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Wednesday, February 4, 2009

TechTalk
SERVING THE MIT COMMUNITY

Alum's $100 million gift targets AIDS vaccine

Ragon Institute to unlock mysteries of the immune system

Anne Trafton
News Office

MIT is joining Massachusetts General Hospital and Harvard in a bold new initiative to develop an AIDS vaccine, a challenge perfectly suited to the Institute and its world-leading expertise in engineering, computational sciences, molecular biology, clinical research and interdisciplinary research.

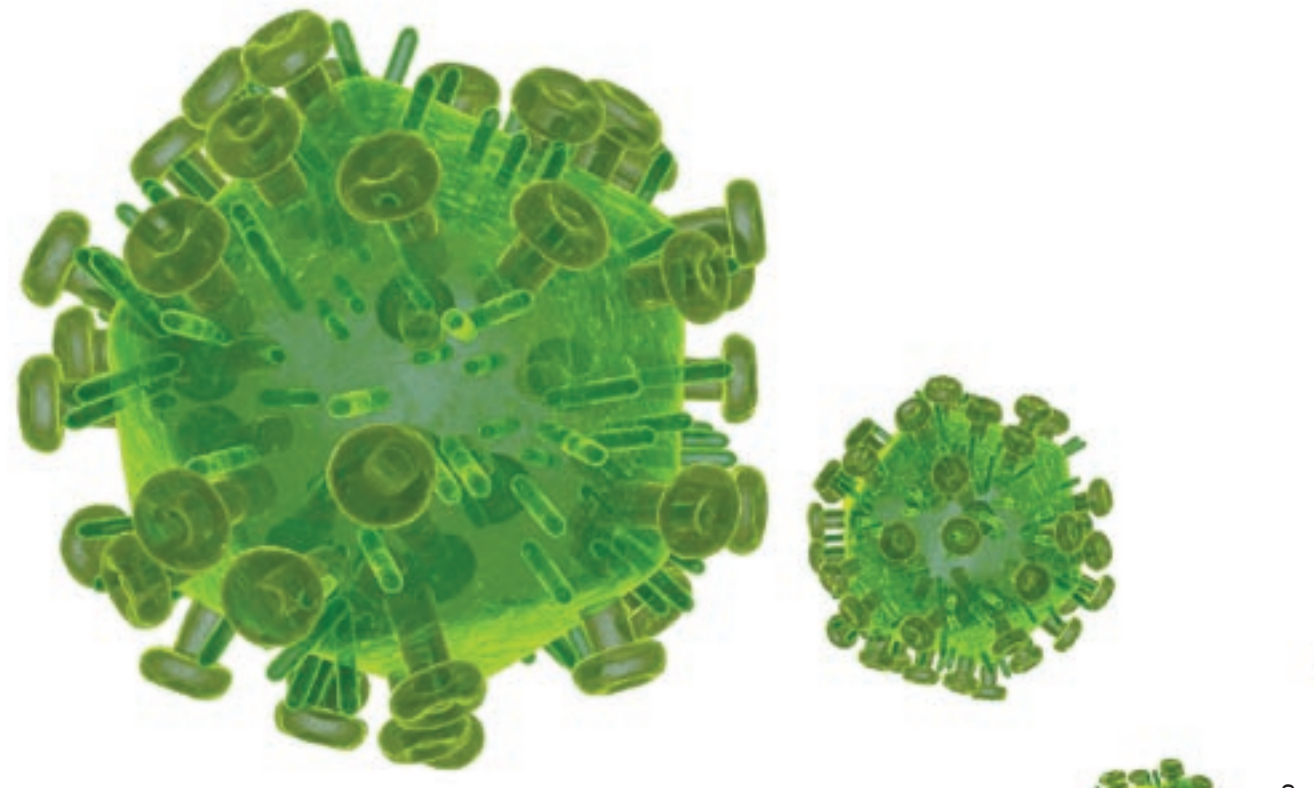
Founded through a 10-year, $100 million grant from the Phillip T. and Susan M. Ragon Institute Foundation, the Ragon Institute will bring together scientists and engineers from MIT, MGH and Harvard in a collaborative environment designed to support basic scientific research that can be applied for clinical use.

Phillip (Terry) Ragon is a 1971 graduate of MIT and founder of Cambridge-based InterSystems Corporation.

The new institute, announced Wednesday, Feb. 4, will play to MIT's strengths in interdisciplinary research, in particular the combination of engineering and life sciences, said Subra Suresh, dean of the School of Engineering and Ford Professor of Engineering.

"The study of human diseases has been a rapidly growing focus of research in the MIT School of Engineering in recent years," Suresh said. "The importance of the engineering disciplines in the study and eventual cure of human diseases is being increasingly emphasized by the biological and medical communities. We are delighted with the opportunities this very generous gift presents to further expand the role of MIT engineering in the study of human diseases, and we are excited about opportunities for even greater collaborations in this area with the School of Science, and between MIT, Harvard and the Massachusetts General Hospital."

▶Please see RAGON, **PAGE 7**



A 10-year, $100 million grant from Phillip T. and Susan M. Ragon Institute Foundation will create the Ragon Institute, bringing together scientists from MIT, MGH and Harvard. The initial focus of the institute will be one of the most pressing global health problems today: the need for an effective vaccine against the human immunodeficiency virus, shown here in an artist's rendering.

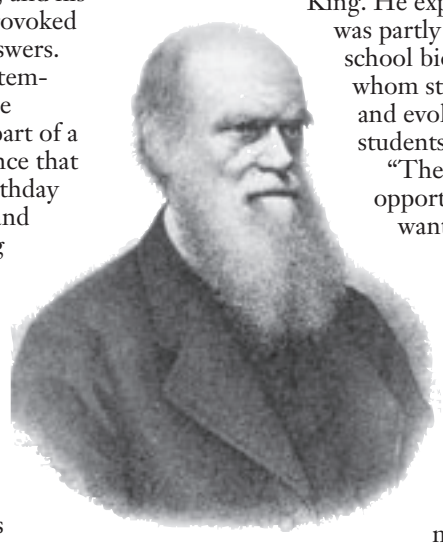
IMAGE / ISTOCKPHOTO

Darwin lives

MIT conference marks famed naturalist's 200th birthday

Stephanie Schorow
News Office

Charles Darwin was arguably the most radical, disruptive thinker of the 19th century, and his theories on evolution provoked as many questions as answers. Many of the mysteries stemming from his ideas were explored last month as part of a three-day MIT conference that celebrated the 200th birthday of the famed naturalist and examined his continuing impact on geology, biology and culture.



Among the questions addressed at the Jan. 22-24 Darwin Bicentennial Symposium were "How did fish start walking on land?" "Why do animals that live in dark underground caves lose eyesight and pigmentation?" and, "If humans evolved from primates, why aren't we continuing to evolve?"

The conference was meant not only to explore the ongoing questions posed by Darwin's work, but also to underscore the important place evolution has in education, said symposium organizer and MIT Professor of Molecular Biology Jonathan King. He explained that the event was partly geared toward high school biology teachers, many of whom struggle to make Darwin and evolution relevant to their students.

"The bicentennial was an opportunity that we didn't want to pass up," King said.

The conference, which took place a few weeks before Darwin's Feb. 12 birthday, began with an examination of the evolution of the solar system and the Earth and continued with sessions on the mechanics of evolution, Darwin's impact on culture and other topics.

The session on "Evolutionary Mechanisms Among Vertebrates" was perhaps the

▶Please see DARWIN, **PAGE 6**

Select W1 upgrades to proceed this spring

Work made possible by donor's generosity

PHOTO / **MELODY CRAVEN**

The W1 residence hall

Thanks to the extraordinary generosity of an anonymous donor, MIT will proceed with limited improvements to the W1 residence hall this spring.

"The valuable work that we can now do to W1 underscores our commitment to advancing this important project. It would not be possible without the generous support of a true friend of MIT," said Chancellor Phillip L. Clay.

The work to be done this spring consists of renewing the building envelope, including rebuilding and bracing parapets; cleaning and repointing masonry; replacing windows; and repairing limestone lintels and sills. In addition, copper roofs on the building's two cupolas will be reclad.

"This work is critical to the overall project and makes economic sense, as it protects the building from further decay," Clay said. "While we are delighted with the chance to do this

▶Please see W1, **PAGE 3**

Events at MIT

Today

• **MIT Hillel Ulpan** (Community Hebrew class) Kickoff — in partnership with MISTI/MIT-Israel program. 5-6 p.m. in W11, the community room. Are you interested in studying Hebrew? We offer classes for all levels, from beginners who don't speak a word, to those who are fluent.

Thursday, Feb. 5

• **MLK breakfast.** Johnnetta Betsch Cole will be the keynote speaker at the 35th annual Martin Luther King Jr. breakfast, with the topic of "Yes We Must: Achieve Diversity Through Leadership." 7:30 a.m. in Morss Hall. Registration required.

• **Opening Reception: LVAC Exhibitions.** 6-8 p.m. in E15-109. Opening for Melanie Smith: Spiral City and Other Vicarious Pleasures and Davis, Cherubini in Contention at List Visual Arts Center, running from Feb. 6-April 5.

Monday, Feb. 9

• "**Incomplete Environmental Regulation, Imperfect Competition, and Emissions Leakage."** Speaker: Meredith Folwie (Michigan), 4-5:30 p.m. in E51-376.

• **STS Colloquium — Agricultural Biotechnology and Society: African Perspectives.** Speaker: Calestous Juma, Professor of the Practice of International Development and Director of the Science, Technology, and Globalization Project, Harvard University's John F. Kennedy School of Government. 4-6 p.m. in E51-095.

Tuesday, Feb. 10

• **Recent advances, new trends, and future challenges within the Li-ion battery energy storage system.** Speaker: Jean-Marie Tarascon. 4:15-5:30 p.m. in 66-110.

Wednesday, Feb. 11

• "**Foreign Policy Challenges for the Obama Administration."** Speaker: Nicholas Burns, Kennedy School, Harvard University. Noon-1:30 p.m. in E38-615.

• "**A New World Economy."** Speaker: Martin Feldstein, Harvard University Discussant: Simon Johnson, MIT. 4:30-6 p.m. in E51, Wong Auditorium.

• **MIT Energy Club Lecture Series: Future of Energy Panel.** 6-7 p.m. in E51-335. Discussion on America's Energy Future with American Electric Power (AEP) Chairman & CEO, Michael G. Morris; Former New York Governor, George Pataki; President of Ceres, Mindy Lubber.

PHOTO / **DONNA COVENEY**

Waves of tranquility

An unknown artist recently turned Killian Court into a zone of tranquility and calm, in part thanks to the blanket of fresh snow that fell in January. A Zen garden was raked into the fluffy powder — signifying the ability to face all matters in life with calmness and perfect composure.

Awards &Honors

Bhatia among tech paper's 10 'Women to Watch'

Sangeeta Bhatia, a professor of electrical engineering and health sciences and technology, was named one of the 10 "Women to Watch" on Jan. 23 by the newspaper Mass High Tech.

Sangeeta Bhatia

Also a member of the David H. Koch Institute for Integrative Cancer Research at MIT and a Howard Hughes Medical Investigator, Bhatia was cited with nine others for leading their respective fields and for outstanding dedication to technology, entrepreneurship, lifelong learning and civic responsibility.

The women will be honored from 5:30-8:30 p.m. on Thursday, March 12, at The Charles Hotel, 1 Bennett St., Cambridge.

Love wins Dana grant

Chris Love, an assistant professor in the Department of Chemical Engineering, has been awarded a Human Immunology Grant from the Dana Foundation. The three-year, $400,000 grant will fund the project, "Single-cell Microtools for Profiling Human Immune Responses to HIV." The Dana Foundation is a private philanthropic organization with particular interests in brain research, immunology and arts education.

J-PAL wins major international award

Frontiers of Knowledge prize carries purse worth more than $500,000

Stephanie Schorow
News Office

MIT's Abdul Latif Jameel Poverty Action Lab (J-PAL), which uses scientific methods to assess the effectiveness of poverty relief and development programs, has been given a major international award in recognition of its contributions and innovations.

The BBVA Foundation Frontiers of Knowledge Awards seek to recognize and encourage world-class research and artistic creation by awarding 3.2 million euros (about $4 million) in eight categories such as basic science, climate change, arts and biomedicine.

J-PAL, established five years ago in MIT's Department of Economics, won the category of "development cooperation," which honors research endeavors and practical actions in the fight against poverty and exclusion. The BBVA jury cited J-PAL's impact on the field of development and in generating knowledge of how to address poverty. The award comes with a cash prize of 400,000 euros (about $515,000). J-PAL co-director and co-founder Esther Duflo, MIT economics professor, expressed her delight at the award and what it means for the poverty lab, which, she said, "attempts to respond accurately to the question about where development money really goes and which programs work and which not, so we can plan better for the future of development cooperation."

J-PAL is run by Duflo, the Abdul Latif Jameel Professor of Poverty Alleviation and Development; Abhijit Banerjee, the Ford Foundation International Professor of Economics; and Rachel Glennerster, executive director of the lab. The lab promotes the use of randomized trial methods, similar to methods used to test experimental drugs and vaccines, to evaluate development interventions in areas of education, health, women's empowerment and rural development. For example, J-PAL has measured the effectiveness of bed net campaigns in combating malaria and strategies to reduce teacher absenteeism.

The BBVA jury, chaired by the director of the Economic Growth Center at Yale, Mark R. Rosenzweig, said J-PAL's methodology has been "extended to policy questions where nobody had previously thought to use it and, in some cases, has led to important policy actions."

The annual Frontiers of Knowledge Awards are determined in collaboration with the Spanish Council for Scientific Research. The first recipient in the inaugural edition of the awards was announced in January in the "climate change" category; the honor went to U.S. researcher Wallace S. Broecker. The last six recipients will be announced later this month; the awards will be presented in a formal ceremony in spring.

For more information about J-PAL, see www.povertyactionlab.org.

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News in brief

New Sloan site to share teaching resources, knowledge

In an effort to share its knowledge with the world for free, MIT's Sloan School of Management launched a web site on Monday, Jan. 26, that offers case studies, teaching videos and other innovative instructional resources to anyone with access to the Internet.

While many business schools charge for these types of materials, MIT Sloan developed the new site, MIT Sloan Teaching Innovation Resources (MSTIR), to provide its most current work and developments at no charge. The web site can be found at https://mitsloan.mit.edu/mstir/.

MIT Sloan Deputy Dean JoAnne Yates said, "Our goal is to spread knowledge and make a difference in the world of business education — to have an impact on business education and where it is going in the future."

Although MSTIR's collection of materials covers a wide range of organizations, industries and geographic areas, it focuses on areas in which MIT Sloan's research and teaching are on the cutting edge and for which teaching resources are not as widely available. These areas currently include sustainability, industry evolution and global entrepreneurship. The school plans to add more areas as the site grows.

The web site also offers faculty at MIT Sloan and elsewhere exclusive access to teaching notes and videos, as well as an opportunity to engage in online discussions of the downloadable teaching materials.

Masdar Institute joins MITEI as founding public member

The Masdar Institute of Science and Technology, building on its long-standing relationship with MIT, became the inaugural founding public member of the MIT Energy Initiative on Jan. 19, a collaboration that will support ongoing research and development of alternative and renewable energy technologies and solutions.

"As we press for bold answers to the world's energy challenges, we actively seek global partners who share our commitment to excellence and innovation. Given its demonstrated commitment to renewable energy research and experimentation at scale, the Masdar Institute will be a valuable partner in MITEI," said MIT President Susan Hockfield.

"The Masdar Institute is excited to be deepening our relationship with MIT by joining this initiative. This is a natural extension of our mandate to help advance research and development in Abu Dhabi and worldwide," said Sultan Al Jaber, CEO of Masdar.

The Masdar Institute is one of several public and private organizations in the alternative-energy sector that have joined as members of MITEI. As a founding public member, Masdar will have a seat on MITEI's governing board and will also be directly involved in identifying sponsored research programs.

The Abu Dhabi-based Masdar Institute, which commences classes in September 2009, was developed in cooperation with MIT's Technology and Development Program to be the world's first graduate-level institution dedicated to the study and research of advanced energy and sustainable technologies.

DUSP's Briggs joins Obama administration

Xavier de Souza Briggs, associate professor of sociology and urban planning in the Department of Urban Studies and Planning, was named associate director of the White House Office of Management and Budget and began a two-year professional leave effective Inauguration Day, Jan. 20.

In his new position, Briggs oversees six cabinet agencies — the departments of housing and urban development, treasury, transportation, justice, commerce and homeland security. The role encompasses many of the issues that are central to the concerns of MIT's Department of Urban Studies and Planning: economic recovery and opportunity, environmental sustainability, affordable housing, civil rights, equitable and effective response to civil emergencies, and more.

Xavier de Souza Briggs

Briggs has a national reputation for his work on social capital and the "geography of opportunity" — a policy and research field concerned with the consequences of segregation by race and income and with efforts to respond, such as through "housing mobility" programs that help families exit high-poverty, high-risk neighborhoods in search of better places to raise their children.

Briggs has pledged to report back and reappear on campus — physically or virtually — as often as the job allows. He will also send information about opportunities for students and alumni to work, study or in other ways help out at OMB or elsewhere in federal service.

Nyhart memorial service scheduled for March 7

A memorial service for John Daniel Nyhart, the former dean for student affairs who served MIT for 41 years in a variety of roles, will be held at 2:30 p.m. on Saturday, March 7, in the MIT chapel.

As dean from 1969 to 1972, Nyhart helped build community ties at MIT during a time of great unrest on American college campuses. During that period, he devoted his attention to developing and strengthening relationships between faculty and students.

He died on Dec. 6 from pneumonia contracted as a result of Lewy Body dementia. He was 77.

Top high school students to compete in Blue Lobster Bowl

The region's top science students will face off at the annual Blue Lobster Bowl to be held Saturday, Feb. 7, at MIT, competing against one another to answer questions on topics such as biology, marine science, chemistry and ocean engineering.

Sixteen teams of students from 12 Massachusetts high schools will answer quick buzzer questions and more-complex team-challenge questions, with the winning team advancing to the NOSB finals in Washington on April 25-28.

The Blue Lobster Bowl begins at 7:30 a.m., Feb. 7, in MIT Building 26, Lobby 100. Volunteers and spectators are welcome. For more information, see http://bluelobsterbowl.mit.edu/.

Obituaries

Lee Anne Coffey, EHS business manager, 41

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

A resident of Halifax, Mass., Coffey served MIT for 21 years in different roles, beginning in Facilities, followed by Environmental Medical Services, the Senior Counsel's Office and the Environment Programs Office.

Lee Anne was a wonderful friend and colleague, and a devoted wife, mother, daughter, sister and aunt who will be missed beyond words, colleagues said. They noted that everyone who knew her felt her kindness and sincerity, and that she possessed a remarkable gift for putting people at ease and was always there to lend a hand to anyone in need.

Lee Anne Coffey

"Lee Anne is a shining example of dedication to her family, her work and the community. MIT has lost someone special," said Managing Director for Environmental Programs Bill VanSchalkwyk.

Lee Anne loved being a mother and enjoyed camping, hiking and outdoor activities. She also served on the Halifax Conservation Commission. She is survived by her husband, Jim Coffey, and their children, Jimmy, 6, and Elora, 1.

Calling hours will be held from 2–4 and 7-9 p.m. on Sunday, Feb. 1, at the Shepherd Funeral Home, 216 Main St. (Rt. 106), Kingston, Mass. A funeral service will be held at the funeral home at 10 a.m on Monday, Feb. 2.

Donations can be made to the James and Elora Coffey Memorial Fund c/o The Community Bank, 110 Main St., Bridgewater, MA 02324.

A memorial service celebrating Lee Anne's life will be held at the Institute at a later date.

Institute employees honored for their work through two diversity programs

Three MIT community members will be honored through two programs designed to recognize excellence in work performance and enhance leadership capabilities of high-performing minority employees.

The Institute's human resources department sponsors the two programs — The Partnership Inc. and the YMCA Black Achievers — underscoring MIT's commitment to diversity and inclusion, showing the value of professional development and raising the awareness of MIT as a world-class employer.

This year's recipients and their awards are:

Sharon D. Clarke, Manager of Disabilities Services, Central Human Resources
The Partnership Inc. Professional Development Program, Boston Fellows Program

Julian S. Green, Program Coordinator, MIT SEED Academy, MIT Office of Engineering Outreach
The Partnership Inc. Professional Development Program, Boston Associates Program.

Lisa M. Owens, Chief Radiologic Technologist, MIT Medical
YMCA of Greater Boston, Black Achievers Award Recognition Program

W1: Some work this to begin this spring

Continued from **Page 1**

important work now, the fundamental economics have not changed. We have our work cut out to raise the additional funds to complete the project."

Dean for Student Life Costantino "Chris" Colombo met last week with the Phoenix Group — about 50 undergraduates who currently live in NW35 and were slated to occupy W1 once it was renovated — and informed them of the updated plan.

"It's a real demonstration of the commitment to moving this project forward, and we're so fortunate to have this generous donor," Colombo said.

Construction on the W1 residence hall paused last year as a precautionary measure amid general economic uncertainty. The building, which for many years served as a graduate residence hall, had been scheduled to become an undergraduate residence beginning in 2010.

Awards&Honors

Three MIT researchers named to the ACM

Three MIT researchers — Hari Balakrishnan, Joel Moses and Madhu Sudan — have been named among the 44 new members of the Association for Computing Machinery (ACM), an educational and scientific society uniting the world's computing educators, researchers and professionals.

Balakrishnan, professor of electrical engineering and computer science, was nominated to the ACM for contributions to computer networking and distributed systems; Institute Professor Moses was cited for developing the Macsyma computer system for formula manipulation; and Sudan, the Fujitsu Professor of Computer Science and Engineering, joins the association for his contributions to algorithms and complexity theory.

"These men and women are the inventors of technology that impact the way people live and work throughout the world," said ACM President Wendy Hall.

The ACM will formally recognize the new fellows at its annual awards banquet on June 27, in San Diego. Additional information about the ACM 2008 fellows and award winners is available at www.acm.org/awards.

Sloan professor wins technology innovation management award

Edward Roberts, the David Sarnoff Professor of Management of Technology in the MIT Sloan School of Management, has been named one of the top 50 researchers in the technology innovation management (TIM) field by the International Association for the Management of Technology. The organization will present Roberts with his award — given based on the number of articles published by an author over the last five years in the top 10 TIM journals — at its annual conference in April.

PhD candidate wins inaugural 'Earth Award'

Neri Oxman, a PhD candidate at the Media Lab, received the first of what are to be annual "Earth Awards," presented in New York on Jan. 12. The awards are designed to recognize "future-crucial design solutions that will improve our collective social, cultural, economic and ecological quality of life." Oxman was honored as the creator of a new rapid-manufacturing process called "FAB.REcology," which produces material with gradually varying physical properties.

Chemists engineer plants to produce new compounds

Periwinkle plant cells could synthesize potential drugs

Anne Trafton
News Office

In work that could expand the frontiers of genetic engineering, MIT chemists have, for the first time, genetically altered a plant to produce entirely new compounds, some of which could be used as drugs against cancer and other diseases.

The researchers, led by Sarah O'Connor of the Department of Chemistry, produced the new compounds by manipulating the complex biosynthetic pathways of the periwinkle plant. This sort of manipulation, which O'Connor and her graduate student, Weerawat Runguphan, reported in the Jan. 18 issue of Nature Chemical Biology, offers a new way to tweak potential drugs to make them less toxic (and/or more effective).

Genetic engineering is not new: Scientists have known for years how to get plants to resist pests and herbicides or to produce substances such as insecticides by inserting genes from other plants or animals. What is new, however, is the ability to induce plants to create new products by tinkering with the plants' own synthetic pathways.

O'Connor's laboratory has studied periwinkle for several years because it produces a variety of alkaloid compounds of pharmacological interest, including vinblastine, a drug commonly used to treat cancers such as Hodgkin's lymphoma.

Periwinkle also produces serpentines, which have shown promise as anti-cancer agents, and ajmalicine, which is used to treat hypertension. Other plant-produced compounds have shown pharmacological activity but are too toxic for use in humans.

The current work builds on research O'Connor and grad student Elizabeth McCoy reported two years ago. They found that periwinkle cell cultures could produce novel compounds if fed starting materials slightly different from their normal substrates.

IMAGE / **PATRICK GILLOOLY**

"That inspired us to think about metabolic engineering in a much more sophisticated way," said O'Connor, the Latham Family Career Development Associate Professor of Chemistry. "We can virtually re-engineer the pathway."

O'Connor and Runguphan focused on an enzyme involved in an early step of the alkaloid synthesis pathway. The enzyme normally accepts a terpenoid called secologanin and tryptamine, an alkaloid, as substrates.

Another graduate student, Peter Bernhardt, engineered a mutant form of the enzyme that can accept tryptamine with a halogen (such as chlorine or bromine) attached. Runguphan grew genetically engineered plant cell cultures that produce the mutant enzyme and got them to synthesize several compounds that periwinkle plants would normally never produce.

The halogens could serve as points of attachment to add other novel chemical groups to the compounds, modifying their effectiveness and/or toxicity as drugs, said O'Connor.

So far all of the genetic engineering has been done in plant cell cultures, but Runguphan has started growing a tiny whole periwinkle plant with the mutant enzyme.

In the future, the researchers plan to use the same approach to produce additional compounds, in hopes of creating new and more effective drug candidates.

The research was funded by the National Science Foundation, the National Institutes of Health and the American Cancer Society.

Astronomers crack longstanding lunar mystery

Ancient rock's magnetic field shows that moon once had a dynamo in its core

David Chandler
News Office

IMAGE / **NASA**

The collection of rocks that the Apollo astronauts brought back from the moon carried with it a riddle that has puzzled scientists since the early 1970s: What produced the magnetization found in many of those rocks?

The longstanding puzzle has now been solved by researchers at MIT, who carried out the most detailed analysis ever on the oldest pristine rock from the Apollo collection. Magnetic traces recorded in the rock provide strong evidence that 4.2 billion years ago the moon had a liquid core with a dynamo, like Earth's core today, that produced a strong magnetic field.

The particular moon rock that produced the new evidence was long known to be a very special one. It is the oldest of all the moon rocks that have not been subjected to major shocks from later impacts — something that tends to erase all evidence of earlier magnetic fields. In fact, it's older than any known rocks from Mars or even from the Earth itself.

> *People have been vociferously debating this for 30 years.*
>
> **Ben Weiss**
> **Assistant Professor of Planetary Sciences**

"Many people think that it's the most interesting lunar rock," said Ben Weiss, the Victor P. Starr Assistant Professor of Planetary Sciences in MIT's Department of Earth, Atmospheric and Planetary Sciences and senior author of a paper on the new finding published in Science on Jan. 16. The rock was collected during the last lunar landing mission, Apollo 17, by Harrison "Jack" Schmidt, the only geologist ever to walk on the moon.

"It is one of the oldest and most pristine samples known," said graduate student Ian Garrick-Bethell, who was the lead author of the Science paper. "If that wasn't enough, it is also perhaps the most beautiful lunar rock, displaying a mixture of bright green and milky white crystals."

The team studied faint magnetic traces in a small sample of the rock in great detail. Using a commercial rock magnetometer that was specially fitted with an automated robotic system to take many readings "allowed us to make an order of magnitude more measurements than previous studies of lunar samples," Garrick-Bethell said. "This permitted us to study the magnetization of the rock in much greater detail than previously possible."

And those data enabled them to rule out the other possible sources of the magnetic traces, such as magnetic fields briefly generated by huge impacts on the moon. Those magnetic fields are very short lived, ranging from just seconds for small impacts up to one day for the most massive strikes. But the evidence written in the lunar rock showed it must have remained in a magnetic environment for a long period of time — millions of years — and thus the field had to have come from a long-lasting magnetic dynamo.

That's not a new idea, but it has been "one of the most controversial issues in lunar science," Weiss said. Until the Apollo missions, many prominent scientists were convinced that the moon was born cold and stayed cold, never melting enough to form a liquid core. Apollo proved that there had been massive flows of lava on the moon's surface, but the idea that it has, or ever had, a molten core remained controversial. "People have been vociferously debating this for 30 years," Weiss said.

The magnetic field necessary to have magnetized this rock would have been about one-fiftieth as strong as Earth's is today, Weiss said. "This is consistent with dynamo theory" and also fits in with the prevailing theory that the moon was born when a Mars-sized body crashed into the Earth and blasted much of its crust into space, where it clumped together to form the moon.

The new finding underscores how much we still don't know about our nearest neighbor in space, which will soon be visited by humans once again under current NASA plans. "While humans have visited the moon six times, we have really only scratched the surface when it comes to our understanding of this world," said Garick-Bethell.

The research, which also included MIT undergraduate student Jennifer Buz and David L. Shuster of the Berkeley Geochronology Center, was funded through the NASA Lunar Advanced Science and Exploration Research Program, as well as the Charles E. Reed Faculty Initiatives Fund, the Victor P. Starr Career Development Professorship, and the Ann and Gordon Getty Foundation.

PHOTO / **DONNA COVENEY**

Associate Professor Eric Hudson

Physicists discover surprising variation in superconductors

Work may lead to understanding of new class of materials

Anne Trafton
News Office

MIT physicists have discovered that several high-temperature superconductors display patchwork quilt-like variations at the atomic scale, a surprising finding that could help scientists understand a new class of unconventional materials.

The researchers said the variation in a property known as the Fermi surface, which has never been seen before in any kind of material, could just be an oddity. But it could also serve as an important clue for physicists working to unravel the mystery of why a broad new class of materials exhibits exotic properties from high-temperature superconductivity (the ability to carry electricity with no resistance) to colossal magneto-resistance (the ability to dramatically change electrical resistance when a magnetic field is applied).

In such materials, known as strongly correlated electronic materials, interactions between electrons, normally weak enough that they can essentially be ignored, dominate the physics of the material, leading to a host of unexplained phenomena.

"These materials are so unusual that we decided to check for variations that would normally be impossible — and there they were," said Eric Hudson, associate professor of physics and senior author of a paper on the work that appeared online in Nature Physics on Jan. 25.

Hudson and colleagues found that the Fermi surface, a measurement of the distribution of electrons in a material, varies at the atomic scale across the surface of two bismuth-based superconductors, which belong to the class of strongly correlated electronic materials. Until now, it was believed that Fermi surface was uniform throughout any material.

"The idea that electrons separated by just an atom's distance can behave so differently is astonishing," Hudson said.

The discovery that electronic properties can vary so much on the nanoscale could shed light on how this class of materials deals with strongly interacting electrons, and how their unusual properties arise, he said.

To study the Fermi surface, the researchers used a common technique called scanning tunneling microscopy, which, combined with a new analysis method called quasiparticle interference, can reveal, on an atom-by-atom basis, what electrons are doing.

The lead author of the paper is physics graduate student William Wise. Other MIT authors are graduate student Kamalesh Chatterjee; former graduate student Michael Boyer; and former postdoctoral associates Takeshi Kondo and Yayu Wang. Researchers from Nagoya University in Japan and Brookhaven National Laboratory also contributed to the work.

This research was funded by the Research Corporation, the Materials Research Science and Engineering Center, the National Science Foundation and the Department of Energy.

Nitric oxide shown to cause colon cancer

Study offers proof of compound's role

Anne Trafton
News Office

Researchers long ago established a link between inflammation, cancer and the compound nitric oxide, which may be produced when the immune system responds to bacterial infections, including those of the colon. However, the exact nature of the relationship was unknown — until now.

Scientists from MIT's Division of Comparative Medicine and Department of Biological Engineering have found that nitric oxide produced by inflammatory cells during bacterial infection can cause colon cells to become cancerous. The finding suggests that blocking the compound may help prevent or treat colon cancer, the third most common form of cancer in the United States.

The researchers, led by James Fox, director of the Division of Comparative Medicine (DCM), reported their findings in the Jan. 19 online edition of the Proceedings of the National Academy of Sciences.

Many years ago it was discovered that gastrointestinal infection by H. pylori is often linked to cancer in humans; a related bacteria called H. hepaticus has similar effects in mice.

Nitric oxide is produced during the inflammatory response to such bacterial infection, but it has been unclear whether it was damaging cells or protecting them. By studying mice, the MIT team found that nitric oxide produced by different types of cells has different effects.

"Nitric oxide delivered by inflammatory cells, in particular, is important in causing changes in intestinal epithelial cells, setting the stage for cancer development," said Susan Erdman, principal research scientist in the Division of Comparative Medicine and lead author of the PNAS paper.

In mice infected with H. hepaticus, the researchers found that blocking an enzyme needed to produce nitric oxide reduced colon cancer rates. More work is needed to study the exact effects of nitric oxide and develop potential clinical therapies for colon cancer, Erdman said.

"Therapies will need to be targeted to inhibit the damaging effects of nitric oxide while preserving as many of the protective elements of nitric oxide as possible," she said.

"This study is a wonderful example of the value and final product that results from an interdisciplinary team effort," said Fox.

Other authors of the paper are Varada Rao, former postdoctoral fellow in the DCM; Theofilos Poutahidis, DCM visiting scientist; Arlin Rogers, principal research scientist in the DCM; Christie Taylor, DCM research technician; Erin A. Jackson, DCM research technician; Zhongming Ge, DCM molecular biologist; David Schauer, professor of biological engineering; Gerald Wogan, professor emeritus of biological engineering; and Steven Tannenbaum, professor of biological engineering.

A better way to pinpoint underground oil reserves

CEE mapping technology could make extraction more efficient

Denise Brehm
Civil and Environmental Engineering

Picture this: an accurate map of a large underground oil reservoir that can guide engineers' efforts to coax the oil from the vast rocky subsurface into wells where it can be pumped out for storage or transport.

Researchers in MIT's Department of Civil and Environmental Engineering have developed technology that can generate such a map, which has the potential to increase significantly the amount of oil extracted from reservoirs.

The new technology uses the digital image compression technique of JPEG to create realistic-looking, comprehensive maps of underground oil reservoirs using measurements from scattered oil wells. These maps would be the first to provide enough detail about an oil reservoir to guide oil recovery in the field in real time.

"Our simulation studies indicate that this innovative approach has the potential to improve current reservoir characterization techniques and to provide better predictions of oil-reservoir production. The hope is that better predictions ultimately lead to more-efficient operations and increased oil production," said Behnam Jafarpour, a recent MIT graduate who is now an assistant professor in petroleum engineering at Texas A&M University.

PHOTOS / **(L) COURTESY BEHNAM JAFARPOUR, (R) L. BARRY HETHERINGTON**

Left, Behnam Jafarpour; right, Dennis McLaughlin

Jafarpour and Dennis McLaughlin, the H.M. King Bhumibol Professor of Water Resource Management at MIT, published a pair of papers describing the technique that will appear in an issue of the Society of Petroleum Engineering Journal, as well as a third paper that appeared in the June 2008 issue of Computational Geosciences.

The spatial structure in geologic formations makes it possible to compress rock property maps. But JPEG compresses the many pixels in a detailed image down to a few essential pieces of information that require only a small amount of storage. In the oil reservoir characterization application developed by MIT researchers, a similar mechanism is used to provide concise descriptions of reservoir rock properties. The new technique uses oil flow rates and pressure data from oilfield wells to create a realistic image of the subsurface reservoir.

Petroleum extraction is expensive and relatively inefficient — sometimes as little as one-third of the oil in a reservoir is actually recovered through pumping. So engineers rely on enhanced recovery techniques such as water flooding to mobilize the oil. To guide this work, they make real-time predictions of subsurface variables, including oil saturation and pressure, but they're essentially working blindly. The rock properties needed to make these predictions (for instance, fluid conductivity of rock at a particular depth) can't be seen or measured.

Instead, engineers infer geologic properties indirectly from seismic data and measurements taken at scattered wells.

"In a typical reservoir, millions of pixels are needed to adequately describe the complex subsurface pathways that convey the oil to wells. Unfortunately, the number of seismic and well observations available for estimating these pixel values is typically very limited. The methods we've developed extract more information from those limited measurements to provide better descriptions of subsurface pathways and the oil moving through them," said McLaughlin, lead researcher on the project.

In a 36-month, simulated oil-recovery process, McLaughlin and Jarfarpour's estimation approach accurately captured the main features and trends in fluid conductivity of a reservoir formation, demonstrating that the new technique is robust, accurate and efficient.

"Our next step — already in progress — is to test our idea in real oil reservoirs and evaluate its impact on oil recovery under realistic field settings," Jafarpour said.

This research was funded by Shell International Petroleum Co.

Race and the presidential election

Voting analysis shows Obama won because of his support among minorities

Stephanie Schorow
News Office

Some political observers have declared that the election of the first black president signals a new era of post-racial politics in the United States — but the data show otherwise, two MIT researchers say.

Through careful analysis of 2008 exit-poll data, the researchers found that Barack Obama won the election precisely because of his race, most significantly because of his appeal among black voters who turned out in record numbers.

"Ironically, the candidate whom commentators lionized for ending America's debilitating racial divisions won the election on the basis of increasingly distinct white and nonwhite voting patterns," wrote the two researchers — Charles H. Stewart III, the Kenan Sahin Distinguished Professor and head of the Department of Political Science at MIT; and Stephen Ansolabehere, professor of political science at MIT — in the current issue of Boston Review. "Racial polarization in American voting patterns was the highest it has been since the 1984 election."

Despite many predictions, Obama did not "provoke a backlash among white voters," according to research compiled by Stewart and Ansolabehere. However, the percentage of blacks voting Democratic rose from 88 percent in 2004 to 95 percent in 2008. Hispanic voters — who had been drifting into the Republican camp in recent years — heavily favored Obama;

PHOTO / **ILAVENIL SUBBIAH**

Professor Charles Stewart, head of the Department of Political Science

Hispanics voting Democratic rose from 56 percent to 67 percent. "This additional support among nonwhites proved decisive," Stewart and Ansolabehere concluded.

Indeed, "had blacks and Hispanics voted Democratic in 2008 at the rates they had in 2004, McCain would have won," they wrote.

This is not to say that Democrats lost ground among white voters; they did gain white votes but only a modest 3 million. "John McCain, on the other hand, received 2.3 million fewer votes than did George W. Bush in 2004. Most of this loss, 1.5 million votes, came from the net defection of blacks and Hispanics who voted Republican four years earlier; by comparison McCain lost only 1.4 million white voters. Thus, Obama gained not only by bringing new minority voters into the electorate, but also by converting minority voters who had previously been in the GOP stable," the researchers wrote.

The "youth" vote has been touted as a deciding factor in Obama's favor and while those under 30 voted overwhelmingly Democratic, youth turnout was only 18 percent of the total — nowhere near the highs of 1972 and 1992. Thus, it had virtually no impact on Obama's victory, Stewart said in an interview.

Of greater significance were voting patterns of the "older young," those aged 25 to 30, Stewart said. This group was strongly for Obama and is likely to remain Democratic eight years from now even as they gain in social and economic power. Like the generation of Reagan Republicans before them, Obama Democrats could impact elections for decades, Stewart said.

The shift in Hispanic voting patterns is also significant. Hewing to anti-immigration positions, Republicans largely turned off Hispanic voters, Stewart said. Not only does that make it unlikely that these voters will "turn back" to Republicans, but the Hispanic population is growing — a boon to Democrats although Hispanics are not as "monolithically Democratic as African-American voters," Stewart said.

Stewart noted that current research is preliminary; as more exit-polling data is released, MIT researchers will be able to get a better idea of why populations voted in certain patterns and the possible effect of other factors, such as vice-presidential picks.

While some may fairly argue that "the fact that whites did not run away from Obama is evidence of post-racial politics," post-election commentators went overboard in suggesting "race doesn't matter in American politics," Stewart said.

Given white voting patterns, Republicans may even be tempted to return to racial politics to drive a wedge between white votes and the Democratic party, Stewart noted. He doubts that will happen.

"Watching how whites respond to Obama will be very critical to both Obama's future prospects and the nature of future campaigns," he said. "I don't think we're out of the woods yet in respect to seeing things like Willie Horton ads."

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.

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Coat: Ladies grey tweed-look winter coat, size 12, below-knee length, like new, $35. Men's ties, like new, $2 each. Rosalie, 781-391-1307.

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PHOTO / **ANDREA FRANK**

Political science professor Suzanne Berger

Berger gets French Legion of Honor medal

Stephanie Schorow
News Office

MIT political science professor Suzanne Berger was presented with a French Legion of Honor medal on Monday, Jan. 26 in recognition of her research and her efforts to strengthen ties between MIT and French researchers.

Berger, the Raphael Dorman and Helen Starbuck Professor of Political Science, said she was notified by a letter from French President Nicolas Sarkozy that he had recommended her for the insignia of Knight of the Legion of Honor.

"For me this is a great honor as so much of my own research has to do with France," said Berger, director of the MIT International Science and Technology Initiatives Program. "[But] this is, in fact, an honor that belongs to MIT because it recognizes what a whole group of us have been trying to do with MIT students — to build bridges that allow collaboration across borders."

Berger's books include "Peasants Against Politics," "The French Political System: Dualism and Discontinuity in Industrial Societies" (with Michael Piore) and the recent "How We Compete."

The award was presented by Pierre Vimont, France's ambassador to the United States.

DARWIN: MIT conference celebrates famed naturalist's 200th birthday

Continued from **Page 1**

most significant, King said, as it featured lectures by world leaders in many relevant fields.

The session featured a discussion on the evolution of fins into limbs, which King called one of the most important transitions in evolution.

Evolutionists have theorized that land creatures evolved from fish, but proof of such a change — fossil evidence of the intermediary physiology of ocean animals that ventured onto land — has been hard to come by. That changed when Jenkins' team discovered the remains of an unusual creature that 375 million years ago had the capabilities to move from shallow water to land.

With great relish, Jenkins described the discovery of a fossil of the long-extinct Tiktaalik roseae, which had weight-bearing fins that could assume both fin-like and limb-like postures. Darwin and others had theorized about such creatures; its remains were finally found in 2006 in the Canadian Arctic.

Another issue that intrigued Darwin and continues to interest researchers today was why dark, underground cave environments worldwide produce fish, insects and other animals that are blind and lack pigment.

Tabin, who has researched the blind Mexican Cave Tetra or Astyanax mexicanus by crossing it with similar, sighted tetras, suggested that the loss of eyesight does reflect natural selection by conferring three possible advantages: eyes are vulnerable to infection, eyes have an "energy cost" to the body and no eyesight provides more neural space for other necessary senses, such as taste.

Darwin's research in the Galápagos Islands included his speculation on why local finches — now called Darwin's finches — evolved to have a variety of beaks: short, long and broad. Tabin's team, working with finch embryos, has been able to target the genes that control for beak size and create, for example, broad beaks in normally short-beaked birds. Such work has implications for manipulating what Tabin calls a "species' blueprint" to "make a cat instead of a mouse."

While anti-evolutionary groups may argue that humans are immune from evolution, Sabeti showed how humans are continuing to evolve. She cited the human ability to digest cow's milk, which developed rapidly over a span of 10,000 years and coincided with the domestication of cattle. Being able to digest a ready protein source and to also wean babies more quickly conferred evolutionary advance.

Johnnetta Cole to address MLK breakfast

Stephanie Schorow
News Office

Educator and humanitarian Johnnetta B. Cole, the first African-American woman to serve as president of Spelman College, will be the keynote speaker at MIT's 35th Annual Dr. Martin Luther King, Jr. Breakfast Celebration on Thursday.

Echoing slogans from the recent presidential election, the breakfast will focus on the theme: "Yes We Must: Achieve Diversity through Leadership." The event will feature remarks by MIT President Susan Hockfield, Chancellor Phillip L. Clay, Provost L. Rafael Reif, and students Ana Lorena Ramos Maltés, Matt Gethers and Joy Johnson. The Rev. Robert Randolph, chaplain to the Institute, will give the invocation. The MIT Gospel Choir will perform.

Cole joins Donna Brazile and Gwen Ifill as the latest in a long line of distinguished speakers for MIT's annual event honoring the legacy of the slain civil rights leader.

Cole's academic and community service work has consistently addressed issues of racial, gender and other forms of discrimination. She is the only individual to have served as president of the two historically black colleges for women in the United States: Bennett College for Women (2002-2007) and Spelman College (1987-1997). Cole is also professor emerita of Emory University, from which she retired as the Presidential Distinguished Professor of Anthropology, Women's Studies and African American Studies. From 2004 to 2006, she was the first person of color to serve as the chair of the board of the United Way of America.

Johnnetta Cole

She is now the chair of the board of the Johnnetta B. Cole Global Diversity and Inclusion Institute, founded at Bennett College.

The breakfast, which begins at 7:30 a.m. Thursday, Feb. 5, in Morss Hall, is open to the community, but space is limited and reservations are necessary. Register at: http://web.mit.edu/mlking/www/event_index.html.

RAGON: New institute to tackle quintessential MIT problem

Continued from **Page 1**

'A SHINING EXAMPLE'

Since HIV was identified as the cause of AIDS more than 25 years ago, more than 25 million people have died. While some effective treatments exist, the search for a vaccine has been unsuccessful so far.

"I am delighted that our alumnus, Terry Ragon, has encouraged the collaboration between MGH, Harvard and MIT scientists and engineers in the fight against AIDS," said Marc Kastner, dean of the School of Science. "A major revolution in the next decade will come from the convergence of biology and the physical sciences and engineering, and the Ragon Institute will be a shining example of this revolution."

The steering committee for the Ragon Institute includes faculty members from each of the collaborating institutions, with two each from MIT, Harvard and MGH. It will be headed by Bruce Walker from MGH, a leader in the study of the human adaptive immune response to HIV infection.

The new institute will continue the hallowed MIT tradition of contributing its engineering and science expertise to help solve global problems, said Arup Chakraborty, the Robert T. Haslam Professor of Chemical Engineering, Chemistry and Biological Engineering and a member of the faculty steering committee planning for the new institute.

> *What MIT brings to the table is new technology, as well as computational models that offer new approaches to thinking about basic immunology in the context of human responses to infection.*
>
> **Arup Chakraborty**
> **Robert T. Haslam Professor of Chemical Engineering**

"What MIT brings to the table is new technology, as well as computational models that offer new approaches to thinking about basic immunology in the context of human responses to infection," said Chakraborty, who uses computational methods to study the immune response.

Darrell Irvine, the Eugene Bell Associate Professor of Materials Science and Engineering and Biological Engineering, is the second MIT faculty member on the steering committee. His laboratory develops methods to image immune cell functions and also develops materials for vaccine delivery.

"The institute will act as a bridge to allow faculty from engineering and the physical sciences to bring new technologies of relevance to HIV into the field, and facilitate collaborations with some of the leaders in the HIV vaccine effort," Irvine said.

TARGETING THE IMMUNE RESPONSE

Key MIT faculty involved in the Ragon Institute will also include Jianzhu Chen, professor of biology; Hidde Ploegh, professor of biology and member of the Whitehead Institute; and Christopher Love, assistant professor of chemical engineering.

Other faculty will be drawn from a range of fields, including chemical engineering, chemistry and biology. "All of us who are involved in this are very excited about the opportunity to focus on this particular problem," Love said.

Love and others will focus on studying the immune responses of rare individuals who are infected with HIV but do not progress to AIDS. Figuring out how to induce that kind of immunological control of the virus could help researchers develop a vaccine for people with different genotypes.

Love's lab has developed new assays that can monitor the immune response of single cells, allowing them to pinpoint precisely how the responses differ.

"If you understand what characteristics in the response are correlated with effective protection, then from an engineer's perspective you can think about designing a vaccine that would provoke the same kind of response," Love said.

In another line of attack, researchers will study the behavior of a special subset of immune cells, known as CD8 T cells, responsible for remembering what pathogens the body has encountered. Vaccines that resemble the HIV virus could prime the immune system to "remember" the virus and help the body mount a more successful response if HIV is encountered, Chen said.

"By better understanding the basic principles of the immunological response, especially CD8 cells, we can more rationally develop vaccines against HIV," he said.

Commercial real estate values plummeting, MIT index shows

Transaction sale prices of commercial property sold by major institutional investors fell by more than 10 percent — a record — in the fourth quarter of 2008, according to an index developed and published at the MIT Center for Real Estate that also posted a record 15 percent drop for the year.

The 10.6 percent drop in the transactions-based index (TBI) for the fourth quarter is the largest quarterly decline in the gauge's history, which dates to 1984. The previous record was a 9 percent drop in the fourth quarter of 1987. The 15 percent fall in 2008 is also a record, topping the 10 percent and 9 percent declines in 1992 and 1991, respectively.

The index's performance means that prices in institutional commercial property deals that closed during the fourth quarter for properties such as office buildings, warehouses and apartment complexes are now 22 percent below their peak values attained in the second quarter of 2007. The index has fallen in five of the past six quarters, but the recent drop is by far the steepest.

"With the index already having fallen 22 percent in the current downturn, it now seems likely that this down market will be at least as severe as that of the early 1990s for commercial property," said Professor David Geltner, director of research at the Center for Real Estate. In the last major downturn in the U.S. commercial property market 20 years ago, the TBI declined a total of 27 percent from 1987 through 1992, with most of that drop occurring in 1991-92. "Nevertheless, a decline of 22 percent compares favorably to the stock market, which has lost more than 40 percent over the same period, including 20 percent in the last quarter."

The MIT/CRE publishes not only the price index based on closed deals, but also compiles indices that separately gauge movements on the demand side and the supply side of the market that it tracks. The demand-side index tracks the changes in prices that potential buyers are willing to pay. That index has now fallen steadily, dropping again in the third quarter by 10.3 percent, and is down 23 percent for the year.

3 Questions: Kosta Tsipis on nuclear proliferation

"3 Questions" is a series from the MIT News Office that gives members of the community the opportunity to sound off on current events in their field of expertise. In this installment, Kosta Tsipis, former director of MIT's Program in Science and Technology for International Security, discusses the threats posed by nuclear proliferation. Tsipis is also a longtime member of the Pugwash Conferences on Science and World Affairs, a group that works to reduce the threats posed by nuclear weapons.

Q. How much should the new Obama administration focus on stopping nuclear proliferation? Should it be a top priority?

A. Nuclear Proliferation has two forms: 1.) The de novo acquisition of a nuclear arsenal by a Nuclear Proliferation Treaty signatory state like Iran. 2.) The acquisition of a nuclear explosive, or the needed fissile material to construct one, by a nonstate group such as a terrorist organization.

The Obama administration apparently considers nuclear proliferation a top priority. It appears to be involved in robust dialogue with Iran regarding the latter's nuclear intentions. Over the past year a group of U.S. nuclear nonproliferation experts, including William Perry, past U.S. Secretary of Defense and a member of the Obama campaign's national security working group, have held a series of meetings in the Hague and Vienna with Iranian officials, under the auspices of the Pugwash group (Pugwash, founded in 1957 by an international group of scientists close to their national governments, received the Nobel Prize for Peace in 1995 for its persistent efforts to limit the threat of nuclear war and the elimination of nuclear weapons). In such meetings, Pugwash scientists participate in their private capacity but then they inform their respective governments about the outcome of their deliberations.

Q. How have the risks associated with nuclear proliferation evolved over the past two decades, as we have moved beyond the Cold War and into the post-9/11 era?

A. During the Cold War, the concern was the limitation of the unbridled proliferation of the number of nuclear weapons in the arsenals of the United States and the Soviet Union. By the late 1960s, the United States and the Soviet Union possessed several thousand nuclear weapons, some of them in hair-trigger readiness for their use. Vigorous nuclear arms control efforts and the resulting Limitation Treaties between the two nations stemmed the quantitative arms race and reduced the risk of a nuclear war. Now the dominant proliferation risk is the acquisition of nuclear explosives by parastate or nonstate entities such as a terrorist organization. So the goal is to deny them access either to ready nuclear explosives or to fissionable material, enriched uranium 235 or plutonium 239. Therefore the nonproliferation efforts of the Obama administration must focus on how to safeguard such items and how to disrupt the efforts of terrorists to acquire, transport and detonate a nuclear explosive in a populated area.

Q. What can and should be done to minimize the risks of nuclear proliferation?

A. There is a wide-ranging number of mutually reinforcing antiproliferation measures that can be undertaken immediately:

1.) Secure existing nuclear explosives, and enriched uranium that can fuel nuclear explosives, against theft or clandestine purchase.
2.) Limit production of 5 percent enriched uranium as fuel for civilian nuclear reactors only in few centers globally, combined with formal unconditional guarantees of supply to nations with nuclear power plants, and so break the nexus between civilian nuclear power and the sub rosa proliferation of nuclear weapons to additional states.
3.) De-emphasize the utility of nuclear weapons in the defense planning of nuclear nations, especially in the cases of the United States, Russia, Israel, Pakistan and India.
4.) Strengthen the IAEA (International Atomic Energy Agency) verification of reprocessing facilities in nations with nuclear power plants, and of the routine operations of CANDU reactors.
5.) Reduce the number of deliverable nuclear weapons in the arsenals of nuclear nations and especially those of the United States and Russia, ultimately leading toward the complete elimination of such weapons.
6.) Adopt a complete "no first use" agreement among all nuclear states.
7.) Complete all such counter-proliferation agreements during the 2010 NPT Treaty Review by initiating intense negotiations during the summer 2009 preparatory conference.

CHAMELEON GUITAR
blends old-world and high-tech

David Chandler
News Office

Natural wood, with its unique grain patterns, is what gives traditional acoustic instruments warm and distinctive sounds, while the power of modern electronic processing provides an unlimited degree of control to manipulate the characteristics of an instrument's sound. Now, a guitar built by a student at MIT's Media Lab promises to provide the best of both worlds.

The Chameleon Guitar — so named for its ability to mimic different instruments — is an electric guitar whose body has a separate central section that is removable. This inserted section, the soundboard, can be switched with one made of a different kind of wood, or with a different structural support system, or with one made of a different material altogether. Then, the sound generated by the electronic pickups on that board can be manipulated by a computer to produce the effect of a different size or shape of the resonating chamber.

Its creator, Media Lab master's student Amit Zoran, explains that each piece of wood is unique and will behave in a different way when it is part of an instrument and begins to vibrate in response to the strings attached to it. Computers can't model all the details of that unique responsiveness, he says. So, as he began experimenting with the design of this new instrument, he wondered "what would happen if you could plug in acoustic information, like we do with digital information on a memory stick?"

Under the direction of Media Lab Associate Professor Pattie Maes, and with help from experienced instrument builder Marco Coppiardi, he built the first proof of concept version last summer, with a variety of removable wooden inserts. The concept worked, so he went on to build a more polished version with an easier quick-change mechanism for switching the inserts, so that a musician could easily change the sound of the instrument during the course of a concert — providing a variety of sound characteristics, but always leaving the same body, neck and frets so that the instrument always feels the same.

PHOTOS / **WEBB CHAPPELL**

Media Lab student Amit Zoran shows the Chameleon Guitar, along with a variety of the interchangeable soundboards — made of different woods and other materials — that can be inserted to alter the guitar's acoustic characteristics.

With Coppiardi's help, he selected spruce and cedar for the initial soundboard inserts. This January, he demonstrated the new instrument at the annual Consumer Electronics Show in Las Vegas, where it received an enthusiastic response. He also demonstrated the earlier version at two electronics conferences last year.

The five electronic pickups on the soundboard provide detailed information about the wood's acoustic response to the vibration of the strings. This information is then processed by the computer to simulate different shapes and sizes of the resonating chamber. "The original signal is not synthetic, it's acoustic," Zoran says. "Then we can simulate different shapes, or a bigger instrument." The guitar can even be made to simulate shapes that would be impossible to build physically. "We can make a guitar the size of a mountain," he says. Or the size of a mouse.

Because the actual soundboard is small and inexpensive, compared to the larger size and intricate craftsmanship required to build a whole acoustic instrument, it will allow for a lot of freedom to experiment, he says. "It's small, it's cheap, you can take risks," he says. For example, he has a piece of spruce from an old bridge in Vermont, more than 150 years old, that he plans to use to make another soundboard. The wooden beam is too narrow to use to make a whole guitar, but big enough to try out for the Chameleon Guitar.

The individual characteristics of a given piece of wood — what Zoran refers to as the "romantic value" of the material, "is very important for the player," he says, and helps to give an individual instrument a particular, unique sound. Digital processing provides an infinite range of variety. "Now," he says, "it's possible to have the advantages of both."

For now, Zoran is concentrating on developing the guitar as a thesis project for his master's degree, and hopes to continue working on it as his doctoral thesis project. After that, he says, he hopes it will develop into a commercial product.