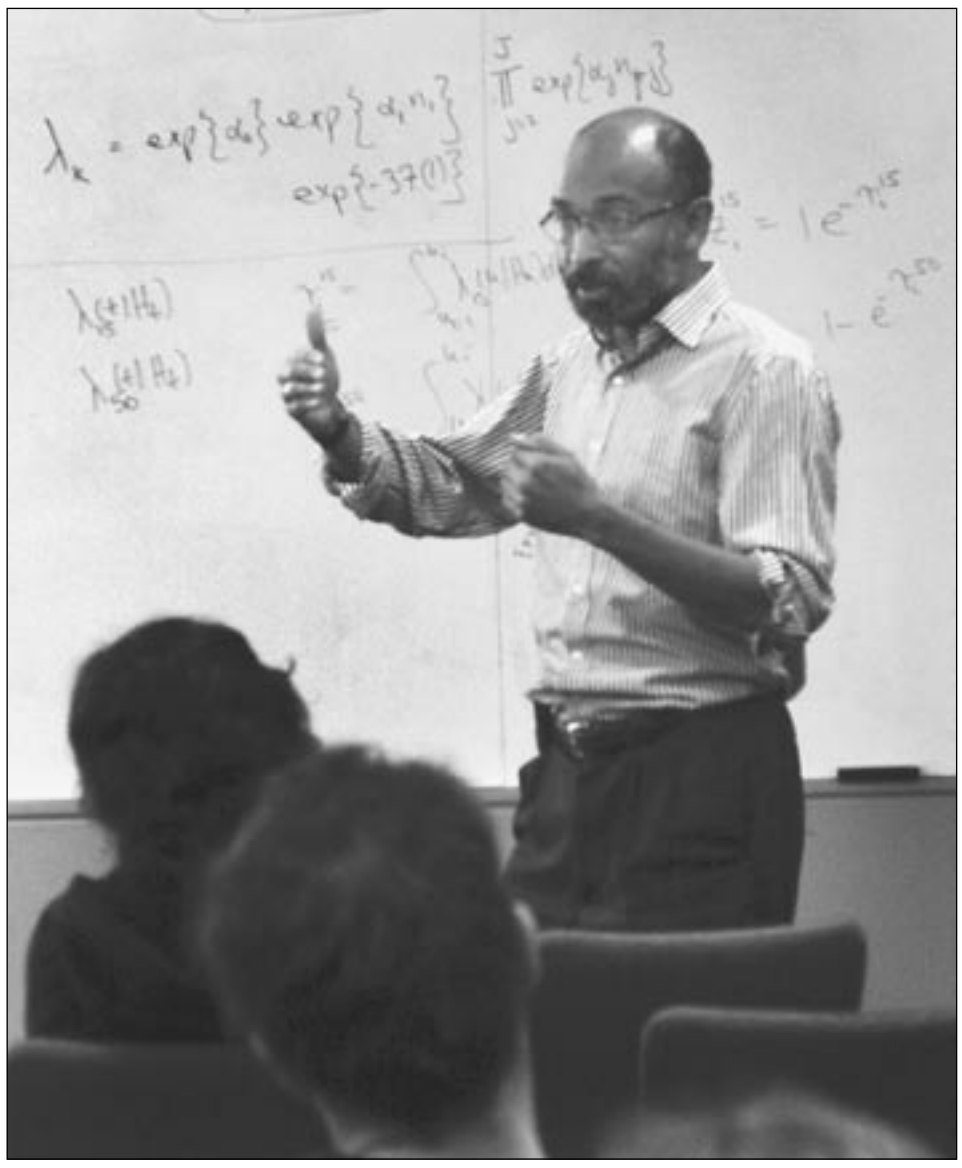


PHOTO COURTESY / **HARVARD-MIT DIVISION OF HEALTH SCIENCES AND TECHNOLOGY**

Dr. Emery N. Brown, professor in the MIT-Harvard Division of Health Sciences and Technology, studies what happens to the brain during anesthesia.

PHOTO / **DONNA COVENEY**

Alumnus Kudzai Takavarasha (S.B. 1999) talks to freshman Bonnie Krenz at the International Development Fair, held in Lobby 13 on Friday, Sept. 29.

Fair showcases international development opportunities Sept. 29

Sasha Brown
News Office

Roughly 50 departments, programs and student groups highlighted their international work at the fifth annual International Development Fair on Sept. 29 in Lobby 10 from 1 to 3 p.m. The event was designed to showcase the many groups, projects and activities at MIT that provide students with an opportunity to work on issues related to international development.

Offices like the Public Service Center, which provides opportunities for students to create their own projects, and the MIT Program in Developmental Entrepreneurship (DE), which focuses on design and implementation of commercially sustainable products and services for low-income communities around the world, participated in the fair along with student-led initiatives like FloodSafe Honduras, a group of MIT students and affiliates who work in Honduras to solve community problems using engineering and science skills.

"The fair brings students and organizations together, to promote awareness and encourage the exchange of ideas," according to the event web site.

For Sandy Pentland, the Toshiba Professor of Media Arts and Science, whose work in DE has been ongoing, the event is a good opportunity to start conversations. "The idea is to build a broader coalition so that people who are interested can do everything they might be interested in doing," said Pentland, who works in the Media Lab.

The annual fair is organized by the MIT International Development Network, a community network developed to promote and share information about activities, programs, events and formal academic offerings related to international development. The fair is the flagship event of MIT's International Development Week, which ran from Sept. 21 to 29 this year.

AWARDS AND HONORS

Professor Emeritus **Alan Davison** of chemistry is one of two recipients of the 2006 Jacob Heskel Gabbay Award in Biotechnology and Medicine. Davison and Alun Gareth Jones of Brigham and Women's Hospital will share the award for their role in the development of contrast agents used in cardo-diagnostic procedures.

The award, which consists of a $15,000 cash prize and a medal, was established at Brandeis University in 1989 by the Jacob and Louise Gabbay Foundation to recognize outstanding research in the biomedical sciences. An award ceremony and symposium will be held Nov. 6.

Subra Suresh, Ford Professor of Engineering, will receive an honorary doctorate degree from Sweden's Royal Institute of Technology in Stockholm on Nov. 17. Suresh was selected in recognition of his pioneering and multidisciplinary research that encompasses materials science and engineering, mechanical engineering, biological engineering and mechanics.

Anne M. Mayes, professor of materials science and engineering, will receive the 2007 Carl S. Marvel Creative Polymer Chemistry Award. She is being recognized for her "unique ability to blend theoretical and experimental studies to elucidate the behavior of polymers." She will receive the award, which consists of a plaque and an honorarium of $2,000, at a symposium held in her honor at the spring 2007 meeting of the American Chemical Society.

Two MIT students, **Rocco Ciccolini and Peter Oates**, were recently honored in Washington, D.C., as Environmental Protection Agency Science to Achieve Results (EPA STAR) graduate fellows. The graduate fellowship program is designed for students pursuing advanced degrees in environmental sciences.

Studio glass artist will give 2006 Hazlegrove lecture

Richard Marquis, one of the pioneers of the American studio glass movement, will present the Ninth Annual Page Hazlegrove Lecture on Glass Art on Tuesday, Oct. 10, at 7 p.m. in Wong Auditorium.

Marquis, from Whidbey Island, Wash., was one of the first American artists to work in the fabled Venini studio in Venice, Italy, where he traveled after receiving a Fulbright-Hayes Fellowship. He has shared this knowledge and expertise throughout the United States, Europe, Japan, Australia and New Zealand, expanding technical vocabularies, combining Venetian techniques with new and experimental approaches, and redefining glass as an artistic medium.

For more information, call x3-5309 or visit web.mit.edu/glasslab.

Reddy Kilowatt, right, a glass sculpture by Richard Marquis, combines classical and contemporary glass techniques then adds a good dose of whimsy.

PHOTO / **RICHARD MARQUIS**

MIT Sloan alum succeeds in business ... of fiction

Amy MacMillan
Leaders for Manufacturing Program

Procrastination has paid off pretty well for Cynthia Blair, an alumna of the MIT Sloan School of Management.

Back in 1977, when Blair was supposed to be working on her master's thesis, she instead spent winter break scratching out the opening 50 pages of a novel.

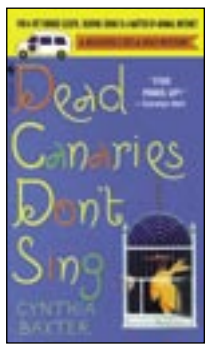
Cynthia Blair

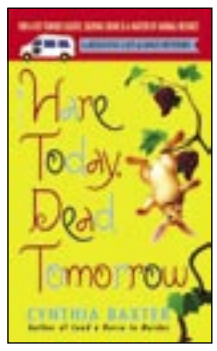
That first book, "Once There Was a Fat Girl," was published in 1981, inspiring Blair to quit her job to write full time. She managed to churn out 29 young-adult books and 13 women's novels between the early 1980s and the mid-1990s.

"It really snowballed into a writing career that kept me going financially," she said. At least it did for a while.

Mobile vet

In the mid-1990s, Blair's steady writing career stalled. Smaller publishing houses were gobbled up by larger companies, and the new conglomerates focused on featuring fewer books by big-name authors. Blair had a following, but had not made a commercial breakthrough. Her publisher, Ballantine Books, dropped her.





Blair picked up the pieces from the fallout, and for a while she tried other types of writing. But she missed fiction.

Then, inspired by a friend who's a veterinarian with a clinic on wheels, Blair decided to base a mystery series on a traveling vet.

Her latest book, "Hare Today, Dead Tomorrow," is the fourth in her Reigning Cats and Dogs Mystery Series, which she started in 2004 under the pen name Cynthia Baxter (www.cynthiabaxter.com). Blair chose to publish under a pen name because she was writing in a new genre, and didn't want readers to have preconceived notions based on her previous work.

The successful series features persistent veterinarian Dr. Jessica Popper, who finds herself solving murders in fictional Long Island settings. The fifth book in the series, "Right From the Gecko," is due to come out in spring 2007, and Blair plans to write at least two more books featuring Popper. Other books in the series include "Lead a Horse to Murder" and "Dead Canaries Don't Sing."

A head for business

If fiction writing and an M.B.A. from MIT Sloan seem incongruous, Blair points out that as an author it helps to know something about the outside world. Her first few books were set in a business environment. "Working in business gave me an understanding of how the world works," she said.

Now 53, and living on Long Island, her memories of MIT are some of the happiest of her life, she said. She experienced a lot of firsts living in Cambridge—first apartment, first time living in a city and her first time living independently. "Cambridge was such a vibrant place. There were so many clubs at MIT—yoga, ballroom dancing, drama. I couldn't believe how much there was to do."

Last year, Blair added travel writing to her resume. She's done several travel pieces for honeymoons.about.com and has traveled to Tahiti and Bora Bora. But she said she enjoys fiction writing more than any other kind of writing. "Nonfiction is easier, because it's fact. But, in fiction writing, you create your own world … it's almost as much fun as reading, and you are in control. I find it really exhilarating."

Blair and her husband, Michael Bell, live in Stony Brook, N.Y., and have four adult children between them. Blair is on the board of the MIT Long Island Alumni Association and is also president of the New York/Tri-State Chapter of the national writers' organization, Sisters in Crime.

French hip-hop artist will perform

Mary Haller
Office of the Arts

Acclaimed French hip-hop composer and choreographer Franck II Louise will present a talk and demonstration at MIT tonight titled, "Konnecting Souls: Hip Hop and New Technologies," at 7 in Kresge Little Theater.

Set to premiere in Paris at the end of October, "Konnecting Souls" transforms dancers into musical instruments using motion sensors.

A pioneer of the French hip-hop scene, Louise has composed music for some of France's most prestigious hip-hop companies and is co-writer of the film "Un Kif à l'Opéra."

In 2003, he began working with new technologies through the Konnecting Souls research project. In his latest work, dancers are fitted with sensors linked to a musical interface so that they can compose the music of the show in real time and become, in effect, instruments. The event is part of a series, "Hip-Pop in French: Contemporary Theater, Film, Dance, Comics and Graphic Arts," sponsored by MIT foreign languages and literatures section, the MIT Contemporary French Studies Fund, and the MIT Center for Bilingual/Bicultural Studies. For more information, call x3-4771.

ANESTHESIA

Continued from Page 7

would not affect the respiratory system, that would allow us to lose consciousness of pain but still allow us to breathe."

His research team explores this by administering more and more of an anesthetic drug while measuring brain activity using MRI, fMRI and EEG simultaneously.

"We see how the regions of the brain stop talking to one another," he said. "We give subjects an auditory task—they're asked to click a button with their left hand when they hear a low tone and click a button with their right hand when they hear a high tone—in order to develop a clinical definition of anesthesia. When the subject stops responding, we want to know what the EEG tells us and what the images show us."

One of Brown's collaborators is HST faculty member Dr. Richard Wurtman, professor of BCS and HST, who is looking for precise locations in the brain that are affected by anesthesia.

"Anesthesiology is being practiced today in much the same way it was when it was first developed at MGH 160 years ago," he said. "To me, anesthesiology is one of the most exciting frontiers in medicine. If you look at the deep question—where did this person go under anesthesia—we can get insights about consciousness, about sleep, about meditation. These are interesting, exciting medical and philosophical questions."

Newton's apple tree bears fruit at MIT

PHOTOS / **DONNA COVENEY**

Above, the plaque in the President's Garden; left, apple from Newton's tree.

Ed Vetter (S.B. 1942) gave MIT an apple tree that is a direct descendant of the tree under which Isaac Newton sat when he is said to have conceived the theory of gravity.

"I couldn't think of a better place than MIT to put a tree that illustrates a law of physics," says Vetter, whose tree stands in MIT's President's Garden, a sunny spot off the Infinite Corridor.

This fall, the beloved tree bore bright, healthy fruit—a sure sign of flourishing and a link between past and present days.

The MIT apple tree was grown from a cutting of a tree in England's Royal Botanical Gardens that was grown from a cutting of Newton's apple tree. Vetter was given the plant as a gift from the National Bureau of Standards when he left office as undersecretary of the U.S. Commerce Department in 1977. He presented the young plant to MIT that same year.

"I'll be honest with you, whenever I'm at MIT I always stop to see how the tree is doing," he says. "I've watched it grow from eight inches to 12 feet. It makes me feel good to know that it has flourished and that people enjoy it."

It is a fact, he says, that over the years the tree has become the apple of his eye.

—Liz Karagianis