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TechTalk
SERVING THE MIT COMMUNITY

MIT is No. 1 in U.S. News ranking

Sarah H. Wright
News Office

MIT has once again earned top honors in U.S. News & World Report's annual ranking of American graduate school programs, with the School of Engineering, the Department of Economics and more than a dozen MIT departments or programs ranked No. 1 nationwide.

U.S. News & World Report magazine has published its well-regarded graduate school rankings for 17 years. The 2006 edition of its book, "America's Best Graduate Schools," hit the newsstands April 1.

MIT's School of Engineering was ranked No. 1 among U.S. graduate engineering schools, with Stanford University, the University of California at Berkeley and Georgia Institute of Technology taking 2nd, 3rd and 4th place, respectively.

MIT also placed first in seven of 12 engineering specialties—aeronautics and astronautics, chemical, computer, electrical, materials, mechanical and nuclear engineering—fifth in civil engineering and seventh in biomedical engineering.

The magazine's criteria for determining overall engineering rankings include peer assessment, recruiter assessment, research activity, student selectivity and doctoral student-to-faculty ratio. MIT scored 100—the top—overall.

MIT's Economics Department was ranked No. 1 overall among doctoral programs in economics. The Institute's programs in econometrics, macroeconomics and public finance also took No. 1 rankings, with programs in development economics, industrial organization, international economics and labor economics all ranking among the top five.

MIT's Political Science Department was ranked 10th in the nation, along with Columbia University and UCLA. The Institute's Psychology Department ranked 12th, along with Stanford University and the University of Texas-Austin. The Institute's programs in behavioral neuroscience and cognitive psychology ranked fourth and sixth, respectively.

Department chairs and senior faculty ranked doctoral programs in social science and humanities based on academic excellence. MIT's Sloan School of Management tied for fourth place overall with Northwestern's Kellogg School of Management.

Business school deans and MBA program directors ranked business specialty programs on academic quality and placement success, among other categories. MIT's Sloan School's programs in information systems, production/operations and supply chain/logistics were ranked No. 1.

The magazine's ranking of American undergraduate programs appears in August.

Buddhist message written in sand

Denise Brehm
News Office

Painstakingly created grain by grain, the 4-foot Vajrasattva Sand Mandala was completed yesterday at Simmons Hall in a Buddhist ritual intended to form a physical expression of insight, awareness and altruism.

MIT's Buddhist chaplain, Tenzin (Tibetan for "Holder of Dharma") L.S. Priyadarshi, worked with Lama Dhondup Tsering, a Buddhist monk trained at the Gyuto Tantric College in India, to create the mandala, which they started on Saturday, April 2.

Buddhists use the visual and aural to try to condition the mind, to become aware of thoughts ("In any one moment, we have 3,000 thoughts in our mind," Priyadarshi said), to filter them down, and finally to manifest the good thoughts in speech or action.

The image at Simmons Hall focuses on the cosmic Buddha of insight and purification, according to Priyadarshi,

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PHOTO / **DONNA COVENEY**

Lama Dhondup Tsering, a Buddhist monk, works painstakingly Monday to create a sand mandala at Simmons Hall. It will be on view through Saturday.

Math whiz fights terror with smarts

Cathryn M. Delude
Special to MIT Tech Talk

The man who keeps the hit TV show "Numb3rs" mathematically honest is also using a rarified math theory to correct a flaw in standard counterterrorism thinking. A recent visiting professor of mathematics at MIT and a Hollywood math consultant, Dr. Jonathan D. Farley realized that experts could make potentially grave errors by overestimating their effectiveness at breaking up terrorist cells. "They're asking the wrong question and getting the wrong answer," Farley explains.

It's an easy mistake to make, since most government operatives don't use lattice theory to analyze social networks. Lattice theory, which includes Boolean algebra, is Farley's favorite conceptual realm, and his talent at it has earned him great acclaim. (In 2003, he solved a problem posed by MIT's Richard Stanley in 1981.)

He used to joke that it has no practical purpose whatsoever, but after the Sept. 11 terrorist attacks, Farley wondered if pure math actually could save lives. He remembered the opening line in the movie "A Beautiful Mind" about John Nash: "Mathematicians won the war." And, he remembered Palestinian leader George Habash's words: "Terrorism is a thinking man's game."

Being a thinking man, Farley says, "it's better to fight smarter, not harder," and fighting Al Qaeda with abstract theory could more accurately assess our vulnerability to future attacks than current methods. As a bonus, it could also prevent financial resources from being wasted on phantom fears at the expense of real dangers.

"People often view terrorist cells as a

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'Clocky' earns grad student 15 mins. of fame

Sasha Brown
News Office

A relatively simple product designed to combat a common problem is turning Media Arts and Science graduate student Gauri Nanda into a celebrity.

Working to solve the main cause of oversleeping—the snooze bar—Nanda has designed an early morning hide-and-seek process that could revolutionize the morning for many oversleepers.

Clocky—a shag-carpeting-covered digital clock on two wheels—jumps from the bedside table to find a hiding spot each time the snooze bar is pressed. A few minutes later, when the alarm sounds for a second time, the sleeper must first find the clock before he or she can press snooze again. Its designed to force people up and out of bed, making them less likely to keep snoozing.

Nanda created Clocky last semester

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Researchers ID gene linked to brain size

A tiny molecule is key to determining the size and shape of the developing brain, researchers from the Picower Institute for Learning and Memory at MIT reported in the March issue of Nature Neuroscience. This molecule may one day enable scientists to manipulate stem cells in the adult brain.

A candidate plasticity gene and its growth-promoting protein, CPG15, could potentially be used to develop therapies for renewing damaged or diseased tissue. While stem cells regenerate neurons in only a few regions of the adult brain, researchers have speculated that a lack of adult stem cells may cause memory deficits and other disorders.

Elly Nedivi, Fred and Carol Middleton assistant professor in brain and cognitive sciences at MIT, found that cpg15—one of many novel plasticity-related genes she has uncovered—is key to the survival of neural stem cells in early development.

Nedivi, postdoctoral associate Ulrich Putz and brain and cognitive sciences graduate student Corey C. Harwell identified a form of CPG15 that protects cortical neurons from apoptosis, or programmed cell death. Apoptosis is a normal and essential part of early development, when brain cells proliferate rapidly and some are killed off, but little is known about how apoptosis of growing neurons is regulated.

"CPG15 is one of the few molecules shown to be essential for survival of specific stem cell populations in the developing brain," Nedivi said. "By controlling apoptosis, CPG15 allows the progenitor pool (of cells) to expand, and even modest changes in the size of the progenitor pool during its exponential growth phase can drastically affect the final size and shape of the cortex."

Over-expressing CPG15 in rats gives them bigger brains. In addition, their enlarged brains have grooves and furrows like evolved mammalian brains with larger surface areas.

"We propose that by countering early apoptosis in specific progenitor populations, CPG15 has a role in regulating size and shape of the mammalian forebrain," the authors wrote.

This knowledge may one day be used to enhance survival of normally occurring stem cells in the human brain, or to grow neurons outside the body and then deposit them where needed to replace damaged or diseased tissue.

This work was supported by the National Eye Institute and the Ellison Medical Foundation.

Youngsters get peek at labs

Sasha Brown
News Office

For dozens of AP and advanced biology high school students from Cambridge and beyond, MIT's spring break offered a chance to become graduate students for a day.

On Wednesday and Thursday, March 23 and 24, more than 160 students from six different area high schools, including Cambridge Rindge & Latin School (CRLS), came to Building 68 to tour labs, attend presentations and generally get a feel for the graduate student experience at the Institute. Students from Arlington, Peabody, Hudson, Lawrence and Newburyport also attended.

The program, now in its third year, invites students to take a closer look at biology and to learn what it takes to embark on graduate studies in the field. "We are trying to help make science exciting and real. We want some of them to learn that you can make a living doing this," said biology Professor Jonathan King, who takes part in the event every year.

The students spent the day in small class or lab activities. Each lab focused on one activity designed to spark interest and to be easily applicable to student's real lives. For example, one lab focused on microbiology and sporulation, which is relevant to anthrax and other infectious diseases.

Another lab showed the different stages of development of fruit flies and displayed flies with eye mutations as well as flies whose nervous systems glow green.

"I was surprised by how interested they were," said Jessica Whited, a Ph.D. candidate who helped lead a tour called "Neurobiology in Flies" in the Garrity Lab. "They were asking really good questions and explaining what they saw clearly."

Graduate student Ishara Mills, who worked with students on examining mutant zebrafish embryos agreed. "They actually sounded like scientists," she said.

"They were definitely excited to be here," said Shannon Flaugh, a fellow graduate student. Flaugh worked on explaining sickle cell anemia and the structure of hemoglobin by using protein modeling software and individual laptop computers.

"I was delighted to see how excited and interested my students were in the research going on at MIT. I think it is remarkable and wonderful that you all make this investment in our high school students," said Elizabeth Howell, a biology teacher at Arlington High School. "Every one of them mentioned how well treated they were and they noticed the passion and talent of the investigators they interacted with. It gives me a wealth of ideas to refer back to for the rest of the year."

All told, nine labs participated in the tour and more than 16 graduate students, 12 postdocs and five faculty members were involved. "According to some of the returning teachers, the field trip is one of the highlights of their school year," said biology Instructor Mandana Sassanfar, one of the organizers of the annual event, which is funded primarily through the Howard Hughes grant awarded to Professor Graham Walker of the Biology Department, one of the founders of the program.

"The students appeared to enjoy all of the activities today but it is always very important to excite them about research, show them how science is really done and to give them the opportunity to meet grad students, postdocs and researchers in action," said Sassanfar. "They will notice that scientists are very nice, quite young and normal people, with a passion for research and discovery."

PHOTO / **MANDANA SASSANFAR**

Eleventh-grader Nick Tetreault of Hudson High School examines a model of a mitotic spindle at MIT on March 23. Tetreault was one of dozens of high school biology students who visited the Institute during spring break to see what graduate work in the field is like.

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graph, with members as nodes connected to each other if they have a direct communications link," Farley says. "But they're leaving out the most important part, the hierarchy," he says. "Terrorist cells have chains of command (partially ordered sets) from leaders to midlevel operatives to the workers who carry out orders."

As simplified examples, the graph theory would conclude that blocking four intersections along Massachusetts Avenue between Kresge Auditorium and Harvard Square could prevent MIT students from driving to the square. But students could use side streets to bypass the blocked intersections.

Likewise, the graph theory would show that capturing four members of a 15-member terrorist cell arranged as a binary tree gives a 93 percent chance of disabling the whole cell. Even without knowing the captives' positions in the hierarchy, it's still possible to plug in the "cut sets" that could break the command chain into a probability formula, and that probability is, unhappily, only 33 percent. "Lattice theory won't tell you how to fight the terrorists, but it might tell you if you've won the battle," Farley says.

Farley's hypothesis, published in late 2003, interests several military researchers, including Rebecca Goolsby of the Office of Naval Research. "With covert missions, there's a lot of missing data, and some of it is wrong," she says. "Jon came up with a new approach and drew up good questions" for approaching these "very muddy" issues in an analytical way.

An associate professor of applied mathematics at Vanderbilt University, Farley was a Dr. Martin Luther King Jr. Visiting Professor in the MIT Department of Mathematics from January 2003 to December 2004. He is also the co-founder of a mathematical modeling consulting firm. "Our ultimate goal is to develop software so that law enforcement experts without these rigorous mathematical skills can ask—and answer—these same analytical questions about security."

Sense scent's complexity

Sasha Brown
News Office

Of all the five senses, the sense of smell is taken the least seriously, Dr. Luca Turin of Flexitral Inc. told a standing-room-only crowd gathered in Room 180 in the Biology Building on Monday, April 4.

"There is a psychological resistance to taking smell seriously," said Turin, who hopes to change that with his lifelong study of scent.

Turin believes the problem is the common misconception that scents are subjective. In fact, he said, "There are a very small number of molecules that smell different to different people."

For scientists, scent has proven elusive because it has been close to impossible to predict a scent by looking at its molecules before synthesis. Traditionally, the shape of molecules has been thought to determine scent, but Turin's theory is that the vibration of molecules is the true cause of smells.

With a Ph.D. in biophysics and physiology from the University of London, Turin has been studying scent for years. Turin's life and research are the subject of a 2003 book by journalist Chandler Burr, "The Emperor of Scent: A Story of Perfume, Obsession and the Last Mystery of the Senses."

In the early 1990s, Turin learned of a device known as the spectroscope that could analyze molecules and their vibrations. He quickly became convinced that the human nose acts as a spectroscope of sorts for scent.

Thus far, his theories have proven to be controversial at best, he said. Turin has identified many molecules that are shaped similarly, but whose scents are different, disproving the more popular shape theory of scent. However, proving his vibration theory has been slightly more difficult, he said. Nevertheless, his research has been successful enough to launch his own scent company, Flexitral. He said Flexitral now has nine synthetic scents on the market.