MIT readies for Commencement day

President Emeritus Vest, new head of National Academy of Engineering, will speak

MIT President Emeritus Charles M. Vest will deliver the principal address at MIT’s 141st Commencement exercises, to be held Friday, June 8, at 10 a.m. in Killian Court.

During the ceremony, 2,155 undergraduate and graduate students are scheduled to receive 1,983 bachelor's degrees, 1,915 master's degrees, 279 doctorates and 10 engineer's degrees.

In making the announcement, MIT President Susan Hockfield said, “I am very pleased that Chuck Vest has agreed to give the 2007 Commencement address at MIT. During his 14 years as MIT's president, he quietly put his stamp on almost every aspect of the Institute and its life. At the same time, he achieved national and international recognition for his thoughtful insights into the crucial issues facing higher education and research in the United States and in our globalizing world. As he anticipates the next chapter of his career in Washington, it is the perfect moment for him to share with our graduates his reflections on the role of MIT in the world.”

In April, Vest was elected to a six-year term as president of the National Academy of Engineering, effective July 1.

Vest earned his B.S. degree in mechanical engineering from West Virginia University in 1963 and his M.S. and Ph.D. degrees from the University of Michigan in 1964 and 1967, respectively. He is the recipient of 10 honorary doctoral degrees and is a life member of the MIT Corporation, the Institute’s board of trustees.

As president of MIT from 1990 through 2004, Vest placed special emphasis on enhancing undergraduate education, exploring new organizational forms to meet emerging directions in research and education, building a stronger international dimension into education and research programs, developing stronger relations with industry and enhancing racial and cultural diversity at the Institute.

Vest has also worked to bring issues concerning education and research to public attention.

model for tracking flu progression may reduce death toll

Engineer survived 1968 pandemic

Anne Traffen
News Office

Nearly 40 years ago, MIT Professor Richard Larson spent a week sick in bed with the worst illness he’d ever had—the particularly virulent strain of flu that swept the globe in 1968. “That was the sickest I’d ever been,” Lar sus recalled. “I really thought that was the end. It took him two or three months to recover fully from the illness.”

Known as the Hong Kong flu, the virus killed 750,000 people worldwide, the second worst influenza pandemic the world has seen since the infamous 1918-1919 epidemic of so-called Spanish flu.

Now, many experts fear the world is on the brink of another deadly flu pandemic. And Larson wants to be sure that people are ready to deal with it.

To that end, he and his colleagues have developed a mathematical model to track the progression of a flu outbreak, and their results show that the death toll of an epidemic could be greatly reduced by taking steps such as minimizing social contacts and practicing good hygiene, such as frequent handwashing.

The report, “Simple Models of Influenza Progression within a Heterogeneous Population,” was published in the May-June issue of Operations Research, which is See INFLUENZA Page 10

Women’s Technology Program graduates members of first class

Erin Michael Sallus
School of Engineering

When seniors Alisha Schor, Emily Shlakovsky and Kyung Jin Chang step to the stage to accept their S.B. degrees at the 141st Commencement ceremony on June 8, they will be among six seniors making history as the first members of MIT’s Women’s Technology Program (WTP) to graduate from the Institute.

It was only five short years ago, in the summer of 2002, that they initially arrived on campus to participate in the inaugural session of WTP, a four-week academic and residential experience where pre-college female students explore engineering through hands-on classes, labs, and team-based projects. At the time, having just finished their junior year in high school, the six seniors knew they wanted to pursue science and engineering degrees. They quickly realized the resource and opportunity available through WTP, and committed to stay students thinking in new directions.

As a member of the MIT Student Pugwash organization—which encourages students to understand how their work impacts society—Sequeira learned about the graduation pledge in a lecture last fall from a professor who led the pledge in the 1960s.

“Maybe it’s time to do it again,” thought

Green ribbons signify responsibility pledge

Stephanie Schorow
News Office Correspondent

Wearing a little green ribbon during the 2007 Commencement ceremonies may not change the world. But, say MIT organizers of “The Graduation Pledge of Social and Environmental Responsibility,” the effort might change a few minds. And that might start students thinking in new directions.

Something like that happened to Christopher J. Sequeira, a graduate student in the Department of Aeronautics and Astronautics and the Technology and Policy Program, who is coordinating the pledge effort.

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Solar power helps rekindle Great Dome lighting tradition

A new lighting scheme will turn the iconic Great Dome of Building 10 into a “nighttime beacon.”

Using the same amount of electricity needed to run two hair dryers, a total of 12 new fixtures will illuminate the dome, the Roman numerals that spell out 1916 (the year the building opened) and the limestone facade of Building 10.

MIT President Susan Hockfield will flip the switch on the new lighting at a June 9 ceremony at 10:30 p.m. The event, which comes at the conclusion of a full day of Tech Day activities that will bring 3,500 alumni and alumnae to the campus, will take place in Killian Court. All members of the MIT community are invited to attend the lighting ceremony.

The new lighting system incorporates energy-saving light-emitting diode (LED) fixtures made possible through the generosity of an anonymous donor. The efficient new system will replace now-defunct fixtures.

The donor has also provided funding for a new 40-kilowatt photovoltaic array in the Department of Chemistry, will be on display on campus June 7-10.

Faculty speakers will explore political, economic and strategic contexts necessary to secure sufficient energy for the future. The 15th annual Cambridge First Day celebration at MIT will honor five local organizations that are working to preserve and bring vitality to Cambridge.

MIT President Susan Hockfield will present Cambridge First Day Awards on June 12 to the Cambridge African American Heritage Alliance; the Cambridge Historical Society; the magazine Growing up Cambridge; the Longfellow Community School Oral History Project; and the Longfellow National Historic Site and Friends of the Longfellow House.

In addition to the awards, each honoree will receive $1,000 to support their continued work and a bound City Council resolution.

Tech Day focuses on improving today’s energy sources and tools

Nancy DuVergne Smith
MIT Alumni Association

Energy—particularly the opportunity for near-term efficiencies and sustainable change—takes center stage at Tech Day 2007, to be held on the MIT campus on Saturday, June 9. Tech Day is the intellectual highlight of Tech Reunions 2007, which is expected to draw more than 3,200 alumni and guests to dinners, tours and performances on campus June 7-10.

Faculty speakers will explore political, economic and strategic contexts necessary to secure sufficient energy for the future.

At Tech Day, political science professor Nazli Choucri will describe the political, economic and strategic contexts necessary to secure sufficient energy for the future.

John M. Deutch ’81, Institute Professor in the Department of Chemistry, will examine issues related to improving the use and efficiency of fossil and renewable energy sources are developed. Deutch’s recent work has explored national security consequences of U.S. oil dependence, nuclear options, China’s energy options and the biomass movement.

Deutch is author of “Making Technology Work: Applications in Energy and the Environment” and served as an advisor to Presidents Carter, Reagan and Clinton.

Deutch co-authored “The Future of Nuclear Power,” one of the Institute’s major energy reports, with MITEI Director Ernest J. Moniz, the Cecil and Ida Green Professor of Physics. The report documented the changes required in government policy and industry practices that would enable nuclear power to play a significant role in reducing carbon emissions and providing energy resources.

Improvement in the built environment is the subject of John Fernandez ’85, associate professor in the Department of Architecture’s building technology group. Fernandez will explore the ecology of contemporary construction. His effort involves identifying the consumption profile and resource requirements of existing buildings and formulating design strategies for reuse and recycling of building materials and components. He is actively working with the construction industry and design profession to establish common ground for construction ecology partnerships. This work is described in his recent book, “Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction.”

Participants at the reunion celebration, who come from as far away as Brazil and Japan, are signed up for more than 120 reunion events on and off campus. All alumni and members of the campus community are invited to the Fierce Boathouse Sunday morning beginning at 7:30 a.m. to cheer on competing class rowers, from the classes of 1952 to 2002.

Cambridge First Day honors five Cambridge Mayor Kenneth E. Stenze, Cambridge City Manager Robert W. Healy and the City of Cambridge were honored at the 15th annual Cambridge First Day celebration on June 9.

The event was the culmination of a full day of energy-related events and achievements that have furthered the mission and enhanced the quality of life in the aeroastro department.

—Beth Marois, student services coordinator
Seniors describe four years at MIT as full of surprises and challenges

Ruth Walker
News Office Correspondent

There were, not surprisingly, some surprises along the road to graduation for the dozen and a half students Tech Talk profiled as ‘hometown heroes’ when they entered college as freshmen in 2003.

Jose Medrano of Pico Rivera, Calif., is one who found himself in a whole new field.

As an incoming freshman, he had indicated an interest in chemical engineering. "But biology had the most impact. That completely blew me away. I was so fascinated I ended up majoring in it.

Particularly meaningful for him was getting to study cutting-edge biological research techniques with the very professors who had developed them.

One thing that stood out to him was how the nature of the academic work evolved over time. The introductory course he suggested was more like high school coursework. "But as you progressed, it was less book work and more thinking. It was less about ‘What is the right answer?’ and more about ‘How did you get the answer?’ It was more like being a scientist,” he said.

Biology was where Joseph Goldbeck, of Boiceville, N.Y., started. "I don’t know about surprise, but I would certainly say it was in my blood!” he told her. And so (S.B. 1978). But then she took a course in metallurgy this July.”

She explained in an e-mail, “The first surprise was that mechanical engineering, had two big surprises at MIT. First-year students Richard Bates, Samantha Fox, KT McCook and Katie Pease were among a dozen MIT students in a class—offered for the first time last semester—that investigated ways to help MIT and the City of Cambridge reduce energy use and greenhouse gas emissions. On May 11, Team Wind, as the four called themselves, presented their results assessing the economic, technical, aesthetic and policy issues connected with installing small and micro-scaled wind turbines on MIT buildings to capture wind energy. In the audience were MIT and Cambridge decision-makers who could help implement the proposed projects.

Nowhere near the scale of commercial turbines with 100-meter-wide blades, the Skystream 3.7 made by Arizona-based Southwest Windpower has compact 12-foot rotors. The Skystream system has an installed cost of around $7,800, although it has never been installed on a building before, and would be eligible for around $2,700 in rebates through the Massachusetts Technology Collaborative. It would provide 2,600 kilowatt hours (kWh) of energy annually.

For Gullotti, one of the surprises at MIT was that for the first time she found herself in an environment where, as she put it, “everyone is like me.” When she arrived at the Institute, she found herself in an environment where there was no one at the table who could easily figure out how to split the check.

The group was blown away by how few of the students in a class—offered for the first time last semester—that understood support of wind power on campus. The problem is that even an MIT-owned 29-story apartment building—was that even an MIT-owned 29-story apartment building—would provide 2,600 kilowatt hours (kWh) of energy annually.

Students find energy answers are blowing in the wind

Deborah Halber
News Office Correspondent

Four students who spent the spring semester determining whether MIT should install rooftop wind turbines uncovered both good news and not-so-good news. The group was blown away by the number of students—offered for the first time last semester—that understood support of wind power on campus. The problem is that even an MIT-owned 29-story apartment building—would provide 2,600 kilowatt hours (kWh) of energy annually.

Two key factors in the project were the cost of the wind turbine and the amount of energy it would provide. The group calculated that the cost to MIT would be nine cents per kWh compared with 15 cents per kWh from a utility company. A turbine installed on the Eastgate would have a payback of 11 years, the group calculated.

The students measured wind speeds at seven campus locations before settling on the Eastgate tower, which houses graduate students and their families in 203 apartments at the east end of campus. The building is close to the Charles River, generally considered a good option for wind power density. A site needs class 3 wind power density, translating to mean wind speeds of around 12 mph, to be economically attractive. MIT’s campus is largely class 1.

The new class, “Energy, Environment and Society,” focused on solving real-world problems. Jeffrey L. Stein- feld, professor of chemistry and director of the Labora-
yory for Energy and Environment (LFE) education pro-
gram. Jefferson W. Tester, the H.P. Meisner Professor of Chemical Engineering; and Amanda Graham, manager of the LFE education program, designed and led the class, aided by three graduate student teaching assistants.

The feel strongly that students develop projects leading to real-world products rather than more abstract outcomes provides a very different learning experience,” Graham said. “The students meet the people who care about the material they generate, and there’s a sudden shift in their investment and motivation that we hope will deepen their experience and commitment and extend their learning.”

The A. Alfred Taubman Fund for Excellence in Education supported the development of this class.

Closing fume hoods could save $1 million

Deborah Halber
News Office Correspondent

A device that sucks up noxious fumes also devours almost $1.4 billion worth of potential energy savings each year.

Fume hoods, widely used by high-tech industries, hos-
pitals and universities, help keep workers from breathing harmful chemical vapors but also consume a lot of energy. A simple device to stop a fume hood running 24 hours a day uses as much energy as a single-family home.

The possible energy savings for more than 750,000 fume hoods across the United States is $1.36 billion annually, according to Lawrence Berk-
ley National Laboratory in California.

Fourth-year Ph.D. student in materials science Dan Wesolowski, left, discusses wind direction and velocity on a rooftop with mechanical engineering sophomore Richard Bates. They and other students put equipment on a number of roofs around the Institute for a month to determine the viability of using wind turbines to generate power. MIT’s co-generation plant is visible behind them.

Conclusive analysis of fume hood use in MIT chemis-
try laboratories, MIT stands to save up to $1 million an-
ually in energy costs.

Lab rat

During his senior year at MIT, Steven T. Amandi spent days and nights in the chemistry building. That would not be unusual for a chemistry student. But Amandi was a mechanical engineering major working under Leon R. Glicksman, professor of building technolo-
y and mechanical engineering. Amandi proved MIT’s thesis that you don’t have to be a chemistry student to develop the course.

Amandi has moved on, but his senior thesis, “Potential Energy Savings on the MIT Campus,” is still very much on the minds of MIT students, staff and administrators. His work led to the passage in 1993 of legislation that led to increased awareness of campus-wide use of fume hoods.

Fume hoods line the walls of more than a dozen labs in...
S-Lab stimulates sustainability at MIT Sloan

Teresa Hill
Laboratory for Energy and the Environment

Insights and energy from several engineering disciplines, architecture, urban planning, management, public policy and the humanities inspired the 60 students enrolled in Sloan’s innovative new Laboratory for Sustainable Business (S-Lab) this year. Teams collaborating with 14 clients to craft business approaches to environmental and social issues showcased their final projects in the lobby of Building E52 on the afternoon of May 16.

Coordinator Sarah Slaughter, an expert in sustainable infrastructure and construction, said that S-Lab “was a learning experience for many of the students, giving them an opportunity to make real change happen…[in] environmental restoration, policy development and social change.” Eight Sloan faculty co-taught the course, using case material, internship experience and integrated analytic tools and frameworks to identify business opportunities presented by the real-world challenges of sustainable energy, the impacts of globalization on social structures and the widening gap between the world’s “haves” and “have-nots.”

The experimental offering drew student from several MIT departments, including advanced undergraduates and master’s and doctoral candidates, and students from other area universities. The initiative represents a new wave of concern over environmental and social responsibility at business schools in the United States and abroad, many of which now have course requirements in those areas. The Sloan faculty focused on sustainable business planning in recognition of the key role climate change is playing in both public and private sector policy and practice.

According to Richard Locke, the Abin J. Siteman Professor of Entrepreneurship and professor of political science, the S-Lab approach is unique in that it synthesizes multiple disciplines. “Up until now we have considered aspects of sustainability—climate, energy, water, food, poverty and social development—in isolation,” he says. “S-Lab is developing an integrated framework to consider the system dynamics of human societies, along with tools and techniques that are used in all sustainability dialogues.”

Acting as entrepreneurs, students used interactive computer-based simulations to invest in firms using renewable resources in a framework of existing policies and business models. The simulations enabled them to see how changes to any set of factors might affect sustainable profitability. “Students engaged in deep learning,” observed Slaughter, as they “worked with the organizations to identify the nature of sustainability and developed new systematic approaches to help each organization reach its sustainable objectives.”

Primed with this innovative learning, the wisdom of eight faculty members, extensive case study and theoretical reading, and the practices reported by guest speakers, students worked in teams to develop solutions to real-world sustainability challenges presented by participating groups. These included large established firms, such as Disney Imagineers, Intel and Nike; startup and small firm participants were GoLoco, a social network facilitating ride sharing; Mibanco, a Latin American microcredit group; Good Energies, a fund investing in renewables; Greenedel Technologies, a biodiesel firm, the Spark Group, an investor in schools and microfinance in Chennai (formerly Madras); India; and Merida, a maker of natural fiber board coverings.

NGOs and government groups included the World Bank; the Universidad Francisco Marroquin program in microfinance; Health Care Without Harm, an organization for improving the environmental quality of buildings; and Friends of Petit-Anse, a Haitian group empowering the poorest of the poor. The Global Energy Initiative’s Campus Energy Task Force also worked with S-Lab students on their applications.

More than $1.1 million has been awarded to 22 faculty teams, some of whom are developing new subjects, thanks to the d’Arboeoff Fund for Excellence in Education for Sustainable Business. The S-Lab Funds from the Classes of 1951, 1955, 1972 and 1999. Both funds are administered by the Office of Faculty Support.

Dean for Curriculum and Faculty Support Martin E. L. Klugman noted that the S-Lab awards reflect a broad and profound commitment to educational innovation among many of MIT’s undergraduate students.

The d’Arboeoff Fund for Excellence in Education supports projects designed to enhance and potentially transform the academic experience of MIT’s undergraduate students. The awardees include:

Building a Constructive Culture

Biological Engineering: Professor Drew Dlugosch—Dlugosch is a recipient of the New England O’Neill Foundation Award in Environmental Education and is a co-founder of the Environmental Education Association of New England.

Materials Science and Engineering: Professor Roberto Buonsanti—Buonsanti explores the link between the properties of materials and the solutions required to meet environmental regulations.

Rederetigraphy: Professor David Smith—Smith studies the use of optical techniques to analyze the properties of materials and their potential for use in the development of new materials.

Music and the Supernatural: Witches, Magi and Ghosts


The New Third World Challenge

Architecture: Professor Ricardo Bofill—Bofill is a leading architect and urban planner who has designed numerous projects in the developing world.

Mapping Controversies

Program in Science, Technology, and Society: Professor Vincent Antonini—Antonini is the editor of the book “The Politics of Knowledge: Mapping Controversies” which explores the role of science and technology in shaping public opinion.

Revisiting World Literatures


The Fischer Files Podcast

Professor Peter Fischer, Physics—Fischer’s project would produce 12 weekly programs on high-level physics, introducing students to the fundamental concepts of physics and their applications.

More information can be found at the Office of Faculty Support web site: web.mit.edu/facultysupport/programs.html.
DNA-damage test could aid drug development

Eric Bender
Whitehead Institute

In the daunting marathon that leads to successful drugs, promising drug candidates must pass toxicity tests before entering clinical trials. Researchers from MIT and the Whitehead Institute have developed a cell culture assay that could allow hundreds of thousands of tests to be performed from the bone marrow of mice. The precursors to red blood cells are handy for this because such cells normally lose their nucleus during the last stage of red cell formation, and DNA-damaged precursors generate red blood cells containing an easily detected "micronucleus" consisting of fragments of nuclear DNA. Unlike the current procedure, which injects the compound into a live mouse, the new assay is a cell-culture system that could allow hundreds of thousands of tests to be performed from the bone marrow of a single mouse, and potentially from human bone marrow.

Joe Shuga, the graduate student in chemical engineering who developed the assay, is in the unusual position of being a graduate student in three labs, those of Professors Linda Griffith, Harvey Lodish (a Whitehead member) and Leona Samson. "We're all faculty in the biological engineering department, and collaborative projects like this are what the department was intended to do," says Griffith, senior author of a paper on the work published online in the Proceedings of the National Academy of Sciences the week of May 14.

"This is an example of taking fundamental lab science and doing something useful with it," says Lodish, whose lab has extensively studied the DNA repair systems by which red blood cells are generated. Shuga first worked with post-doctoral researcher Jing Zhang in Lodish's laboratory to adapt techniques from an established cell-culture system based on mouse fetal liver cells to create a new system based on adult red cell precursors from mouse bone marrow. Shuga patiently optimized the system, which allows the precursors to proliferate and differentiate in the normal way, dividing four or five times before they stop dividing and becoming immature red blood cells. Shuga then studied the way these developing cells reacted to three toxic DNA-damaging agents whose effects had been studied by Samson's lab and found the results correlated well with the results of the test. Additionally, he experimented with mutant mice created by Samson's lab that are deficient in certain DNA-repair systems. The bone marrow cells derived from these mice, and the cells cultured from that bone marrow, proved more sensitive to the toxic agents than were the cultured cells from normal mice, further confirming the results.

With the new assay, "instead of testing one chemical and one dose in one animal, you'll be able to test one animal, get the bone marrow, and test a thousand different conditions," says Samson, the American Cancer Society Research Professor. "You'll be able to look in more detail at different doses given at different times in the cell differentiation process.

This is a much cheaper assay that's at least as predictive as previous assays," emphasizes Griffith, "and drug developers can afford to use it a lot earlier in the drug development process." It also could help to avoid issues with animal testing. "The European Union is trying to minimize animal testing," Shuga points out. "A ban on animal testing of cosmetic products goes into effect in 2009."

Next steps in the research, which may be carried out by industry partners, will be to test the assay in rats and other organisms, and with a wide variety of other toxic chemicals. This research is the first stage in a new type of clinical drug toxicity test," says Lodish. "And although we haven't done it, you may be able to extend the technique to humans."

In the meantime, the Whitehead assay is "in the vanguard of new approaches that use cell cultures to determine drug safety," notes Eric Bender, Whitehead's associate director for technology and science. The scientists found that even when nothing new is being learned. Challenging the monkeys to adjust their task triggered systematic changes in their neural activities on top of the background "noise."

The researchers said their findings suggest a new theory of how the brain learns.

"What surprised us most was that the neural representation of movement seems to change even when behavior doesn't seem to change at all," said Sebastian Seung, professor of physics and computational neuroscience and a Howard Hughes Medical Institute investigator. "This was a surprising degree of instability in the brain's representation of the world."

Seung and Institute Professor Emilio Bizzi led the study, which was published in the May 24 issue of the journal Neuron. Lead author on the study was Uri Rokni, a postdoctoral fellow in Seung's laboratory.

In earlier work, Bizzi and colleagues measured neural activities in the motor cortex while monkeys manipulated a handle to move a cursor to targets on a screen. In control experiments, the monkeys had to move the cursor to targets in the same way they had been trained. In learning experiments, the monkeys had to adapt their movements to compensate for novel forces applied to the handle.

The scientists found that even when the monkeys were performing the familiar control task, their neural activities gradually changed over the course of the session.

To explore the significance of these background changes, Rokni analyzed the data from the learning component of Bizzi's experiments. He found he could distinguish learning-related neural changes from the background changes that occurred during the control experiments. From this analysis, Rokni developed a working theory that combined the concepts of a redundant neural network and that of a "noisy" brain.

"A good analogy to redundant circuitry, which accomplishes the same behavior by different wiring configurations, would be a piece of text, in which you can say the same thing with different words," Rokni explained. "Our theory holds that the learning brain has the equivalent of a teacher and a tinkerer—allowing the signal and noise in the learning process, respectively.

In producing a specific piece of text, the tinkerer just randomly changes the words, while the teacher continually corrects the text to make it have the right meaning. The tinkerer only notices the meaning and not the precise wording. When the teacher and tinkerer work together, the text changes but the meaning remains the same. For example, the tinkerer may change the sentence "John is married" to "John is single", and the teacher may correct it to "John is not single."

"In the same way, learning in the brain has two components—error-correction and noise—that even though the brain representation keeps changing, the behavior remains fixed. We think the tinkerer, that is the noise, is not merely a nuisance to the teacher but is actually helping the teacher explore new possibilities it wouldn't have considered otherwise."

To test this idea, Rokni constructed a mathematical model of a redundant cortical network that controls movement and used it to simulate the learning experiment with the monkeys. In this model, learning of the connections was assumed to be a considerably noisy process. "When we ran the simulation long enough, the performance became good, but the neural representation kept changing—similar to the experiments," Rokni said.

According to Rokni, the concepts of redundant networks and "noisy" brain have important implications for neurobiology. "I don't think redundancy—that the brain can say the same thing in different ways—has really been fully appreciated before."

"More practically, people who are constructing devices that translate brain signals to operate such external devices as neural prostheses will have to take such constantly changing neural representations into account," said Rokni.

"—Courtesy Howard Hughes Medical Institute
Systems model shows sustained policy incentives, carbon taxes will widen alternative vehicle use

Imagine a vehicle that runs on hydrogen or biofuels and offers the same features, performance and price as today’s gasoline vehicle. Could it capture half the market? Not likely, concludes a new MIT analysis of the challenges behind introducing alternative-fuel vehicles to the market place—not even if it is three times more fuel-efficient.

One of the barriers is this Catch-22: Until a high number of alternative fuel (AF) vehicles are already on the road, people won’t consider buying one. The researchers’ conclusions are not all gloomy. If policy incentives are kept in place long enough, adoption will reach a level at which the market will begin to grow on its own. But “long enough” may be a surprisingly long time.

Given today’s environmental pressures and energy security concerns, we need to move away from fossil-fuel-powered vehicles. But repeated attempts to introduce other technologies during the past century have nearly all failed. Defeating the gasoline-consuming internal combustion engine (ICE) has proved difficult.

The challenge is not just introducing an AF vehicle,” said postdoctoral associate Jenser Struben of the Sloan School of Management, who has been examining the mechanisms behind such market transitions. “Consumer acceptance, the fueling infrastructure and manufacturing capability all have to evolve at the same time.”

Thus, consumer exposure to AF vehicles is just one feedback loop that can affect adoption. Similarly, fuel suppliers won’t build AF stations until they’re certain of future demand; but until the fuel is widely available, consumers won’t buy the vehicles. And manufacturers won’t be able to make AF vehicles cheaper and better until their produc- tion volume is high; but highvolume production won’t happen until such improvements are in place to attract buyers.

Then, of course, there’s the status quo to be overcome—the well-established and highly attractive gasoline-ICE vehicle and the fueling infrastructure, energy supply chain and other industries that support it.

Understanding market behavior

To analyze the behavior of this system over time, Stru- ben and Professor John D. Sterman of the Sloan School have developed a system dynamics model that simulates how markets for AF vehicles may (or may not) grow. The model can track the fate of various vehicle platforms, including conventional and advanced ICE, hybrids and plug-in hybrids, hydrogen fuel cells and biofuels. Deci- sions made by consumers, fuel suppliers and manufactur- ers change the market, consumer opinion, vehicle attributes and other factors, which then feed back to alter the decisions people make tomorrow.

Finally, the model accounts for the peculiarities of human behavior. “Our model doesn’t assume that every- body is perfectly rational,” said Sterman. “Instead, we try to model how people actually make decisions such as which cars to buy and when and where to drive them. Emotion and social status matter, along with the economics.” Thus, people’s buying decisions may not reflect the actual features of an AF vehicle but rather what they have heard or read about it. Drivers who are worried about locating fuel for their AF vehicles may fill their tanks early—a behavior that reduces the vehicles’ effective range and may cause unanticipated side effects such as crowding at filling stations.

Analyses to date show that a key factor slowing AF-

CRE redefines housing affordability

Anissa G. Ramirez is passionate about shattering the stereotype of scientists as serious and dull. Ramirez wants to show kids what she knows firsthand: Science can be fun.

Ramirez, who has recently been named an MIT Martin Luther King Jr. Visiting Professor, created the successful and engaging Science Saturdays lecture series at Yale Uni- versity for school children. Ramirez, an associate profes- sor of mechanical engineering at Yale, also hosts the campus-based show, which introduces middle-school-age children to scientists—explaining who they are, and how and why they study what they study.

According to Ramirez, a materials scientist who has developed novel materials for microelectromechanical sys- tems (MEMS) by exploring how materials thinner than a human hair behave mechan- ically. “Science is for everyone and those who do it come in all colors, shapes and sizes. I am committed to getting the word out so that more New Haven children can benefit from this program,” she said. The scientists participating in the program are of various backgrounds, ages and dis- ciplines, and they speak on topics such as “Why Birds Are Dinosaurs” and “What Frogs Are Telling Us.”

Ramirez, who received a Ph.D. degree in materials science and engineering from Stanford University, research- es the development of thin film NiTi shape memory alloys for MEMS systems. MEMS, which integrates mechanical elements, sensors, actuators and electronics on a silicon
MIT researchers probe bone’s tiny building blocks

Team’s results could lead to new composites that mimic bone’s capacity to ‘fail gracefully’

Deborah Halber
News Office Correspondent

In work that could lead to more effective diagnoses and treatments of bone diseases using only a pinhead-sized sample of a patient’s bone, MIT researchers report a first-of-its-kind analysis of the mechanical properties of bone.

The work, reported in the May 21 advance online edition of Nature Materials, sheds new light on how bone absorbs energy.

“Of all the important questions as to why things are broken, one that’s not been well answered is: What happens on the system view. What’s involved in building an electric vehicle. In addition to providing an unusual opportunity for hands-on learning, the project will ultimately yield a sleek Porsche 914 into an electric vehicle. Their goal? To make their creation not only more efficient but also more sustainable.

“With the world facing increasing energy demands, developing electric vehicles is becoming a priority. The team found that the mechanical properties of bone vary greatly within a single region only two micrometers (millionths of a meter) wide. Because a variety of disorders tied to disease or aging lead to changes in bone structure, the researchers’ discovery of the nonuniformity of bone’s mechanical properties at very small length scales could lead to improved diagnoses of diseases. For example, if specific nanoscale patterns of stiffness within bone structure are tied to disease or aging, these could potentially be identified earlier or provide more conclusive evidence of a disorder.

The researchers also formulated a computer model to study the effects of their experimental results on larger-scale biomechanical properties. For example, using the model they found that the nonuniform stiffness patterns were advantageous to bone’s ability to absorb energy.

“We tend to think that if a material is nonuniform, it is not as tough," Suresh said. "This work shows otherwise. Our thesis is that nature, by making bones tougher materials, he said.

The study was led by Christine Ortiz, associate professor of materials science and engineering. “The structure, quality and integrity of bone change dramatically with age and disease, hence understanding the origins of the mechanical properties of this major load-bearing, structural tissue in our body is extremely important from a medical standpoint,” Ortiz said.

Using a tabletop instrument called a molecular force probe, which uses an extremely small probe tip to poke out a tiny fragment of bone, Ortiz and colleagues mapped the stiffness of bovine shin bone into complex, colorful, two-dimensional contour maps similar to those used by geographers.

The team found that the mechanical properties of bone vary greatly within a single region only two micrometers (millionths of a meter) wide. Because a variety of disorders tied to disease or aging have yet to be done.

The Porsche was donated by Professor Yang Shao-Horn of mechanical engineering, who with her husband, Quinn Horn, bought it on eBay and made it available to students interested in converting it to an electric-powered vehicle. In addition to providing an unusual opportunity for hands-on learning, the project will ultimately yield information valuable to Shao-Horn’s research on advanced batteries.

“On the system view. What's involved in building an electric vehicle. In addition to providing a unique opportunity for hands-on learning, the project will ultimately yield information valuable to Shao-Horn’s research on advanced batteries. Specifically, she and her team in the Electrochemical Energy Laboratory will be able to measure the conditions that batteries encounter inside an operating vehicle.

“In the laboratory we work on materials to make batteries safer, last longer and have higher energy,” she said. “But we are also interested in gaining a good perspective on the system view. What’s involved in building an electric vehicle, and what’s required of the batteries?”

The student project took off a year ago when Valence Technology, Inc., agreed to donate 18 high-tech rechargeable batteries valued at $20,000 each, plus a battery-management system. While today’s electric cars generally use single chemistry lead-acid batteries, Valence provided its enabling lithium phosphate rechargeable batteries, which are lighter, last longer, charge faster, have a longer lifetime and don’t pose a safety risk.

Leading the assembly team in the Sloan Automotive Laboratory is senior Emmanuel Sin, who was awarded the Peter Griffith Prize for an “outstanding experimental project and thesis” by the Department of Mechanical Engineering in May.

Sin’s main collaborators on the project are sophomore Ryan King of mechanical engineering; freshman Jeremy Kuempel; graduate student Gerardo Jose la O’, who initiated the project; and graduate student David Danielson, who obtained funding for supplies and tools from Manit Energy Capital. Both la O’ and Danielson are in the Department of Materials Science and Engineering.

To make the conversion, the students replaced the original engine with an electric motor, 12 of the batteries, the battery-management system, various relays and a controller that makes all the components work together. Things haven’t always gone smoothly. “There’s been a lot of adapting things that don’t work as they’re designed,” said King.

“We had to come up with some creative solutions.”

In the next few weeks they hope to put the Porsche through its paces. For example, they’ll determine its acceleration and top speed and will see how far it will go on a single charge.

According to their best estimates, the car should produce 50 to 60 horsepower, have a top speed of 70 to 100 miles per hour, and travel 100 miles or more on a single charge. Flipping it into a wall socket should fully recharge the batteries in four to five hours.

Mechanical engineering graduate student Craig Wildman, background, mechanical engineering sophomore Ryan King, center, and freshman Jeremy Kuempel work on remodeling a Porsche in Sloan Automotive Lab. They are installing the motor controller into the rear trunk compartment of the vehicle.

Research scientist Ming Dao, MIT affiliate Kuangshin Tai, Professor Christine Ortiz and Professor Subra Suresh, with equipment they used to study bone regeneration.

Students take Porsche to Electric Avenue

Nancy Stauffer
MIT Energy Initiative

For the past six months a team of MIT students has spent hundreds of hours—compete at night—converting a sleek Porsche 914 into an electric vehicle. Their goal? To demonstrate the viability of advanced electric vehicle technology and to help clarify what research and development has yet to be done.

The Porsche was donated by Professor Yang Shao-Horn of mechanical engineering, who with her husband, Quinn Horn, bought it on eBay and made it available to students interested in converting it to an electric-powered vehicle. In addition to providing an unusual opportunity for hands-on learning, the project will ultimately yield information valuable to Shao-Horn’s research on advanced batteries.

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being developed in conjunction with the Department of Urban Studies and Planning: “What we’re aiming for is for something on the web—on-line, tap, and the number of people in their house- hold and their income and out will pop a map, which will tell you how many units exist in the metropolitan area that would be affordable to you. . . This is very exciting.”

Not so exciting, from the perspective of those hoping for greater housing densi- ty in the suburbs, were the statistics presented on suburban residential land used.

Density has been getting lower and lower. We found only four communities where that was not the pattern,” Polla- kowski said. “Between 1998 and 2004, nearly 40,000 new single-family houses were built in the metro area outside Boston proper. The median lot size was 0.86 acres and the average was somewhere between 1.1 and 1.2 acres.”

“That’s nearly 50,000 acres—about the size of the city of Boston,” Pollakowski said. “This gives an indication of the way land is being tied up in ways that are not likely to change.”

CMI students celebrate exchange program

Sequeira, 24, who is graduating in Febru- ary 2008, the Graduation Pledge of Social and Environmental Responsibility was launched in spring of 1987 at Humboldt State University in Arcata, Calif., by students then concerned about the nuclear arms race.

The pledge itself is simple: “I pledge to explore and take into account the social and environmental consequences of any job I consider and will try to improve these aspects of any organization for which I work.” Students recite the pledge and sign a green ribbon at graduation ceremonies.

The concept soon spread to other schools, including MIT. In 1988, the Coalition to Humanize MIT implemented the pledge in collaboration with the newly formed Graduation Pledge Alliance, Sequeira said. Pledges were also taken at MIT in the early 2000s.

Sequeira wanted to revamp the con- cept. The 2007 effort was implemented by a coalition of MIT groups, including Fugawash, Muslim Students Association, Laboratory for Energy and the Environ- ment, Technology and Culture Forum, and Students for Global Sustainability. On May 16, MIT pledge-takers were honored in a ceremony and received certificates and wallet cards. About 50 of them—a mix of graduate and undergraduate students—often varied disciplines—will walk across the stage on Commencement on June 8 wearing green ribbons. Organizers hope to express to students that they can make a difference in changing the nature of their minds.

The cultural influence of CMI students has also been key to the program’s success, Crawford stressed.

—Suguna-Sirkhala Knisakarma

DNA

Sequeira was eager to explain his own work. “If you could change the micronucleus of a mouse,” notes Shuga. “That premise ki said. “This gives an indication of the way land is being tied up in ways that are not likely to change.”

Another counterintuitive result: Testing the fuel efficiency of the AF vehicle slowed adoption in a simulation representing Florida, entrepreneurs opened AF stations in areas but not in less-populated rural areas where demand is initially low. Urban AF drivers must then avoid the rural areas, reducing the appeal of AF vehicles and slowing their sales everywhere.

Another counterintuitive result: Tri- ppling the fuel efficiency of the AF vehicle might attract more buyers. But since drivers then need much less fuel, energy suppliers build fewer AF stations, lowering the sales efficiency of these efficient cars. The net result? Sales may actually decline.

Self-sustaining markets

Despite such findings, Sterman sees reason for optimism: “There are tipping points with policy incentives that push the new technology forward and suf- ficient coordination across decision-makers, eventually enough AF vehicles will be on the road that all the decision-makers will buy in and the AF market can become self- sustaining.”

The researchers are not ready to make policy recommendations, but their analy- ses provide initial insights. They clearly illustrate the effectiveness of carbon emis- sion taxes, but they also suggest a variety of other factors need to be examined. For example, given the importance of vehicle lifetime, current vehicles may be more effective than direct incentives. This research shows that the tipping point, policy incentives may have to be kept in place for many decades, even through periods of declining fuel prices. Withdrawing the policies too soon could result in another failed attempt to shift the market away from gasoline-pow- ered ICE vehicles.

The work was supported by the Project on Innovation in Markets and Organizations at the MIT Sloan School of Management, the National Renewable Energy Laboratory and Shell Hydrogen.
FUME HOODS

Continued from Page 3

Building 18. There are 156 hoods on the upper five floors alone. Almost all chemistry experiments take place in the hoods, which are packed with fuming test tubes, beakers filled with multicolored liquids and other chemistry equipment. Sliding glass door nashes open and close to provide access to the workspace.

What Amanti found was that on average, 67 hoods were left open at night and 88 were open during the daytime. Of the open hoods, only five were in use at night and 48 were in use during the day. In fact, 45 percent of the entire electrical load in the building was due to fume hood fans when hoods were not in use.

The hoods are attached to a buildingwide ventilation system that sucks away chemical fumes. When a sash is closed, a valve attached to the hood decreases the flow of air to the hood. When enough sashes are shut, the fan assigned to those hoods also slows down to a more energy-efficient mode. If the unused hoods were closed, the consumption of electricity, steam and chilled water would be decreased by approximately 17 percent and save the Institute $300,000 a year in utility costs,” Amanti wrote in his 2006 thesis.

Habit-forming

Amanti’s research came to the attention of Timothy M. Swager, chemistry department head, who shared the report at a department retreat. He also brought it to the attention of Jim Doughtry, energy health and safety coordinator for the School of Science. With the help of Facilities, the Environment, Health and Safety (EHS) Office, and the Laboratory for Energy and the Environment (LFEF), Doughtry prepared a presentation, made in November 2006, to raise awareness of energy use tied to fume hoods.

Graduate student Elsa Olivetti of materials science and engineering, one of the coordinators of student energy initiatives on campus, was a member of the team, which also included Doughtry; Amanda Graham, LFEF education manager; Steven M. Lanou, deputy director of environmental sustainability for the Environmental Programs Office; Peter L. Cooper, manager of sustainability engineering and utility planning for the Department of Facilities; Richard J. Wilk, administrative officer for the Department of Chemistry; and Pamela Greendyke of the EHS Office.

Olivetti, chemistry department representative and an outside contractor did their own calculations. They found there were 1,200 hoods on campus, around half of which have variable air volume. Judicious use of these hoods could result in savings of up to $1 million a year.

At MIT, graduate student Ryan Altman said that prior to the public education campaign, fume hood energy use “wasn’t something we even thought about. It wasn’t a consideration.” Now Altman, an EHS lab representative on the research team of Stephen L. Buchwald, the Camille Dreyfus Professor of Chemistry, is conscientious about his own use of the equipment. He tries to ensure that his entire lab is aware of the effort, through e-mails, signs and word of mouth.

“The biggest challenge is to get it to be on people’s minds to shut their hoods when they go home at night, so we are trying to bombard them with the message from all different venues,” Doughtry said. He is collecting data on current fume hood energy use to show how it is changing over time.

Altman said that when he tells labmates they’re surprised and shocked. They’re pleasantly surprised and shocked. They’re willing to do something to help. It’s just a matter of instilling good habits to replace the bad ones,” he said.

Improving energy efficiency through fume hood use is one of the many campus opportunities being explored by the MIT Energy Initiative’s Campus Energy Task Force to reduce MIT’s energy and carbon footprint.

A team of students in Course 2.009 (Product Engineering Processes) built the Revolution bicycle, designed to help developmentally disabled children learn to ride a bike. Above right, senior mechanical engineering majors Michal Ruchelsman and senior electrical engineer Gabrielle Green, a member of the ‘Bluesteele’ team, which designed the bike, received a $5,000 award in the IDEAS Competition. Other MIT members of the team are senior Elsyas Wari, junior Albert Hernandez, senior Mark Cote, senior Jorge Renjifo-Murdo and Lou Godish, senior business developer in the Office of the Provost. ‘For three years at MIT the academic rigors made it hard to see light at the end of the tunnel. This is a great way to end it, it was an incredible experience working with these students,’ said Ruchelsman. ‘I never thought I’d be able to see the satisfaction of my work, and the impact I can have on other people’s lives, after just four years. Some people don’t see that in a lifetime. It made all the sleepless nights worthwhile.’

Timothy Swager

PhD candidate in Chemistry, is the director of the Laboratory for Energy and the Environment (LFEF). LFEF is committed to using energy more efficiently, reducing waste, and reducing greenhouse gas emissions. LFEF’s mission is to support and encourage research, teaching, and outreach activities that contribute to the development of sustainable technologies and practices.

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David H. Marks

In 1992, the Martin Family Foundation established a doctoral fellowship program that supports students at MIT. Between 1997 and 2006, the Walensky Foundation brought a wonderful group of Swedish postdocs to LFEF, to the benefit of everyone involved.

Q: What now supports sustainability studies at MIT?

A: With the evolution of the MIT Energy Initiative, energy studies are really taking off. We are now working to combine the less-energy-specific environmental projects with other activities to create a new, closely related organization for sustainability studies at MIT.

Q: Can you give us some background on efforts to establish a focus on cross-disciplinary environmental studies at the Institute level?

A: Environmental studies have been really coming together since the mid-1990s. The MIT Environmental Council was formed in the early 1990s and has met monthly since.

The Institute brought in about 85 million over eight years from the Kann Rasmussen Foundation, which was used to support the Climate Study, the Energy Futures project, and the group that initiated the Alliance for Global Sustainability. In 1997, a grant from Ford made it possible to set up the Center for Environmental Initiatives.

Q: Does support for research also stimulate educational initiatives?

A: Through the initial Program in Environmental Engineering and Education, begun in the early 1990s, we worked hard to bring environmental awareness into the education of not only future environmental professionals but also all MIT students. Environmental literacy is important in every field. Also in 1997, the Martin Family Foundation established a doctoral fellowship program that supports around 25 one-semester fellowships. Between 1997 and 2006, the Walensky Foundation brought a wonderful group of Swedish postdocs to LFEF, to the benefit of everyone involved.

Q: What has been the level of investment in these activities?

A: Between 1992 and the present, we’ve raised $60 to $70 million in support of this work, all from private, industrial and foundation sources. With those funds we’ve supported faculty and student research, workshops and larger-scale meetings, communications—the entire array of activities required for a vibrant academic sector.

Q: Is interdisciplinary study of large-scale systems, such as the environment, a tough sell in an atmosphere emphasizing highly specialized and focused research?

A: The objective of interdisciplinary studies is to encourage the best possible research at the personal, disciplinary level of each investigator while fitting that work into the context of wider concerns that will be, of necessity, interdisciplinary. Not an easy trick, but I think we’ve done it suc...
Influenza

Continued from Page 1
came out June 4.
We can't reduce to zero the chance that any of us will get the next bad flu. But there is compelling evidence that we can reduce the chances of our loved ones and ourselves getting the flu by a significant factor," said Larson, the Mitis Professor of Health and Science Systems at the Operations Research Center.

The problem is one of many kinds of avian flu, which has infected birds throughout Asia and Europe, with a few known cases among humans. So far, the disease has not mutated to a form where it can jump easily between birds and humans, but it is likely to happen, the disease could spread around the world in days or weeks.

Larson and his research team decided to model the progress of such an epidemic, taking a unique approach. Unlike most existing models, theirs takes into account people's different levels of social activity and susceptibility to the flu.

One of the report's key findings is that "social distancing"—reducing the frequency and intensity of personal contact—could be an effective way to limit the spread of the disease.

Influenza is normally spread by person-to-person contact, no people who have more social contact with others have a higher risk of catching the disease and then spreading it to others. Because the virus adapts so well to humans, understanding how new outbreaks can be contained is a challenge. The researchers believe that spreading the flu is a "multi- gene" process, one for each level of social activity or propensity to become infected, provides better policy guidance. In Larson's model, every population component is assigned different values for R0, depending on the level of social contact, and susceptibility to infection if exposed to the flu. Considering these factors can be crucial, they took into account how much energy such a policy would require, as well as the overall benefit they could bring.

"We need to be aggressive. We need to take public health measures to reduce social contact, such as encouraging people to work from home and going to school online," Larson said. "This is especially important because it generally takes at least six months from the time of an outbreak to develop an effective vaccine. Those who must continue to work as doctors and public health care workers, should be the first to receive the vaccine. We've also shown that an available avian flu vaccine that might be developed, he said.

Larson says that large institutions that can set and control policies, and well-to-wheels analyses of alternative vehicle technologies and fuels. Q: What's your vision for sustainability research and education at MIT? A: MIT's new focus on energy has given legitimacy to the idea of the sustainability of energy. "We need to take seriously this vision, to see, first, a very high level of environmental literacy among MIT graduates as they go forth to work in their own fields, in industries, governments and universities. Sec- ond, MIT will be producing a generation of experts, a core of professionals in areas directly bearing on sustainability—now it's about 5 per cent of our graduate students. And third, we should focus on improving the first two, of the products of MIT's research and educations of sustainable development. That will have a greater influence on sustainability-related national and international policy and in the training of future leaders," he said.

Right now, Professor Maria Zuber, head of the Department of Earth, Atmo- spheric and Planetary Sciences, is chairing a committee thinking about a sustainabil- ity-prep class. Larson said that the committee needs a significant commitment to sustainability research funded in part by an IBM Faculty Research Award.

Bones

Continued from Page 7

nonuniform at extremely small scale lengths over the course of millions of years of evolution, has not been fully understood. The material must absorb much more energy than a uniform material with the same properties.

I was surprised that we observed a strain that had such environmental differences from its immediate surroundings, said Johs. This strain was what we call "natural selection." It was found at the Stata Center garage, 5 miles from MIT on bus line.

There are many different factors that can affect the structure of the bone. Let's talk about the first two, the products of MIT research and education at MIT. A: MIT's new focus on energy has given legitimacy to the idea of sustainability of energy. "We need to take seriously this vision, to see, first, a very high level of environmental literacy among MIT graduates as they go forth to work in their own fields, in industries, governments and universities. Second, MIT will be producing a generation of experts, a core of professionals in areas directly bearing on sustainability—now it's about 5 per cent of our graduate students. And third, we should focus on improving the first two, of the products of MIT's research and educations of sustainable development. That will have a greater influence on sustainability-related national and international policy and in the training of future leaders," he said.

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LIFE

Continued from Page 9

crisscrossed, for example, in our studies of air quality issues in Mexico City; electricity futures for Shandong Province, China; and data building the case for Shwes and well-to-wheels analyses of alternative vehicles and fuels.

Q: What's your vision for sustainability research and education at MIT? A: MIT's new focus on energy has given legitimacy to the idea of sustainability of energy. "We need to take seriously this vision, to see, first, a very high level of environmental literacy among MIT graduates as they go forth to work in their own fields, in industries, governments and universities. Second, MIT will be producing a generation of experts, a core of professionals in areas directly bearing on sustainability—now it's about 5 per cent of our graduate students. And third, we should focus on improving the first two, of the products of MIT's research and educations of sustainable development. That will have a greater influence on sustainability-related national and international policy and in the training of future leaders," he said.

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Initiative. The group is exploring institu- tional options that may best map onto MIT's strengths and objectives. We're doing ter- rific things here—people need to know.

A longer version of this article appeared in the LFE newsletter, Energy and Environ- ment.
WTP Continued from Page 1

these young women had trouble imagining themselves as students at MIT—let alone graduating with bachelor's degrees from the School of Engineering.

For Sutsky, the worry was that she wouldn’t be capable of tackling the notoriously rigorous freshman curriculum or adjusting to a new “environment of intense intellectual expectations.” Fortunately, though, before she had even decided which universities to apply to, “WTP made attending MIT a realistic option” for her by providing an early glimpse of what it’s really like to be a student at MIT. As students at MIT—let alone graduating with bachelor’s degrees from the School of Engineering. His main hesitation was that people would be “too smart,” in fact, she confesses that it was a WTP offered that first summer but also as role models for teen

Discouraged by the “low number of female students and instructors” in the electrical engineering and computer science department at MIT, Ricket started WTP. He hired a team of MIT women, including graduate and undergraduate students, to help combat the erroneous but prevalent assumption many adolescent girls hold that they won’t succeed as engineers. The students served not only as instructors and residential tutors for the electrical engineering, computer science and math classes that were offered that first summer but also as role models for teen-agers who might be wondering whether or not they would fit in at the Institute.

As Schor attests with a smile, the plan worked for her: “WTP gave me comfort in accepting my admission here, because my main hesitation was that people would be ‘too nerdy,’” but the residential tutors I had were all great and mostly normal! In fact, she confesses that it was a WTP instructor who inspired her to major in mechanical engineering as an undergraduate. “She told me that you get to build things in all of your MechE classes.”

But over and above the insider knowledge she acquired from the program’s staff, Schor says the best part of WTP was the camaraderie that developed among the participants themselves. “It was a great experience to work with people with the same academic desires and abilities as me, and to feed off of each other.” Every group member was equally capable of generating new and creative solutions to problems and had the motivation to do so, which was different than my high school experience.”

No doubt this enthusiasm for teamwork will serve her well in Tarragona, Spain, where she has taken a job with the Dow Chemical Corporation that starts in the fall—just after she spends one more summer in WTP, this time as a residential tutor for the program’s new mechanical engineering track.

Although Sutsky will not be joining her WTP classmate Schor on staff (she’ll be busy preparing to attend George-town University’s master’s program in health physics), she clearly believes in the benefits of the program: “I would recommend WTP to any woman who wants to spend a month evaluating her personal and intellectual comfort zones, and then challenging herself against high-reaching goals and aspirations that she had previously dismissed as unattainable. WTP is a woman’s opportunity to develop, fine-tune and cultivate an invaluable confidence in herself.”

To find out more about WTP, please go to wtp.mit.edu.

International advisory group will assess, support MIT projects

MIT has established a new International Advisory Committee (IAC) to assess and support MIT’s international activities, Provost L. Rafael Reif announced.

The IAC will help to ensure that MIT’s growing international activities “continue to advance our core missions of teaching, research and service,” Reif wrote in an e-mail to the MIT faculty.

Reif charged the committee with designing a strategy to target countries and regions where MIT should focus its international efforts and identifying cross-cutting topics and themes. The IAC will also advise Reif and President Susan Hockfield, Reif and the Faculty Policy Committee on recommendations for increasing opportunities for our students to have diverse international educational experiences. We must engage actively in the world’s most exciting research fields, wherever they may reside. We must increase opportunities for our students to have diverse international educational experiences. We must engage actively in the world’s most exciting research fields, wherever they may reside. We must increase opportunities for our students to have diverse international educational experiences. We must engage actively in the world’s most exciting research fields, wherever they may reside. We must increase opportunities for our students to have diverse international educational experiences. We must engage actively in the world’s most exciting research fields, wherever they may reside. We must increase opportunities for our students to have diverse international educational experiences. We must engage actively in the world’s most exciting research fields, wherever they may reside.

“The committee will report regularly to Hockfield, Reif and the Faculty Policy Committee, and will report from time to time to the MIT faculty on its progress.

In Ford-MIT Alliance is renewed

The Ford-MIT Alliance has been renewed for a third five-year term ($15 million total) beginning January 2008. The alliance reports to Chancellor Phillip L. Clay, with Professor John Heywood, faculty director, Simon Fitzs, alliance director for Ford, and Elaine Savage, MIT’s executive direc-tor, managing a research portfolio of more than 20 projects including active safety, energy, pow-ertrain and other areas. The alliance interacts with visiting executive committee three times annually.

RAMIREZ Continued from Page 6

substrate, enables the development of “smart” products in which the comput-ational ability of microelectronics is aug-mented with microprocessors and microac-tuators.

Before joining the faculty at Yale in 2003, Ramirez worked as a member of the technical staff at Bell Labs’ Lucent Technologies in Murray Hill, N.J., for four years. At Bell Labs, she developed an advanced solder, now being commer-
cialized by Adhera Technologies, that can bond directly to glass and ceramics.

MIT’s Technology Review, when nam-ing Ramirez one of the world’s 100 Top Young Innovators (TR100) in 2003, called her discovery a “holy grail” of metallurgy: a universal solder that can bond metals to ceramics, glass, diamonds and particularly the oxide materials used in semiconductor fabrication. Researchers have been seek-ing this kind of compound because exist-ing solders have failed in electronic and optical devices.

“I’ve brought excitement to unsexy materials like solder,” Ramirez said.

PHOTO COURTESY / WTP

Incoming freshman Kristen Whaley, left, and Andrea Wang work on their final WTP projects.

PHOTO COURTESY / WTP

Christina Giles, right, was a WTP student in mechanical engineering in summer 2006.
COMMENCEMENT

Continued from Page 1

broader public attention and to strengthen national policy on science, engineering and education. He chaired the President’s Advisory Committee on the Redesign of the Space Station and serves on the President’s Committee of Advisors on Science and Technology. He chaired the U.S. Department of Energy Task Force on the Future of Science Programs at the DOE, was vice chair of the Council on Competitiveness for eight years and is a past chair of the Association of American Universities.

Commencement speakers

Hockfield will deliver the traditional charge to the graduates. Other Commencement speakers will include Eric Weese, president of the Graduate Student Council, and Susan J. Shin, president of the Class of 2007.

The Rev. Johanna Kietner, MIT Lutheran chaplain, will deliver the invocation.

Hockfield will also present the following degrees: bachelor of science, bachelor of science/master of science, bachelor of science/master of engineering and advanced degrees in the School of Science, the Woods Hole Oceanographic Institution and the Whitaker College of Health Sciences and Technology.

Provost L. Rafael Reif will award advanced degrees in the Schools of Architecture and Planning; Engineering; Humanities, Arts, and Social Sciences; and the MIT Sloan School of Management.

Admission for ticketed guests begins at 7:30 a.m. Graduates will robe and assemble on the first floor of Johnson Athletic Center beginning at 7:30 a.m. Before 8 a.m. and the beginning of the academic procession, families and guests may enjoy a live view of the graduates robing and assembling via television feed to Killian Court.

Following the exercises, a reception will be held for graduates and their guests on the West Campus Plaza.

Time and venue

A special hooding ceremony for Ph.D. and Sc.D. recipients will take place on Thursday, June 7, at 11 a.m. in Rockwell Cage. Admission for guests begins at 10 a.m.; tickets are not required. Chancellor Phillip L. Clay will preside.

Commencement exercises require complex and precise planning and the comings and goings of guests must be free of obstruction or interference.

In accordance with this policy, Killian Court will only be accessible to members of the graduating class, faculty, stage assembly and ticket-holders. Access to Johnson Athletics Center will also be limited. In both Killian Court and Johnson, visitors will be required to pass through security checkpoints.

For more specific details, please see the Statement by the Chancellor’s Committee on Protocol for Demonstrations at Commencement and Other Academic Exercises. Questions regarding locations for demonstrations may be directed to Gayle Gallagher, executive officer for Commencement, at gayle@mit.edu.

For those unable to get into Killian Court, a live online webcast of the Commencement exercises will be available on and after June 8.

Parking

For guests attending the Commencement exercises on Friday, complimentary parking will be available in the Albany Street Garage on Albany Street.

Members of the MIT community who normally park in the Albany Street Garage should review the campus changes that are in effect during Commencement time.

Paid parking will also be available in the Marriott Hotel Parking Garage (entrance at the corner of Ames Street and Broadway) and the Technology Square Parking Garage (entrance on Broadway) on Thursday and Friday.

In the event the Commencement exercises in Killian Court are canceled due to severe weather conditions, the speeches will be held in Rockwell Cage for the stage assembly and graduates only. Guests may view the speeches on closed-circuit television in viewing locations throughout the campus.

Complete Commencement information is available at web.mit.edu/commencement/2007/.

Spring forward

Rhododendrons bloomed near the President's Courtyard, welcoming the Institute community to Commencement.