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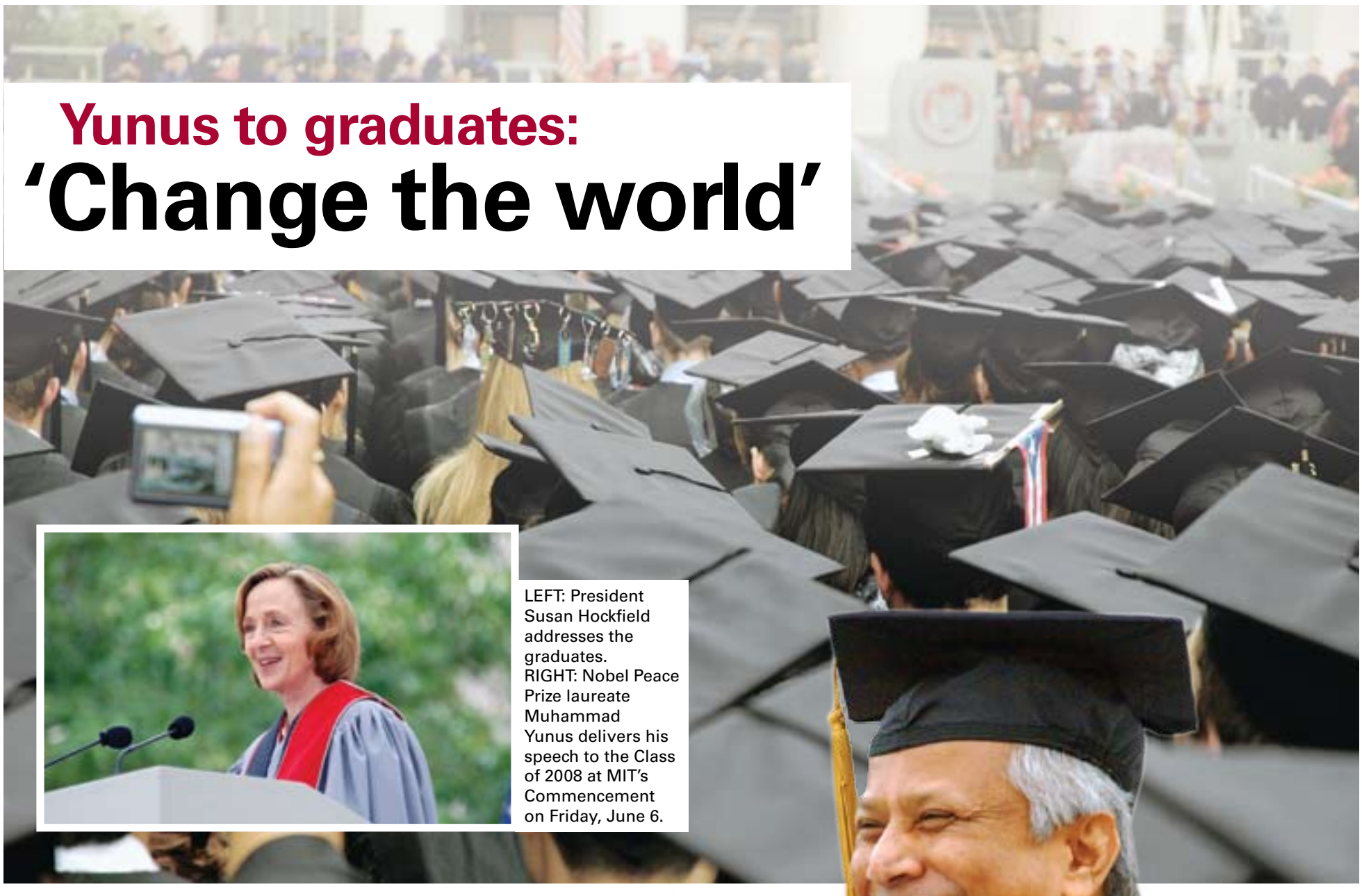
Wednesday, June 11, 2008

TechTalk

SERVING THE MIT COMMUNITY

Yunus to graduates:

‘Change the world’



LEFT: President Susan Hockfield addresses the graduates.
RIGHT: Nobel Peace Prize laureate Muhammad Yunus delivers his speech to the Class of 2008 at MIT’s Commencement on Friday, June 6.

PHOTOS / **DONNA COVENEY, SARAH PUTNAM**

David Chandler
News Office

2006 Nobel Peace Prize laureate Muhammad Yunus told graduating students at MIT’s 142nd Commencement exercises on Friday that they “represent the future of the world,” and urged them to spend at least part of their time in coming years creating a whole new kind of businesses to help make the world a better place.

Nature cooperated with MIT’s Commencement, but only after threatening to put a serious damper on the ceremony: The opening processional was delayed a few minutes by rain that had been pouring down through the early morning, but the skies cleared just in time for the ceremonies to proceed and for 2,335 graduates to receive their degrees.

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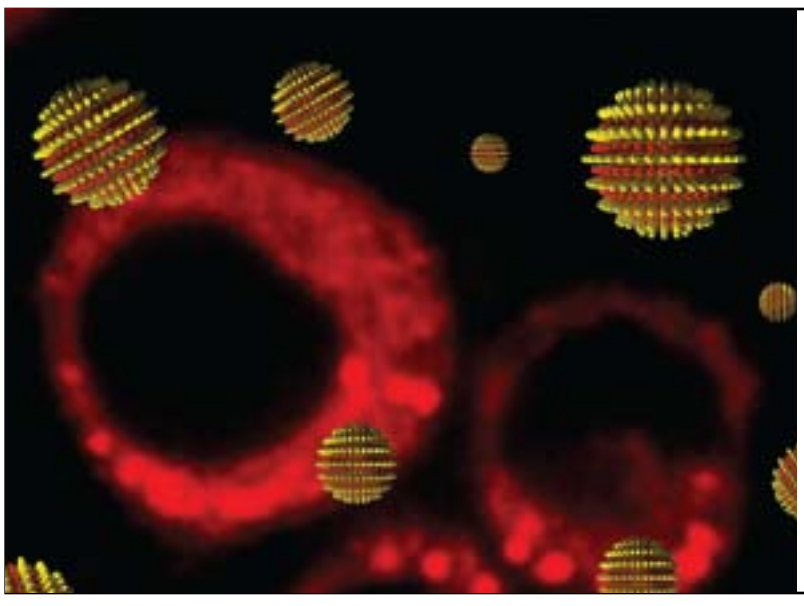

IMAGE / **FRANCESCO STELLACCI, DARRELL IRVINE**

MIT researchers have created ‘striped’ nanoparticles capable of entering a cell without rupturing it. In the background of this cartoon are cells that have taken up nanoparticles carrying fluorescent imaging agents.

MIT: Stripes key to nanoparticle drug delivery

Elizabeth Thomson
News Office

In work that could at the same time impact the delivery of drugs and explain a biological mystery, MIT engineers have created the first synthetic nanoparticles that can penetrate a cell without poking a hole in its protective membrane and killing it.

The key to their approach? Stripes.

The team found that gold nanoparticles coated with alternating bands of two different kinds of molecules can quickly pass into cells without harming them, while those randomly coated with the same materials cannot. The research was reported in a recent advance online publication of Nature Materials.

“We’ve created the first fully synthetic material that can pass through a cell membrane without rupturing it, and we’ve found that order on the nanometer scale is necessary to provide this property,” said Francesco Stellacci, an associate professor in the Department of Materials Science and Engineering and co-leader of the work with

▶Please see NANO, **PAGE 6**

PEOPLE

Schmidt named associate provost

Professor Martin Schmidt, of the Department of Electrical Engineering and Computer Science, will succeed Lorna Gibson in the post.

PAGE 7

RESEARCH

Super sensitive

MIT chemical engineers have built the most sensitive electronic detector yet for sensing deadly gases such as the nerve agent sarin.

PAGE 2

NEWS

Corporation elects new members

The MIT Corporation elected 10 term members and one life member at its quarterly meeting on Friday, prior to the Commencement exercises.

PAGE 7

Langer a winner of Spain's Asturias award

Institute Professor Robert Langer is one of five scientists to receive a top Spanish honor, the 2008 Prince of Asturias Award for Technical and Scientific Research. The five were recognized as "worldwide leaders in the creation of new materials for the benefit of mankind."

Langer was cited for developing "novel biomimetic materials in the form of polymers, nanoparticles or chips which permit the controlled delivery of drugs throughout the human body."

Robert Langer

Each winner will receive a diploma, a Joan Miró sculpture, an insignia bearing the Foundation's coat of arms and a cash prize of 50,000 Euros ($78,000).

"I'm deeply honored to receive this wonderful award. It's a privilege to be considered in the same category as the past and current recipients," Langer said.

The Prince of Asturias Awards have been awarded annually since 1981 in eight different categories: Technical and Scientific Research, Arts, International Cooperation, Communication and Humanities, Social Sciences and Letters and Sports and Concord.

The Prince of Asturias Foundation was named for His Royal Highness the Prince of Asturias, heir to the throne of Spain. One of the main objectives of the Foundation is to uphold and promote "all those scientific, cultural and humanistic values that form the heritage of humanity." The awards will be presented in the autumn at a grand ceremony chaired by H.R.H. the Prince of Asturias.

AWARDS & HONORS

MIT sailing master and coach **Fran Charles** received the prestigious Graham Hall Award for outstanding service by a college sailing professional recently at the 2008 ICSA/Gill National Championship. As recipient of the coveted honor, Charles was inducted into the Intercollegiate Sailing Hall of Fame.

Alan J. Grodzinsky, director of the Center for Biomedical Engineering at MIT, received one of five honorary doctorates from the University of Montreal during its Convocation on Friday, May 30.

Sergey Yekhanin, who graduated with his PhD from CSAIL/MIT in 2007, has been selected as the winner of the Association for Computing Machinery's Doctoral Dissertation Award. The award is presented annually to the author(s) of the best doctoral dissertation(s) in computer science and engineering.

Blood drive June 23-27

MIT's American Red Cross Team and Network will be conducting a blood drive June 23-27 in La Sala de Puerto Rico on the second floor of the MIT Student Center.

All donors and volunteers will get a free Red Sox blood drive T-shirt.

For more information or to make an appointment, visit http://web.mit.edu/blood-drive/www/

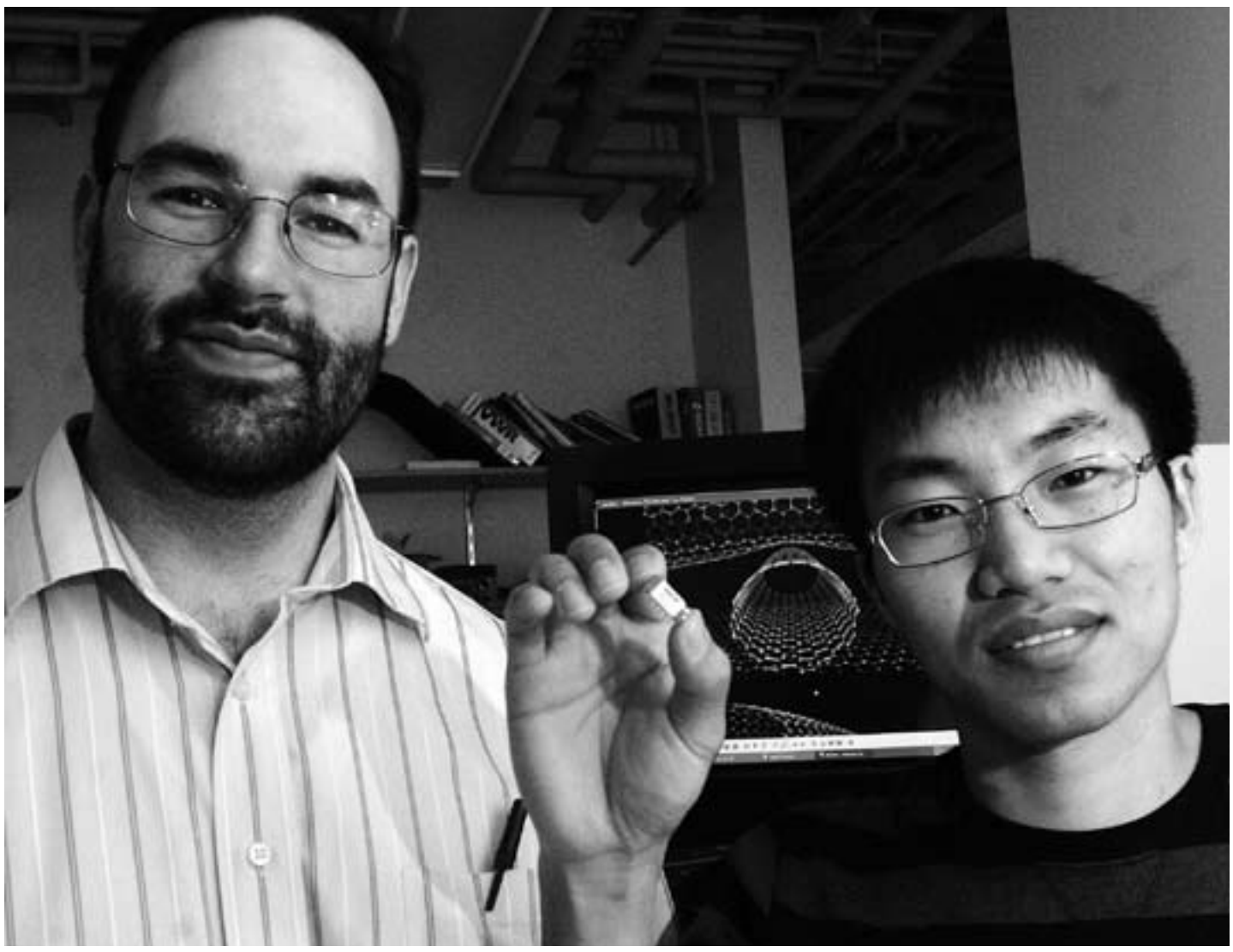

PHOTO / **DONNA COVENEY**

Michael Strano, associate professor of chemical engineering at MIT, and graduate student Chang Young Lee, right. Strano and his team have built a highly sensitive detector, here held by Lee, using carbon nanotubes that can sense very small quantities of neurotoxins.

Super-sensitive and small: New MIT detector uses nanotubes to sense deadly gases

Anne Trafton
News Office

Using carbon nanotubes, MIT chemical engineers have built the most sensitive electronic detector yet for sensing deadly gases such as the nerve agent sarin.

The technology, which could also detect mustard gas, ammonia and VX nerve agents, has potential to be used as a low-cost, low-energy device that could be carried in a pocket or deployed inside a building to monitor hazardous chemicals.

"We think this could be applied to a variety of environmental and security applications," said Michael Strano, the Charles and Hilda Roddey Associate Professor of Chemical Engineering and senior author of a paper describing the work published last week in the online edition of Angewandte Chemie.

Strano's sensor has exhibited record sensitivity to molecules mimicking organophosphate nerve toxins such as sarin: It can detect minute quantities as low as 1 femtomole (1 billion molecules), roughly equivalent to a concentration of 25 parts per trillion. "There's nothing that even comes close," he said.

Sarin, which killed 12 people in a 1995 terrorist attack on the Tokyo subway, can kill at very low concentrations (parts per million) after 10 minutes, so highly sensitive detection is imperative to save lives. The new detector is far more sensitive than needed to detect lethal doses.

To build their super-sensitive detector, Strano and his team used an array of carbon nanotubes aligned across microelectrodes. Each tube consists of a single-layer lattice of carbon atoms, rolled into a long cylinder with a diameter about 1/50,000 of the width of a human hair, which acts as a molecular wire.

The nanotube sensors require very little power—about 0.0003 watts. One sensor could run essentially forever on a regular battery. "It's something that could sit in the corner of a room and you could just forget about it," Strano said.

> *It's something that could sit in the corner of a room and you could just forget about it.*
>
> **Michael Strano**
> **Associate professor of chemical engineering**

When a particular gas molecule binds to the carbon nanotube, the tube's electrical conductivity changes. Each gas affects conductivity differently, so gases can be identified by measuring the conductivity change after binding.

The researchers achieved new levels of sensitivity by coupling the nanotubes with a miniature gas-chromatography column etched onto a silicon chip smaller than a penny. The column rapidly separates different gases before feeding them into the nanotubes.

The new MIT sensor is also the first nanotube sensor that is passively reversible at this level of sensitivity. To achieve this, the team needed to decrease how strongly the nanotube sensor binds different gas molecules on its surface, allowing the sensor to detect a series of gas exposures in rapid succession.

Using a newly described chemistry outlined in a separate paper published in January in the Journal of the American Chemical Society, Strano and co-workers showed that this can be done by coating the nanotubes with amine-type molecules, which donate an extra pair of electrons to the nanotubes.

The coating allows gas molecules to bind to nanotubes but detach a few milliseconds later, allowing another molecule from the column to move in. With a network of these reversible sensors, a gas could be tracked as it spreads through a large area.

The lead author of the paper is Chang Young Lee, a graduate student in chemical engineering. Richa Sharma, another MIT graduate student in chemical engineering, is also an author of the paper. Adarsh Radadia and Richard Masel at the University of Illinois at Urbana-Champaign developed the microcolumn technology.

The work was funded by the Department of Homeland Security under contract to the Federal Aviation Administration and MIT's Institute for Soldier Nanotechnologies. Characterization facilities used for this work were supported by the Department of Energy. Microcolumn and detector development was funded in part by the Defense Advanced Research Projects Agency.

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MIT team develops better X-ray nanomirrors

Nanotechnology will enhance future telescopes

David Chandler
News Office

A new way of bending X-ray beams developed by MIT researchers could lead to greatly improved space telescopes, as well as new tools for biology and for the manufacture of semiconductor chips.

X-rays from space provide astronomers with important information about the most exotic events and objects in our universe, such as dark energy, black holes and neutron stars. But X-rays are notoriously difficult to collect and many interesting cosmic sources are faint, which makes collecting these high-energy rays difficult and time-consuming, even with telescopes on satellites far above our X-ray-absorbing atmosphere.

Now a group of researchers from MIT has fabricated a new, highly efficient, nanoscale Venetian-blind-like device that contains thousands of ultrasmooth mirror slats per millimeter for use in future improved space-based X-ray telescopes. The so-called Critical-Angle Transmission (CAT) gratings feature dense arrays of tens-of-nanometer-thin, freely suspended silicon structures that serve as efficient mirrors for the reflection and diffraction of nanometer-wavelength light—otherwise known as X-rays.

New instrument designs based on these gratings could also lead to advances in fields beyond astrophysics, from plasma physics to the life and environmental sciences, as well as in extreme ultraviolet lithography, a technology of interest to the semiconductor industry. The concept behind CAT gratings might also open new avenues for devices in neutron optics and for the diffraction of electrons, atoms and molecules.

Based on an invention by Ralf Heilmann and Mark Schattenburg of the Space Nanotechnology Laboratory (SNL) at the MIT Kavli Institute of Astrophysics and Space Research, the daunting fabrication challenges were overcome by graduate student Minseung Ahn of the Department of Mechanical Engineering at MIT in a yearlong effort, with the help of financial support from NASA and a Samsung Fellowship.

Motivated by technology goals for NASA's next-generation X-ray telescope, called Constellation-X, the new devices promise to improve more than five-fold upon the efficiency of the transmission gratings on board NASA's Chandra X-Ray Observatory (launched in 1999), which were also built at the Space Nanotechnology Lab. The reason for this improvement lies in the fact that in the new design, X-rays are reflected very efficiently at very shallow angles—akin to skipping stones on water—from the sub-nanometer-smooth sidewalls of the silicon slats, through the spaces between the slats. Also, in the earlier version the X-rays had to pass through a supporting substrate of polyimide, which absorbed many of the rays and reduced the grating's efficiency.

The silicon slats—as thin as 35 nanometers, which is comparable to the smallest feature sizes still under development in commercial computer chip manufacturing—are parallel to each other and separated by as little as about 150 nanometers. The slats have to extend many micrometers in the remaining two dimensions. "Imagine a thin, 40-foot-long, 8-foot-tall mirror, with surface roughness below a tenth of a millimeter," says Heilmann. "Then put tens of thousands of these mirrors next to each other, each spaced precisely an inch from the next. Now shrink the whole assembly—including the roughness—down by a factor of a million, and you have a good CAT grating."

Recent X-ray test results from a prototype device, obtained with the help of Eric Gullikson of Lawrence Berkeley National Laboratory, confirmed that it met theoretical expectations. The results of this work were published in Optics Express (Vol. 16, No. 12) on Monday. They were also presented at the 52nd International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication in Portland, Ore., on May 28, and will be presented again at the SPIE Conference on Astronomical Telescopes and Instrumentation in Marseille, France, on June 23.

Forum examines cities and climate change

The MIT School of Architecture and Planning and the Boston Society of Architects this week held the second of two symposia focused on the challenges facing the modern city in a period of global climate change, bringing together leading urbanists from around the world.

Held at MIT's Tang Center, Monday's event focused on "Cities and Systems: Energy and Mobility in the Green City." Speakers at both events—collectively titled "Mass Impact: Cities and Climate Change"—included architects, engineers, urban and regional planners, political leaders and specialists in urban policy, public health, new technologies and transportation.

Both Monday's symposium and an earlier one, held in March, were motivated by the fact that while cities cover only 2 percent of the world's surface, they accommodate half the world's population and consume three-quarters of its resources. In their density and compactness, they also present a substantial opportunity for easing the causes and effects of global warming.

"The greening of cities will become an enormously important issue over the next decade as urban communities try to confront climate change and meet the considerable demands for carbon emission reductions at a national, state and community scale," said Associate Professor of Architecture Andrew Scott, a co-organizer of the conference. "This is not a problem that is going to go away, so the symposium is a first step in creating a cross-disciplinary discourse about the challenge."

A key goal of the symposia was to establish an agenda for Boston, informed by current best practices, that will help it become an example to follow as a 21st-century sustainable city.

"We have to figure out how to retrofit existing cities, like Boston, to massively reduce greenhouse gases and to respond to the inevitable challenges of energy pricing, limited natural resources and geographic shifts caused by raising sea levels," Scott said. "There are many targets set by government about energy and CO_2 targets but how do we turn these into effective and coordinated action? How can we effectively measure the carbon footprint over time at a city scale?"

Both symposia included a feature called Ten Slides/Ten Minutes, in which professionals associated with the built environment presented projects or research exploring aspects of the discussion topics. The keynote speaker at Monday's meeting was Nicky Gavron, deputy mayor of London from 2004-2008.

Reunion giving surges past $100M

Nancy DuVergne Smith
MIT Alumni Association

Nexi, the robot, stole the show during Technology Day, June 7, when it rolled onto the Kresge Auditorium stage and introduced faculty creator Cynthia Breazeal SM '93, ScD '00. Affable, expressive and quintessentially high tech, Nexi exemplified the Institute's innovation research presented at Tech Reunions 2008, which drew more than 3,240 alumni and guests. The Media Lab robot's spectacular presence was, however, matched by the announcement of alumni reunion giving totals—$100,578,568, a marked increase over last year's total of $54 million.

Participation, a high priority, was also strong. At the Tech Day Luncheon in the Johnson Athletic Center, President Susan Hockfield reflected on senior class gift participation during her first MIT reunion four years ago—27 percent. This year's class swept away the recording-setting numbers of the past two years—51 and 52 percent, with gifts coming from 64.4 percent of the senior class, which gave $16,524. Alumni Association President Harbo Jensen PhD '74 added $25,000 to the Class of 2008 Externship Assistance Fund when the seniors resoundingly met his participation challenge.

Class reunion gift co-chair Glen Strehle '58, former MIT treasurer, was clad in the historic red jacket, like many of his classmates, for the first time. He announced a 50th class reunion gift of $21,316,772 with donations from 70 percent of the class. The 40th reunion class, 1968, raised $7,948,263 with 66 percent participation. The 25th reunion class presented $4,354,508, with donations from 66 percent of the Class of 1983. The Classes of 1938 and 1948 both broke records with gifts of $12,164,710 and $34,854,451, respectively.

"This is an amazing reunion year … that demonstrated the devotion and dedication of alumni," Hockfield noted.

Despite volatile temperatures, alumni attended 153 events such as the 111th Tech Night at the Pops, which featured cellist Carlos Prieto '58, observing his 50th reunion from the Symphony Hall stage. Reunion Row drew a Sunday morning crowd with cheers going up for the winning Class of 1963 team. MIT's oldest alumnus, Yardley Chittick '22, celebrated his 86th reunion. Alumni arrived on campus from 44 states, Washington, D.C., Puerto Rico and the Virgin Islands, plus 24 countries, including Bulgaria, Mauritius and Suriname.

Final Tech Talk until September

The News Office will resume production of Tech Talk in September. For daily updates on MIT news, people and events, please go to http://web.mit.edu/newsoffice.

CLASSIFIED ADS

FOR SALE

House near Thomaston, Maine, minutes from coast in St. George. Expanded cape, circa 1800, 11 rooms with B&B potential. 15 acres gardens, fields and woods. Fireplace and woodstoves, huge room in converted barn. Also has sep. 2-BR apt. $490,000. 207-236-6171.

Wooden bunk bed. Bicycles (Schwinn, boys ages 4-6 and 7-9). Playmobil (police vehicles; submarine), Bionicles and Knights Kingdom sets. Gently used. Contact Dana at bresee@mit.edu or tel. 617-489-4380.

1995 Zuma 12.8' Sailboat with trailer, Beam (width) 5', Weight 130#, Sail Area 65 SF, Self Draining Cockpit, Kick-up Rudder, Easy to handle sail plan. Asking $1,000 or best offer. 339-237-0960

Sofa bed: old, but in good condition. Take it away and it's yours! Contact Peter C. Perdue, 617-905-3702 or pcperdue@mit.edu

RENTALS

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

MISCELLANEOUS

Seeking qualified statistics student or staff for short-term project analyzing correlation between web-based learning systems and performance on standardized tests. Send cover letter and resume to iguana@mit.edu.

Seeking a small and dependable car for my teenage son. Please contact Cheryl at cheryl@mit.edu or 978-276-0670

TUTORING FOR YOUR KIDS I specialize in gifted children and gifted children with ADD, grades 1-8. Twenty years experience. Call me for more information or questions at 617-962-1193 singerd@mit.edu

PHOTOS / **DONNA COVENEY**

LEFT: MIT administration and faculty, along with Commencement speaker Muhammad Yunus, proceed down Massachusetts Avenue for the start of Commencement. RIGHT: Tai DaCosta, who received a BS in Art and Design in the School of Architecture and Planning, cheers on a friend just descending from receiving his diploma.

COMMENCEMENT: Class of '08 graduates

Continued from **Page 1**

Citing his own in experiences in going against all conventional wisdom in the pioneering creation of Grameen Bank in his native Bangladesh—the forerunner of what is now a multibillion-dollar worldwide trend in microlending—Yunus said such businesses have a fundamentally different philosophy than conventional companies that see their prime obligation as the maximization of profit.

What's needed, Yunus said, is to "reformulate the concept of a businessman"—not to replace the present model, but to offer another alternative that people can choose to follow. Such new-style businesspeople, he said, would have as their goal not maximum profit but "achieving some predefined social objective."

Creating such alternative socially conscious businesses, he said, "will bring a big change in the world." And for Yunus, this is not just talk, but a history of real action: In addition to his now-famous bank, he has already created partnerships to start a variety of such socially conscious businesses. For example, he created Grameen Phone to bring cell-phone service to Bangladesh and other developing countries, where most homes have no electricity, plumbing or telephone service.

Yunus has also helped to start "social businesses" including one to make yogurt that has added nutrients to help the millions of malnourished children in Bangladesh, another to provide a low-cost health-insurance program, a company to provide safe drinking water "in a sustainable way to all the people who are faced with a water crisis," an eye-care hospital, a shoe company and one to produce insecticide-treated mosquito nets to combat malaria.

'A wonderful gift inside'

He has even teamed with the giant microchip manufacturer Intel to create a company that will bring information technology to third-world countries, for health care and education.

Every graduate of MIT, he said, has the potential to "design social businesses to overcome poverty, diseases, environmental degradation, food crisis, depletion of nonrenewable resources, etc." The problems facing the world may seem daunting, he said—as they did when he started his first business more than 30 years ago—but "big problems are often just an aggregation of little problems." And these little problems can often be tackled modestly, by setting up a "cute little business."

Such a business may seem like a small contribution, but "if it works out, the whole world can be changed by replicating it in thousands of locations." All people, he said, "are packed with unlimited potential" and carry "a wonderful gift inside them … Our challenge is to help the poor unwrap their gift."

MIT President Susan Hockfield reinforced the challenge to the 983 undergraduates receiving their bachelor's degrees and the 1,352 graduate students receiving master's and doctorate degrees. She described Yunus' message as "do-something optimism," which makes it possible to tackle a big, ancient problem such as poverty and also "allows you to look at a problem as big and new and tangled as energy and climate change, and react not with fear, nor paralysis, but with the analytical curiosity and rigorous creativity of a community of disciplined minds."

While MIT will miss these graduates, she said, "the world right now needs you."

Picking up on that challenge, Phi Ho, president of the Class of 2008, who has already spent time working with underprivileged children in southeast Asia, said that among the lessons he and his classmates have learned from the "unique experience" of MIT is to "find unconventional answers to the problems the world faces today." He and his classmates, he said, "are agents of change for the future."

Graduate Student Council President Leeland Ekstrom added that the typical MIT attitude is to "refuse to accept a 'no,'" and always to want to "make it better, even if it's good enough."

'Sun or rain, it's still joyous'

When parents and friends first arrived at Killian Court on Friday morning and saw a downpour, some decided to stay indoors and watch the proceedings on closed-circuit television. But others were undeterred: "We started to watch indoors but we decided it wouldn't be as much fun as being out here," said Carol Loehmann, whose son, Greg, received his MBA.

Loehmann, who left Cheshire, Conn., at 6 a.m. with her family to make it to MIT in time, said that even with less-than-perfect weather, "It's a joyous occasion. Whether there's sun or rain, it's still joyous."

And many graduates found the Commencement address inspiring. "It was very idealistic, and I wish more people thought like that," said Timothy Mwangi, who received his bachelor's degree in electrical engineering and computer science. "He did make me think about trying to think a little bit more in a socially conscious way."

"Ultimately his message was that you can do anything," said AliciA Jillian Hardy, who received her PhD in mechanical engineering. "If your focus is on helping people, then just get out there and do it," she said.

If this generation can succeed in tackling these great problems, Yunus said, "then yours will be the most successful generation in human history." That's certainly a big challenge, but one that MIT's Class of 2008 seems ready to take on.

Additional reporting by Anne Trafton

The Hooding Ceremony

Thursday, June 5

PHOTOS / **DONNA COVENEY**

ABOVE, LEFT: Chancellor Phillip Clay stands with a beaming AliciA Jillian J. Hardy, the first black American woman to get a PhD in mechanical engineering at MIT. ABOVE, RIGHT: President Susan Hockfield and Bish Sanyal, Ford International Professor of Urban Development and Planning and chair of the faculty, make their way to the hooding ceremony.

LEFT: James Dwight Mclurkin IV hugs his mom, Sandra Lawson after the hooding ceremony at Rockwell Cage on Thursday afternoon.
ABOVE: O. Patrick Kreidl, whose PhD thesis was in electrical engineering, is hooded at the ceremony in Rockwell Cage on Thursday.

COMMENCEMENT 2008

ABOVE: Members of MIT's Class of 2008 make their way to their seats during Friday's Commencement exercises.

PHOTOS / **DONNA COVENEY**

ABOVE: Graduate Student Council President Leeland Ekstrom delivers his address to his fellow classmates.

LEFT: An unexpected guest at this year's Commencement was a family of ducks who navigated their way through Killian Court.

PHOTO / **SARAH PUTNAM**

ABOVE: Graduates wait for MIT's Commencement exercises to begin.
RIGHT: Commencement speaker and Nobel Peace Prize laureate Muhammad Yunus delivers his address to the graduates.

Video, audio and more

For complete coverage of Friday's Commencement exercises, including audio of both Muhammad Yunus' and Susan Hockfield's speeches and a photo slideshow, check out the News Office web site at http://web.mit.edu/newsoffice.

Resource Development, Alumni Association moving

PHOTO / **JOSE ACOSTA**

MIT's Department of Resource Development and the MIT Alumni Association are scheduled to relocate to this building at 600 Memorial Drive this summer.

Tom Witkowski
Resource Development

MIT's Department of Resource Development and the MIT Alumni Association are scheduled to relocate this summer from seven different buildings on campus to a newly renovated building at the western end of campus.

Starting in June and continuing through July, the two organizations will move to 600 Memorial Drive, known as W98. Resource Development will move first, consolidating staff currently housed in four other buildings on campus. The Alumni Association is set to relocate staff from spaces in three other buildings on campus in July.

The vice presidents of both offices believe the move provides strategic opportunities.

"Having all the Resource Development staff together will strengthen our fundraising efforts and sharing space with our Alumni Association colleagues will allow new synergies to develop," said Jeffrey L. Newton, vice president for Resource Development.

Beth Garvin, executive vice president of the Alumni Association, agreed. "Sharing this new building will give us many more opportunities to collaborate and work together for the benefit of MIT, its alumni/ae, donors, and students," she said.

MIT is completing a yearlong renovation of the seven-story building that will provide 68,000 square feet of office space. The first floor of W98 will include a multi-purpose alumni welcome center. This space will make it easy for alumni, corporate sponsors, parents, and friends of MIT to come together at the western side of campus.

Some of the renovations were designed to save energy. The building interior takes advantage of the large south-facing windows and natural light. The majority of offices are open offices, and private offices have glass walls. In addition, the building will have occupancy sensor lighting that will use heat-and-motion detection to control lights. The building will also have lockers to house 20 bicycles. Although both organizations will complete their moves by the end of July, renovations on the first floor will not be completed until the fall.

Built in 1928, the building was originally a jam and table delicacies factory, and most recently the headquarters for a construction company. W98 overlooks the Charles River and Boston and is owned by the MIT Investment Management Co. Boston-based architectural firm Menders, Torrey, & Spencer, Inc. designed the new space.

PHOTO / **CARLOS MUNTADAS**

Making a splash

An MIT-designed building featuring water walls that can be programmed to display patterns and images is being unveiled this week at the opening of the Zaragoza World Expo in Spain.

The Digital Water Pavilion, selected as Time magazine's 'best invention of the year' in the field of architecture when its plans were announced in 2007, is the first of its kind and illustrates the potential of digital architecture to create spaces that dynamically adjust to people and conditions.

Schmidt to succeed Gibson as associate provost

Professor Martin Schmidt of the Department of Electrical Engineering and Computer Science has been appointed Associate Provost, Provost L. Rafael Reif announced last week.

Schmidt will succeed Lorna Gibson, the Matoula S. Salapatas Professor of Materials Science and Engineering, who will return to her research in the Department of Materials Science and Engineering and will be taking a sabbatical next year.

"Professor Gibson brought a depth of experience, sound and thoughtful judgment, and a strategic perspective to this position, and I am deeply grateful for her service," Reif said. "I look forward to working with Professor Schmidt to build on the strong foundation she helped establish."

Professor Schmidt SM '83, PhD '88 has been a faculty member since 1988. From 1989 to 2006 he served as the director of the Microsystems Technology Laboratories (MTL) at MIT. His teaching and research is in the areas of micro and nanofabrication of sensors, actuators, and electronic devices, microelectromechanical systems (MEMS), design of micromechanical sensors and actuators, and micro/nanofabrication technology. He is the co-author of more than 60 archival journal publications and 110 peer-reviewed conference proceedings. His appointment will commence July 1.

The Associate Provost chairs the Committee for the Review of Space Planning (CRSP), with oversight for space planning, allocation and renovations across the Institute. The position also includes responsibility for managing faculty affairs, including faculty development, renewal, and grievance policies and procedures.

During her tenure as Associate Provost, Professor Gibson oversaw the David H. Koch Institute for Integrative Cancer Research from program development through to the beginning of construction. Working with Vice President for Human Resources Alison Alden and her staff, as well as the staff in the Provost's office, she also helped develop the recently announced program for faculty renewal. In addition, she chaired the Advisory Council on Neuroscience overseeing faculty searches.

PHOTO / **TONY RINALDO**

Martin Schmidt

NANO: Stripes key to nanoparticle drug delivery

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Darrell Irvine, the Eugene Bell Career Development Associate Professor of Tissue Engineering.

In addition to the practical applications of such nanoparticles for drug delivery and more—the MIT team used them to deliver fluorescent imaging agents to cells—the tiny spheres could help explain how some biological materials such as peptides are able to enter cells.

"No one understands how these biologically derived cell-penetrating materials work," said Irvine. "So we could use the new particles to learn more about their biological counterparts. Could they be analogues of the biological system?"

When a cell membrane recognizes a foreign object such as a nanoparticle, it normally wraps around or "eats" it, encasing the object in a smaller bubble inside the cell that can eventually be excreted. Any drugs or other agents attached to the nanoparticle therefore never reach the main fluid section of the cell, or cytosol, where they could have an effect.

Such nanoparticles can also be "chaperoned" by biological molecules into the cytosol, but this, too, has drawbacks. Chaperones can work in some cells but not others, and carry one cargo but not another.

Hence the importance of the MIT work in developing nanoparticles that can directly penetrate the cell membrane, deliver their cargo to the cytosol, and do so without killing the cell.

Irvine compares the feat to a phenomenon kids can discover. "If you have a soap film and you poke it with a bubble wand, you'll pop it," he said. "But if you coat the bubble wand with soap before poking the film, it will pass through the film without popping it because it's coated with the same material." Stellacci notes that the coated nanoparticles have properties similar to the cell membrane—not identical—but the analogy is still apt.

Stellacci first reported the creation of the striped nanoparticles in a 2004 Nature Materials paper. At the time, "we noticed that they interacted with proteins in an interesting way," he said. "Could they also have interesting interactions with cells?" Four years later, he and his colleagues report a resounding "yes."

Stellacci and Irvine's coauthors are Ayush Verma, Oktay Uzun, Ying Hu and Suelin Chen of the Department of Materials Science and Engineering (MSE); Yuhua Hu of the Department of Chemical Engineering; Hee-Sun Han of the Department of Chemistry, and Nicky Watson of the Department of Biology.

Irvine has appointments in the Department of Biological Engineering and MSE, and is a member of the David H. Koch Institute for Integrative Cancer Research at MIT. He was recently named a Howard Hughes Medical Institute investigator.

The research was funded in part by the NSF, the NIH and the Packard Foundation.

Corporation names new members at meeting

The MIT Corporation, the Institute's board of trustees, elected 10 term members and one life member at its quarterly meeting on Friday morning, June 6, before the Commencement exercises. Dana G. Mead, chair of the Corporation, announced the election results. All memberships are effective July 1.

The new life member is Arthur J. Samberg, who received an SB degree in Aeronautics and Astronautics from MIT in 1962. Samberg has been an Alumni Association nominee to the Corporation since 2003. He has served as Chair of the MIT Investment Management Company Board since 2004 and on two visiting committees. He received an SM in Aeronautics and Astronautics from Stanford University and an MBA from Columbia University.

It was also announced at the meeting that Antonia D. Schuman, Class of 1958, has been named the 2008-2009 president of the Association of Alumni and Alumnae of MIT. As such, she becomes an ex officio member of the Corporation. Schuman served a previous five-year term on the Corporation from 1995-2000 as an Alumni Association nominee. She succeeds Harbo Peter Jensen who returns to the Corporation for a new five-year term that will conclude in 2013.

As of July 1, the Corporation will consist of 73 distinguished leaders in education, science, engineering and industry; of those, 21 are life members and eight are ex officio. An additional 34 individuals are life members emeritus, participating in meetings but without a vote.

Ursula M. Burns

President, Xerox Corporation

Term: Five years
Education: SB 1980 (Polytechnic Institute of New York), SM 1981 (Columbia University)

Lawrence K. Fish

Chairman, Citizens Financial Group Inc.; Chairman, RBS America

Term: Five years
Education: Bachelor's 1966 (Drake University), MBA 1968 (Harvard Business School)
Current MIT activities: Corporation member (2003-08), Executive Committee (2005-08), Corporation Visiting Committees: Sloan School of Management (2007-present), Urban Studies and Planning (2006-present)

Diane B. Greene

President and CEO, VMware Inc.

Term: Five years
Education: BS 1976 (University of Vermont), SM 1978 (MIT), MS 1987 (University of California at Berkeley)
Current MIT activities: Visiting Committee, Department of Biological Engineering

Helen Greiner

Chairman of the Board and Co-Founder, iRobot Corporation

Term: Five years (alumni association nominee)
Education: SB 1989 and SM 1990 (MIT)
Current MIT activities: Association of MIT Alumnae, Sloan Management Society (2005-10), Electrical Engineering Visiting Committee (2006-10)
MIT Awards: TR100 (Tech Review), 2004

Harbo Peter Jensen

Vice President, ChevronTexaco Global Technology Services Co.

Term: Five years (alumni association nominee)
Education: BA 1971 (Northeastern University), PhD 1974 (MIT)
Current MIT activities: Corporation ex officio member 2007-08. Corporation Visiting Committees (BE, Materials Science and Engineering, Nuclear Science and Engineering)
MIT Awards: Harold E. Lobdell '17 Distinguished Service Award (1986); Bronze Beaver Award (1994)

Abigail P. Johnson

President, Personal and Workplace Investing, Fidelity Investments

Term: Five years
Education: BA 1984 (Hobart and William Smith Colleges), MBA 1988 (Harvard Business School)
Current MIT activities: Corporation member (2007-present); Investment Management Company Board, Director (2007-present), Corporation Visiting Committees: Sloan School of Management (2007-present)

Marta M. Luczynska

Recent MIT graduate

Term: Five years (recent classes nominee)
Education: BS 2006 and MEng 2007 (MIT)
MIT awards: Outstanding Resident Advisor of the Year Award, 2007, Priscilla King Gray Award for Public Service, 2006

Victor J. Menezes

Senior Advisor, New Silk Route Partners, LLC

Term: Five years (alumni association nominee)
Education: Electrical engineering degree 1970 (Indian Institute of Technology Bombay), MS 1972 (MIT)
Current MIT activities: Corporation Visiting Committee, Sloan School of Management (2003-present)

Arthur J. Samberg

Chairman, Pequot Capital Management Inc.

Term: Life membership
Education: SB 1962 (MIT), MS 1963 (Stanford University), MBA 1967 (Columbia University)
Current MIT activities: Corporation Member (2003-present); Executive Committee, ex officio (2007-present); Investment Management Company Board, chair (2004-present); Visiting Committees: Aero-Astro (2003-present), CEE (2003-present)

Antonia D. Schuman

Manager of Advanced Systems, Retired, TRW Data Technologies Division

Term: Ex officio for one year, as president of the Association of Alumni and Alumnae of MIT
Education: SB 1958 (MIT)
Current MIT activities: Corporation Visiting Committee for Athletics, Physical Education, and Recreation (1995-present)
MIT Awards: Lobdell Award (1986); Bronze Beaver (1994)

Peter L. Slavin, MD

President, Massachusetts General Hospital (MGH); Professor of Health Care Policy, Harvard Medical School

Term: One year
Education: BS 1979 (Harvard College), MD 1984 (Harvard Medical School), MBA 1990 (Harvard Business School)

Laura D'Andrea Tyson

Professor, Business Administration and Economics, Haas School of Business, University of California at Berkeley

Term: Five years
Education: BA 1969 (Smith College), PhD 1974 (MIT)
Current MIT activities: Economics Visiting Committee (2007-present)

INTERVIEW WITH THE DEAN

Adele Santos,

dean of the School of Architecture and Planning

Over the course of the spring semester, Tech Talk has brought readers a series of interviews with each of MIT's five school deans. The final interview in this series features Dean Adele Santos of the School of Architecture and Planning. In the following interview with Sarah H. Wright of the MIT News Office, Santos discusses the school's goals and challenges and the role it can play in the future of sustainable cities across the world.

PHOTO / **JUDITH M. DANIELS**

Dean Adele Santos of the School of Architecture and Planning

Q: *You have said that one of your immediate goals when you came here was to look afresh at the programs and direction of the school. What have you done so far?*

A: Well, for starters we've had a change of leadership in every division. Architecture, visual studies, the Media Lab, the Center for Real Estate. And we're now in the process of hiring a new head in urban studies and planning. We've got new leadership all around.

Q: *Architecture, DUSP and Real Estate have all received high rankings since you've been dean. Care to comment?*

A: Architecture was critical. We really needed to bring the department up to its true potential, and it's worked. We're now ranked number two in the country. Which, you know, is terrific. People are starting to say 'Wow, things are really happening at MIT, let's find out what's going on.' But we've got to keep that up. Urban studies and planning is already number one in the country, but there are still moments when we need to ask if our emphasis and resources are in the right places. The Center for Real Estate, the first of its kind in the country, again, needed to take a fresh approach, and now it has a new emphasis on global real estate development. The Media Lab had gone through its period of complete excellence and brilliance, inventing itself, and its motivations needed fine-tuning. I'm really excited about what I see happening over there now in the area of human augmentation—how to use technology to mitigate the effects of mental and physical disabilities.

Q: *Do you have a guiding vision for the school?*

A: Absolutely. The MIT ethos is about making a better world, right? Educating and training both the hand and mind. That is very much who we are as part of this institution. We are trying to invent the future—an approach that is unique when you compare us to our competitors.

Q: *Does one approach or strategy symbolize MIT's unique strength for you?*

A: Collaboration. The notion of cross-institutional, cross-disciplinary collaboration is very much part of the MIT ethos. And most of the activities that take place in our school are collaborative ventures. The architect does not work alone. The planner doesn't work alone. The idea that we can work together on solving problems is critical here.

Q: *What research topics do faculty share now?*

A: A number of faculty from across the school are working on reducing the demand for energy—in how we design buildings and cities, and in the materials and technologies we use in that design. The idea of the city is another place where people come together. Architecture and planning are obvious players in that, and real estate fits in for obvious reasons. And the Media Lab gets involved, too, because now we can embed networks in cities. We can direct traffic through embedded networks in the streets. We can be very sophisticated about messages on billboards, on facades, on moderating climatic issues.

Q: *New cities are going up around the world—how does the school respond to or lead those projects?*

A: City building has really changed its nature quite a bit. It used to be governments that built cities. Now it's the private sector. We're also building cities at a scale and speed that's completely unprecedented. And of course cities absorb enormous amounts of energy and they take lots of energy to build. So you have the whole energy agenda to consider. We know how to make a green building by now but we don't know how to make environments that bring all of these concerns together collectively. That's a fascinating challenge that brings not just our school together but also brings us together with engineering, for example.

Q: *Has the school been sought out for city-building expertise?*

A: Oh yes. I've just come back from Japan where I have negotiated a research grant for us to help in the building of sustainable communities. It's an interesting problem—nobody's really demonstrated how we deal with infrastructure, the water, the sewers, the roads. We've also been approached by a new consortium that wants to do this in India.

Q: *What particular challenges is the school facing right now?*

A: An immediate problem we have is space. We're very dispersed. Our faculty and programs are currently located in six different campus locations—reaching from Central Square to Kendall Square down practically to Memorial Drive and over to Massachusetts Avenue.

It's incredibly frustrating because we do not have those elements that are normal to an architecture school. The other problem is that we don't have exhibition space. I've been harping on this since before I arrived. It is a concern for maintaining the quality of our programs. We can't have traveling shows, we can't really do things that have a bit of a splash, because we have no place to do it.

Q: *Would an exhibition space start the process of centralizing?*

A: Yes. I'm very interested that we should know what other faculty are doing. It turns out so is the dean of engineering, so we have gotten together around this idea that we need a place—like the new gallery at the MIT Museum—where we can all display our work. I've actually started to make some diagrams of where this could be. It may fall on deaf ears, frankly, but the fact is that we need a place where we can reveal MIT, not to the world at large—that, too—but also just to ourselves.

Q: *Is there any place that does this now?*

A: Yes. When we replaced the studio walls in our school with glass, it made an enormous difference. You can walk through our halls now and see what's going on. That's what this whole place should be like. Right now you have Lobby 13, which is a disaster. Between Lobby 13 and Lobby 10, worse than a disaster. And here's an opportunity to do something that doesn't have to be space-consuming, doesn't have to be expensive, but it sort of reveals who we are and what we do, with changing exhibits. We need to show off the incredible work of our faculty and students.

Q: *What about the Media Lab building?*

A: It's going to be magnificent. There will be a café on the top floor and there will be roof terraces and the views of the river and downtown. I suspect people will really want to be there. We'll be bringing the visual artists over from N51-52 to join the Media Lab crowd. The Scheller Teacher Education Program will move and be near the Lifelong Kindergarten Group. And the Comparative Media Studies from SHASS will also be joining them there. With the List Gallery also in that building, we start to have a really interesting cluster of arts and media. I think that kind of synergy is really very exciting.

Q: *Let's shift to global matters. Can you tell us about the Beijing Studio?*

A: We've been collaborating on the Beijing Design Studio with Tsinghua University for 22 years now. That's a long time. Every second year there's an open design studio that brings together our students and faculty from architecture and planning with students and faculty at Tsinghua. They spend approximately six weeks studying some area of Beijing and proposing design solutions. Last year, the Chinese government held an exhibition celebrating the two decades of work produced by this collaboration. Based on this studio, we developed the idea of an urbanization lab, called Urb Lab—a research program focused on the problems of rapid urbanization and city building.

We have also had a design studio in Japan for the past 15 years. This year will be the 16th, organized through Shun Kanda, one of our faculty

Q: *What's the educational goal in all this?*

A: Students get practical, hands-on experience globally. We pick emerging problems that are very critical, built around faculty and student interests. We have faculty and students from India who are inherently interested in the problems that exist there. There's strong faculty and student interest in China. Next we might pick another locus in Latin American. Maybe Mexico City.

And places like India and China aren't just repeating old models that come from somewhere else. We're really rethinking the whole paradigm. How do you build a city for 10 million people, just like that? The world has never done that before.