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Research pays off in cancer fight

Studies find inflammatory disease link

Deborah Halber
News Office Correspondent

The biological processes underlying diseases such as rheumatoid arthritis and cancer are fundamentally linked, and should be linked in how they are treated with drugs, a series of MIT studies indicates.

Key to the work: The researchers applied an engineering approach to cell biology, using mathematical and numerical tools normally associated with the former discipline.

In a series of three papers, the latest of which appeared in the March 24 issue of *Cell*, Professors Douglas A. Lauffenburger, Peter K. Sorger and Michael B. Yaffe, all members of MIT's Center for Cancer Research, led a team of scientists and engineers in looking at how cells make life-or-death decisions. Understanding what tips a cell toward survival or death is key to treating diseases and fighting cancer through radiation, drug therapy and chemotherapy.

The researchers looked at tumor necrosis factor (TNF), a substance produced by the immune system that promotes cell death, and two pro-survival hormones, epidermal growth factor (EGF) and insulin. TNF and EGF induce conflicting pro-survival and pro-death signals, and the "cross-talk" between these signals is not well understood. The MIT studies provide the first big picture of how these two key factors interact in time and space.

The studies uncovered a surprising link between inflammatory diseases and cancer that may change how these diseases are treated in the future.

More effective drugs

Researchers have been exploring ways to use drugs in combination to increase their therapeutic value in fighting tumors.

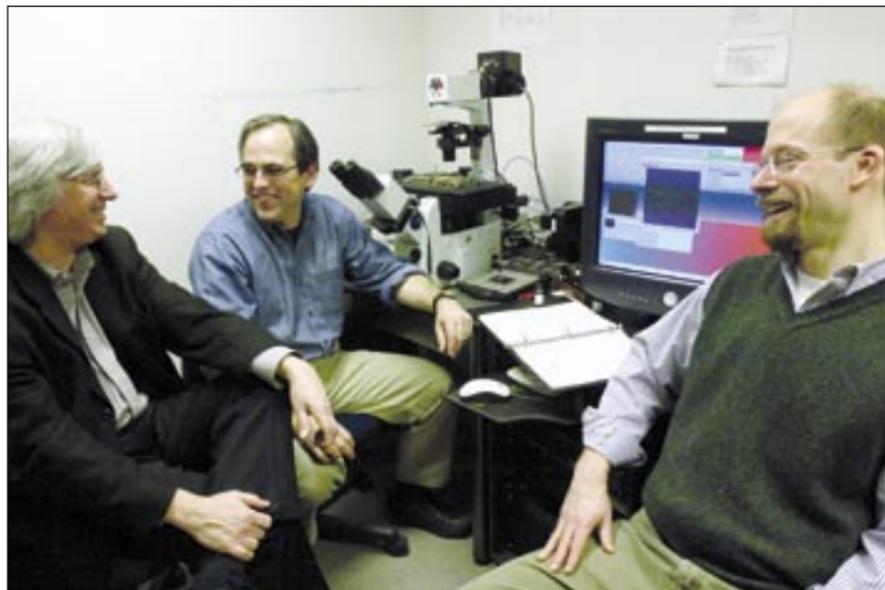


PHOTO / DONNA COVENEY

Professors Douglas A. Lauffenburger, Peter K. Sorger and Michael B. Yaffe share a moment together in Sorger's lab. The three members of MIT's Center for Cancer Research led a team of scientists that has found links between inflammatory disease and cancer.

The results of the three MIT studies have implications for how two classes of drugs involving TNF and EGF affect common biological processes in the body.

Drugs that inhibit TNF are used to treat debilitating chronic inflammatory diseases such as rheumatoid arthritis. Yet TNF, which causes inflammation, also leads to generation of the EGF signals that play a role in many cancers. (The breast cancer drug Herceptin, for example, works by blocking EGF-induced signals.) "TNF is supposed to kill cells. It's counter-intuitive that it simultaneously promotes cell survival by sending an 'autocrine' EGF signal to itself," said Sorger, a professor of biology and head of MIT's Center for Cell Decision Processes. Autocrine EGF messages are analogous to mailing yourself a letter. In the case of TNF, cells also mail back the response via another hormone, IL-1.

"With what we now understand about the interactions between these two factors, we should aim for increasing the therapeutic value from these drugs," Sorger said. "There is a fundamental molecular connection between diseases such as rheumatoid arthritis and cancer. Their protein cascades are connected; one stimulates the process of the other."

"In drug development, we want to identify the really important hubs in the network we should be targeting and when we should be targeting them," said Yaffe, an associate professor of biology and biological engineering. "It's key to figure out the most critical point in the cell cycle for the drug to intervene. This work will help accomplish that goal."

Protein wars

Among the cells lining the intestines of a person with inflammatory bowel disease, two different camps are at war. TNF launches an attack, killing many of the epithelial surface cells, while EGF struggles to survive.

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Technology used to shrink tumors

Deborah Halber
News Office Correspondent

Medical lasers are like science fiction heat rays that can vaporize tumors. The problem has been getting the lasers to where they are needed inside the body while protecting healthy tissue.

Now "perfect mirror" technology, developed by MIT researchers, is being used to shoot a laser through a spaghetti-thin, flexible fiber to attack tumors and other diseased tissue in highly targeted, minimally invasive surgery.

OmniGuide fiber, licensed through MIT's Technology Licensing Office, scored a world first at Brigham and Women's Hospital in Boston last October when thoracic surgeon Dr. Raphael Bueno used it to shrink a patient's cancerous lung tumor by 90 percent. Although carbon dioxide lasers have been used for more than 30 years to surgically remove diseased tissue in the throat, larynx, intestines and elsewhere, there was no easy way to get the lasers inside the body. Extensive surgery was required.

"The OmniGuide fiber gives us a tremendous advantage in treating lung cancer patients, many of whom have limited options because of the sensitive locations of their tumors," Bueno said. Existing laser technologies are considered too risky for some patients because they can penetrate up to a centimeter beyond their placement, jeopardizing organs close to the tumor, including the heart, Bueno said.

The connection with Bueno was facilitated through the Center for the Integration of Medicine and Innovative Technology (CIMIT), a consortium involving MIT, Harvard Medical School and the leading teaching hospitals affiliated with HMS. Bueno first heard

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PHOTO / DONNA COVENEY

There are two sure signs of spring at MIT: The crocuses bloom, and prefreshmen arrive for Campus Preview Weekend. These flowers were out on March 31. Campus Preview Weekend starts tomorrow.

A sign of spring: Campus Preview Weekend

This year's freshmen offer this weekend's prefreshman visitors advice on what to see and do while they're here.

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OpenCourseWare marks 5 years

Five years ago yesterday, in an unprecedented step toward making knowledge accessible worldwide, MIT announced it would make the materials for nearly all of its courses available on the Internet.

Since then, MIT OpenCourseWare (OCW) has flourished beyond all expectations. Educators around the world are extracting pedagogy, ideas and teaching tools from the MIT course materials — including syllabi, course notes, assignments, problem sets and lab notes — to fine-tune their own offerings at their home universities.

OCW now stands as a new model for disseminating knowledge, serving as a sort of "shared intellectual commons" available to educators and learners around the globe.

The accolades pour in from around the world. "Students need to know about this," says Kunle Adejumo, a student at Ahmadu Bello University in Nigeria. "I couldn't

find the information I needed [for a metallurgical engineering course], so I went to OCW."

"No one has to be lost in ignorance anymore all around the world," says Lorenzo Parini, a user from Milan, Italy.

Shen Xin, an experienced engineer in Chengdu, China, was interested in the MBA program at MIT's Sloan School of Management but did not have time to go to school. He's studying online through OCW. "I am very happy to learn the MIT OCW program and visit your web site," he says. "It is very useful."

"We're really happy about what's happening," said Harold Abelson, professor of electrical engineering and computer science, who has been working with OCW since the beginning.

There are now 1,285 sets of course material available

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NEWS

WE'RE NO. 1

U.S. News & World Report ranks MIT's School of Engineering the best in the nation for graduate school.

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A NOVEL IDEA

Alan Lightman, an MIT physicist and author of the acclaimed novel 'Einstein's Dreams,' discusses his work in science and writing.

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RESEARCH

AFTER THE STORM

A team from MIT is working with others on a housing initiative for a storm-ravaged area near New Orleans.

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U.S. News ranks Engineers tops

Sarah H. Wright
News Office

MIT's School of Engineering and more than a dozen MIT graduate or doctoral programs ranked No. 1 nationwide in U.S. News & World Report's annual evaluation of American graduate school programs.

U.S. News & World Report magazine has published its well-regarded graduate school rankings for 18 years. The 2007 edition of its book, "America's Best Graduate Schools," hit the newsstands Monday, April 3.

MIT's School of Engineering was ranked No. 1 among U.S. graduate engineering schools overall, with Stanford University, the University of California at Berkeley and Georgia Institute of Technology taking second, third and fourth place, respectively.

MIT also placed first in five of 12 engineering specialties — chemical, computer,

electrical, materials and mechanical engineering — and second in aerospace/aeronautical engineering, second in nuclear engineering, fourth in civil engineering and eighth 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 overall — the top score.

As in 2006, MIT's Sloan School of Management tied for fourth place overall with Northwestern's Kellogg School of Management in the U.S. News rankings of business schools.

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

This year, U.S. News ranked Ameri-

can Ph.D. programs in science, and MIT shared second place overall with Harvard University and the University of California at Berkeley.

MIT earned top honors for some of its overall doctoral programs, placing first in chemistry (with Berkeley), computer science (with Carnegie Mellon, Stanford and Berkeley), math and physics. MIT earned second place for its overall doctoral program in earth sciences.

Institute doctoral programs were also ranked first in seven subspecialties — inorganic chemistry, artificial intelligence, computer science theory, discrete math and combinations, and nuclear, plasma and quantum physics. MIT doctoral subspecialties ranking second nationwide included genetics/genomics, computer science systems, geology, geophysics, applied math, geometry and atomic/molecular physics.

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

Alexander named new investment head for MIT

The Board of the MIT Investment Management Company (MIT IMC) has selected Seth Alexander, a director of the Investment Office at Yale University, as the next president of MIT IMC, effective May 15, 2006.

Alexander has been a member of the Yale Investment Office for more than 10 years. He has been deeply involved in the management of the university's investments and portfolio strategy, and has particular expertise in marketable securities, timber, asset allocation, hedge funds and international investments. Yale's investment performance has been exceptional among university endowments over the past 20 years.

The MIT IMC was established in 2004 as a separate division of the Institute to manage the Institute's endowment. Its board of directors, chaired by MIT Corporation member Theresa M. Stone, is appointed by, and reports to, the Executive Committee of the MIT Corporation.

Commenting on the appointment, Stone said, "Seth Alexander brings outstanding strategic, analytical, and personal qualities to his new position. The IMC Board is confident that he will continue the highest standards of investment excellence and commitment to the mission of MIT that Allan Bufferd and his Investment Office colleagues have exemplified."

Alexander succeeds Bufferd, treasurer of the MIT Corporation, who has been a member of the MIT administration for 34 years.

Bufferd has participated in the management of MIT's invested funds for most of that time, including his leadership as MIT's chief investment officer for the past 19 years. He became treasurer in 1999, and in July 2004, he became the first president of the MIT Investment Management Company.



Seth Alexander

Technology Review named finalist for magazine award

The American Society of Magazine Editors has named Technology Review, MIT's "Magazine of Innovation," a finalist for the magazine industry's highest honor, the "Ellie."

"MIT should be proud," said Editor in Chief and Publisher Jason Pontin.

Technology Review is a finalist in the general excellence category for magazines with circulations of 250,000 to 500,000. The other finalists in that category are The Atlantic Monthly, Backpacker, New York Magazine and Texas Monthly.

"For magazine editors and publishers, to be nominated for general excellence is like being nominated for best picture," Pontin said. And while he said it was "fantastically unlikely" that Technology Review will win, he admitted he was gratified. "General excellence is the category that everyone cares about."

The National Magazine Awards, nicknamed the "Ellies," honor print and online magazines for "superior execution of stated editorial objectives, innovative editorial techniques, noteworthy journalistic enterprise, and imagination and vigor in layout and design."

The awards are sponsored by the American Society of Magazine Editors in association with the Columbia University Graduate School of Journalism.



PHOTO / DONNA COVENEY

Bearing daffodils

MIT Facilities employees show off bouquets of daffodils and teddy bears purchased to raise funds for the American Cancer Society. In the last eight years, the MIT Women's League Daffodil Days program has raised \$145,000 for cancer treatment, research and education. This year, the program brought in \$34,000 — \$6,000 more than last year. MIT employees bought 163 teddy bears, half of which were donated to children at Children's Hospital and Massachusetts General Hospital, and more than 2,400 daffodil bouquets. Standing, from left, are Sean Kelley, Mike Cobb and Kathy Collupy. Seated are Barry Molloy and Ramika Smith.

Nobelist Linda Buck unravels smell at Picower symposium

Deborah Halber
News Office Correspondent

Vanilla, camphor, lavender and skunk are just a few of the tens of thousands of odors that humans can detect with exquisite sensitivity. Even a tiny change in chemistry can shift a smell from sweet to rancid, according to Nobel laureate Linda B. Buck, but how do mammals detect so many different odors with such precision, and how do their brains translate that information into behavior, emotions and actions?

Buck, a researcher with the Fred Hutchinson Cancer Research Center of Seattle, gave a keynote address, "Unraveling Smell," at the fifth annual Picower-

RIKEN Symposium, "New Frontiers in Brain Science — from Molecules to Mind," held March 26-28 at the Picower Institute for Learning and Memory.

Sponsored jointly by the Picower Institute and the RIKEN Brain Science Institute of Japan, the symposium brought together distinguished neuroscientists from around the world to present state-of-the-art knowledge on emerging brain research technologies, learning and memory, the mechanisms underlying the brain's ability to change in response to stimuli and how systems within the brain interact. In addition to 16 speakers from MIT and elsewhere, postdoctoral researchers and graduate students presented their work at poster sessions during the two-and-a-half-day event.

Buck shared the Nobel prize in 2004 for her work in discovering the odorant receptor (OR) family, which is how the nose detects odors. Humans have close to 350 different ORs, while mice have approximately 1,000. Olfactory sensory neurons of the ORs in the nose transmit odor signals to the brain's olfactory bulb, which relays those signals to the olfactory cortex. From there, odor information is sent to higher cortical areas as well as to limbic brain areas that control emotional, behavioral and physiological responses.

The OR family is used in different combinations to detect different odorants and encode their individual identities, Buck said. Each receptor recognizes multiple odorants, but each odorant is detected by a unique combination of receptors.

Odorants with nearly identical structures have different receptor codes, explaining how they produce different odors. Buck said that she recently found that mixing the scents of rose and clover in certain combinations, for instance, can generate the completely unrelated smell of a carnation.

Wolf Singer, director of the Max Planck Institute for Brain Research in Frankfurt, Germany, gave a second keynote address on "Time as Coding Space in Cortical Processing." Singer's hypothesis is that synchronized responses from neurons distributed throughout the brain through a "self-organized synchronization mechanism" allow a kind of parallel processing in the cerebral cortex that may be key to perception and memory.

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Seasoned freshmen offer Campus Preview advice

Sasha Brown
News Office

With the memories still fresh in their minds, many members of the MIT Class of 2009 had advice for the roughly 875 pre-freshmen who will descend upon MIT during Campus Preview Weekend, April 6-9.

Freshman Anthony Rizos of Arizona recommended that "prefrosh" spend some of their Campus Preview Weekend (CPW) time in the Student Center and also that they sit in on classes. "It was really helpful to get a sense of what lectures feel like, particularly in areas and subjects of personal interest," he said.

"I'd never been to MIT before coming for CPW, so it was a good chance to meet people and get a feel for the place where

I'd be spending the next four years," Rizos said of his experience.

The annual CPW provides accepted students and their parents with an open pass to MIT for four days. They can attend lectures, concerts and dorm dinners while spending time on the campus that may become their home this fall. The potential students stay in campus housing with a current student whose interests match theirs.

CPW typically confirms the match between MIT and the students, said Jennifer Rifken, who is the director of recruitment in the admissions office. Since 2003, between 75 percent and 80 percent of the students who attend CPW have matriculated at MIT.

This year's CPW is themed "MIT Unplugged" and will have 600 events — "more events than ever before," Rifken said. Prefreshmen are invited to explore.

"I want the students to really be able to try MIT on for size," Rifken said.

Freshman Alexis Dale, who hails from Massachusetts' South Shore, attended CPW last year. She encouraged potential freshmen to sit in on as many classes as possible and just to generally observe the campus. "You can really see things as they actually happen," she said.

Dale also encouraged accepted students to take tours of the dormitories. "CPW is the best way to get exposed to what the dorms are really like," Dale said.

For freshman Michael Smith-Bronstein of Seattle, CPW was an opportunity to see MIT in a new light. "I came to meet people," he said. It was the people he met who convinced Smith-Bronstein that the Institute was the right place for him.

"I saw that it was a lot more fun than I

expected," Smith-Bronstein said. Though the myriad activities might seem overwhelming, Smith-Bronstein suggested that prefrosh pinpoint what they would like to see, be it social, academic, athletic or something else, and that they seek that out. The weekend provides an opportunity for accepted students to "find people like them," he said.

The single most important piece of advice Rizos gave was about housing. "I'd say that my CPW dorm assignment held a lot of influence. I spent a lot of time chatting with other students and residents, exploring the halls, and connecting with other prefrosh," Rizos said. "While I may have been on the more informed side, it is notable that I'm living in the same building I was temped in for CPW. So, the living group thing really goes a long way."



PHOTO / DONNA COVENEY

Institute Professor Isadore Singer gave the annual Killian Lecture on Thursday, March 23, in Kirsch Auditorium. Singer received this year's James R. Killian Jr. Faculty Achievement Award

Singer's Killian lecture puts geometry in perspective

Anne Trafton
News Office

When Isadore Singer arrived at MIT in 1950 to teach in the Department of Mathematics, he found that his department had little contact with the physicists also housed in Building 2. More than 50 years later, mathematicians and physicists have much more to bring them together, thanks in large part to work done by Singer during his long career, which earned him this year's James R. Killian Jr. Faculty Achievement Award.

Singer, who was named an Institute Professor in 1987, gave the annual Killian Lecture in Kirsch Auditorium in the Stata Center on Thursday, March 23.

His talk, titled "Some Geometry of the Past Half Century and Its Historical Background," reflected on the mathematical ideas that have developed over the past 50 years, bringing together diverse areas of mathematics, including geometry, analysis and topology. That time period has also seen the development of a closer connection between math and physics.

"Mathematicians and physicists — sometimes they have some (connection) and sometimes they don't. Certainly back in '66 there was not much," Singer said.

When the faculty awarded Singer the Killian Prize last May, Professor Marcus Thompson, chair of the selection committee, said, "Isadore Singer is one of the rare mathematicians who is able to communicate with theoretical physicists in their own language and engage them in genu-

ine collaborations. Most important is the attitude he brings to these collaborations: not the usual mathematical disdain for the physicists' lack of rigor but a conviction that mathematicians must try to understand why the physicists' methods work and to abet them in their efforts."

The Atiyah-Singer Index Theorem, developed in the early 1960s, did much to bring mathematicians and physicists together. The theorem has had applications in many areas of theoretical physics, including gauge theory, monopoles, string theory and the theory of anomalies, among others. In 2004, Singer and Sir Michael Francis Atiyah of the University of Edinburgh shared the Abel Prize, considered the equivalent of the Nobel Prize for mathematics, for the development of their theorem.

The Abel Prize citation described the theorem as follows: "Scientists describe the world by measuring quantities and forces that vary over time and space. The rules of nature are often expressed by formulas, called differential equations, involving their rates of change. Such formulas may have an 'index,' the number of solutions of the formulas minus the number of restrictions that they impose on the values of the quantities being computed. The Atiyah-Singer index theorem calculated this number in terms of the geometry of the surrounding space."

The index theorem "energized mathematicians and physicists and started a new liaison between the two subjects," Singer said.

Singer began his Killian talk with some

reminiscences about his early days at MIT, which he said has "always been a very exciting place, and it seems to me it gets more exciting every year."

After earning his doctorate from the University of Chicago, Singer arrived at MIT in July 1950. His first day included a late-night trip with his new colleagues to a Boston coffeehouse "which at midnight was a meeting place for derelicts, drunks and, apparently, mathematicians." That was followed by an early morning tour of Boston and Cambridge, and Singer started thinking that "maybe I had found a new home, and that turned out to be true."

Singer then described an example of the index theorem, known as the Gauss-Bonnet formula. The formula allows the large-scale shape of an object to be calculated from the local curvature of the object. As an example, he showed a slide of Earth, which is a solid sphere. A person on Earth's surface would not be able to see that shape, but could calculate the shape by measuring the curvature of the Earth at all its points.

The Killian Award was established by the faculty in 1971 as a tribute to James R. Killian, former MIT president and chairman of the MIT Corporation. It is meant to "recognize extraordinary professional accomplishments by full-time members of the MIT faculty; provide a means for the communication of these accomplishments to the faculty, students, other members of the MIT community, and to the general public; and by so doing, honor the contributions made by Dr. Killian to the intellectual life of the Institute."

Junior earns humanitarian scholarship

Sasha Brown
News Office

Junior Matthew Zedler, a mechanical engineering major who uses his technical expertise to assist humanitarian efforts, has been named a 2006 Harry S Truman Scholar.

The Truman Scholarships were established in 1977 to honor students who are likely to make a difference, according to the program's web site.

Former Secretary of State Madeleine K. Albright announced the 75 scholars on March 28. They were selected from among 598 candidates from 311 colleges and universities. Each scholarship provides \$30,000 for graduate study.

Scholars receive priority admission and supplemental financial aid at some premier graduate institutions as well as leadership training, career and graduate school counseling and special internship opportunities within the federal government.

Zedler's community service efforts have been both local and global. Last summer, he spent a month in Lesotho teaching a high school class about hydropower generation.

Since then, he has become an active member of Engineers Without Borders, a humanitarian organization that uses engineering skills to improve the quality of life in developing countries.

In March 2005, he spent spring break with Habitat for Humanity, framing a home for a family in Washington, D.C.

Zedler is also the coordinator of Families Accessing Computer Technology, a computer access and training program run through the Public Service Center.

Zedler, who has a particular interest in energy policy, said he plans to use the scholarship to study mechanical engineering with a particular focus on renewable energy technology and policy. "I will hopefully work with a think tank or government organization for a few years in the U.S. before going to a developing country or the United Nations to work on energy policy there."

Currently spending his junior year at Cambridge University in England, Zedler said that the Truman application process last year was an opportunity to reflect. "The process itself gave me a chance to reevaluate where I am heading in my life and set some goals for myself," he said.

Associate Professor Anne McCants of history, a former Truman Scholar, recommended Zedler. "Matt has already demonstrated his commitment to applying science and technology to 'the problem' of social inequality, and it will be great to have talented, thoughtful and compassionate individuals like him working on the whole complex of these issues in the future," McCants said.

In May, the 2006 Truman Scholars will attend a weeklong leadership development program at William Jewell College in Liberty, Mo. For a listing of the 2006 scholars and more information on the foundation, visit www.truman.gov.

Researchers: Oceans are a major gene swap-meet for plankton

New evidence from open sea experiments shows there's a constant shuffling of genetic endowments going on among tiny plankton, and the "coinage" they use seems to be a flood of viruses, MIT scientists report.

The research, led by MIT Professor Sallie W. "Penny" Chisholm, is uncovering a challenging new facet of evolution, helping scientists see how photosynthesizing microbes manage to exploit changing conditions such as altered light, temperature and nutrients.

The work will be reported in two articles in the March 24 issue of *Science*.

As a result of the new findings, "we are beginning to get a picture of gene diversity and gene flow in the most abundant photosynthetic cell on the planet, the *Prochlorococcus* group of planktonic microbes," said Chisholm, the Lee and Geraldine Martin Professor of Environmental Studies.

These photosynthesizing bacteria "form an important part of the food chain in the oceans, supply some of the oxygen we breathe, and even play a role in modulating climate. So it's very important that we understand what regulates their populations. And now genetic diversity seems to be an important factor," said Chisholm, who holds appointments in the Department of Civil and Environmental Engineering (CEE) and in the Department of Biology.

In one of the journal reports, Chisholm and lead author Maureen L. Coleman, a CEE graduate student, suggest that gene-swapping in ocean microbes resembles the flow of genes already known to occur among disease-causing bacteria. In an ocean context, this exchange mechanism would offer marine microbes a diverse palette of potential gene combinations, each of which might be best suited for a particular environment. This should allow the overall population to persist despite complex and unpredictable environmental changes.

"We postulate that lateral gene transfer ... is an important mechanism for local specialization in the oceans," they wrote in



PHOTO / DONNA COVENEY

MIT marine biologists Ed DeLong and Sallie W. "Penny" Chisholm check out an ocean water sample. Researchers in Chisholm's lab have shown that gene-swapping takes place among ocean plankton and resembles the flow of genes among disease-causing bacteria.

Science. Eventually the scientists hope to provide a unified understanding of genomic evolutionary mechanisms and their impact on microbial ecology in the oceans.

The other paper from Chisholm's laboratory (lead authors are Zackary I. Johnson, now at the University of Hawaii, and Erik Zinser, now at the University of Tennessee), compares six known ecotypes, or subdivisions, of the *Prochlorococcus* microbes according to where they're found and under what conditions they thrive. Their geographic patterns suggest causal relations with environmental variables such as temperature, predators, light and nutrients.

Remarkably, despite centuries of oceanic research, tiny *Prochlorococcus* wasn't even known to exist two decades ago. It was discovered in 1985 during an open ocean research cruise by Rob Olson of

the Woods Hole Oceanographic Institution and Chisholm.

Since then the science has progressed dramatically, and Chisholm can now describe *Prochlorococcus* in detail as "the smallest photosynthetic machine. It can convert the sun's energy into food through photosynthesis using only 1,700 genes, something the human body cannot do with 30,000 genes. In fact, despite all of our technological ingenuity, we cannot even mimic this process."

Chisholm, who is co-director of MIT's Earth System Initiative, explained that as biological oceanographers she and her colleagues are trying to understand the bio-geo-chemistry of the oceans. That is, they're trying to learn "how these

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Grad student judges walkability of cities

Sasha Brown
News Office

Developing cities need to do more to address the needs of pedestrians, according to MIT graduate student Holly Krambeck, who is working on a walkability ranking system for cities.

As such cities grow more congested with cars, changes are often made at the expense of pedestrians, even though walking is the most common means of transportation in developing countries, Krambeck said. She cited the example of New Delhi, India, which recently created a number of new roads without creating new space for walkers.

A dual master's degree candidate in city planning and in science and transportation, Krambeck studied walkability as part of a two-year internship with the World Bank. The work eventually became her master's thesis, which she completed in February.

"How well the pedestrian environment can service (walking) trips will impact the overall quality and efficiency of the urban transportation network, and in turn, overall mobility and accessibility for residents and visitors," Krambeck wrote in her thesis.

Walkability means different things to different people and in different regions, said Krambeck, who had to develop a set of criteria that could be universally applied to cities across the globe. She chose to evaluate "basic walkability," which she defined as "the safety, security, economy and convenience of traveling by foot."

Krambeck developed a test to assess walkability in cities around the globe. Questions included: Is the sidewalk properly lit? Are there benches to relax along the way? Are there accessible public restrooms? Is there ample awning coverage to stay out of the sun and rain? Are the

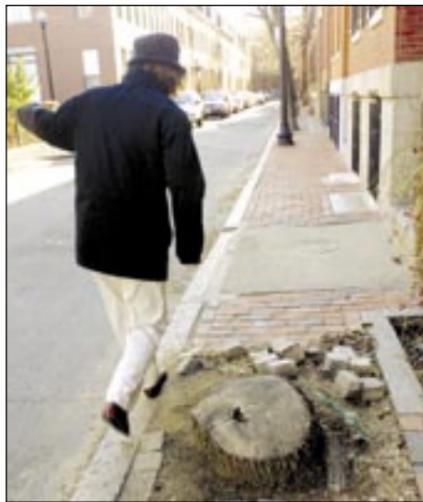


PHOTO / DONNA COVENEY

A pedestrian navigates around a tree stump on a Boston street recently. MIT graduate student Holly Krambeck is studying the walkability of cities, examining such issues as whether sidewalks are well maintained.

sidewalks clean and well maintained? Are there walking obstructions?

Armed with these questions and others, employees of the World Bank led field tests in Beijing, Hanoi, Bangkok, Manila and Karachi while Krambeck led field tests in Alexandria, Va., and Washington, D.C., followed by a full-scale pilot in Ahmedabad, India, where the World Bank was beginning work on an urban development and upgrade project.

Each city was evaluated based on its history with pedestrian fatalities, design problems, laws regarding sidewalk obstruction, transportation education and planning finances.

In Ahmedabad, for example, there are no urban design guidelines for walking paths. Further, the various laws for pedestrians are rarely enforced because traffic police are not sufficiently funded. Twenty percent of all traffic accidents in the city involve pedestrians, according to the Center for Environmental Planning and Technology.

A team of 65 volunteers took to the streets of Ahmedabad, where they surveyed 12.4 miles of road and polled 350 pedestrians. "It was so important that we get local input," Krambeck said.

Using the criteria, which assessed the condition of walking paths, traffic management at intersections and timing of traffic lights, the volunteers found Ahmedabad to be "a very inhospitable place for pedestrians."

The volunteers reported animal waste in the streets, unpaved surfaces, poor drainage and litter, all of which render the streets unappealing, said Krambeck, who helped create a proposal for the World Bank to upgrade the city's pedestrian accessibility. She said she hopes her findings will be incorporated in the upgrade planning project set to begin this year.

As of now, the index ranking the cities is a work in progress. Krambeck presented her work at the annual Association for Pedestrian and Bicycle Professionals conference in Chicago in 2005, and attendees used her methods to assess three different parts of the city.

This past month, she headed to South Africa to present her work on behalf of the World Bank at Velo Mondial — an annual conference where planners, engineers, advocates and government officials meet to discuss strategies for improving nonmotorized transport infrastructure.

For fuller text visit web.mit.edu/news-office/2006/walkability

OMNIGUIDE

Continued from Page 1

about the technology at CIMIT's 2003 annual conference in a lecture series focused on new technologies for surgical applications.

The fiber originated with the "perfect mirror" created in 1998 by Yoel Fink, associate professor of materials science and engineering; John D. Joannopoulos, the Francis Wright Davis Professor of Physics; and Edwin L. Thomas, the Morris Cohen Professor of Materials Science and Engineering.

While the familiar metallic mirror is omnidirectional, which means it reflects light from every angle, it also absorbs a significant portion of the incident light. The new kind of mirror developed by the MIT team can reflect light from all angles and polarizations, just like metallic mirrors, but does so with much higher efficiency. In addition, the mirrors can be "tuned" to reflect certain wavelength ranges and transmit the rest of the spectrum, making them omnidirectional reflectors.

In 2002 a team from Fink's laboratory published an article in the journal *Nature* showing that it was possible to form an omnidirectional perfect mirror into a "pipe" surrounding a hollow core. The mirror's creators then developed a process for making hollow-core fibers that are as thin as spaghetti and transport a beam of intense laser light for meters.

Less than two years later, the fiber was used for the first time in an experimental surgery at Wake Forest Hospital in North Carolina. The U.S. Food and Drug Administration approved the OmniGuide's flexible fiber laser in May 2005, leading the way for its use in treating a growing number of patients at otolaryngology and head and neck clinics and hospitals around the country. It has been used in more than 40 procedures.

"To the best of our knowledge, this is the first-ever FDA clearance for photonic bandgap technology in a surgical system," said Fink, who helped develop the perfect mirror as an MIT graduate student. "From the publication of the study in *Nature* to the first operation in a patient took less than two years. Many times the development of a novel therapeutic tool — from concept to paper to patient — takes 10 years and costs many millions of dollars. Here, we're excited to show an example to the contrary."

OmniGuide Inc., based in Cambridge, Mass., was co-founded by Fink, Joannopoulos, Thomas and Uri Kolodny, who has an M.B.A. from the Sloan School of Management. The company was backed by MIT alumnus and donor Ray Stata, founder of Analog Devices, who also served as OmniGuide acting CEO.

Jacks earns top cancer award

Tyler Jacks, director of MIT's Center for Cancer Research, has been named the 2005 Simon M. Shubitz Lecturer and Award recipient.

The University of Chicago Cancer Research Center presents the Shubitz Award each year to a scientist who has made significant contributions to the field of cancer research. On Monday, April 10, Jacks will deliver the annual Shubitz Lecture at the University of Chicago.

Jacks' research focuses on the genetic events that contribute to the development of cancer. His laboratory has constructed mouse models for lung cancer, astrocytoma, endometrioid ovarian cancer, retinoblastoma and tumors of the peripheral nervous system.

In 2005, Jacks shared the Paul Marks Prize for Cancer Research awarded by Memorial Sloan-Kettering Cancer Center. That award honored him for advancing the understanding of the pathogenesis of cancer.



Tyler Jacks

Experts tackle issues raised by race-based drugs

Sarah H. Wright
News Office

Scientists and scholars specializing in medicine, public health, social sciences, ethics and law will convene at MIT on Friday and Saturday, April 7 and 8, for a groundbreaking conference on the complex implications of such drugs as BiDil, a heart medication approved by the FDA in 2005 for treating patients who identify themselves as black.

The crossdisciplinary discussion, titled "Race, Pharmaceuticals and Medical Technology," was organized by the Center for the Study of Diversity in Science, Technology and Medicine (CSD) at MIT. The event, which will take place at the MIT Faculty Club, is free and open to the public.

Dr. David S. Jones, assistant professor of the history and culture of science and

technology, is director of CSD, which is part of the Program in Science, Technology and Society (STS) at MIT.

As organizer of "Race, Pharmaceuticals and Medical Technology," Jones described its overarching goal as "trying to figure out how to respond to the implications of BiDil."

For example, Jones asked, "Is it the old racism, repackaged as genetic science? Is this appropriate clinical practice, based on recognition of real biological differences between different races?"

"Or, is racial medicine just a passing phase on the road to a future of fully individualized medicines?"

The FDA's approval of BiDil, which is marketed by Lexington, Mass.-based NitroMed, met with immediate controversy. Critics feared the government was endorsing the idea that blacks differ biologically from other groups and implicitly promoting racial stereotyping.

Presenters will focus on the case of BiDil in particular and on the promises and pitfalls of racial therapeutics in medicine generally. The potential and implications of pharmacogenetics — drugs and medical treatment customized by genetics for individuals — will also be explored.

Sessions include "Pragmatism and Its Discontents," "Minority Populations on Trial," "Histories of Racial Therapeutics" and "The Future of Racial Genetics."

Individual speakers and topics range widely across disciplines. Susan Reverby of Wellesley will speak on "BiDil as Tuskegee's Child: What Does It Mean?"

Dr. Keith Ferdinand, a New Orleans-based cardiologist whose practice was swept away by Hurricane Katrina, now practices in Atlanta. He will speak on "BiDil and Race."

Other talks include "Ashkenazi Jews: Overburdened and Overexposed?"

"Imperialism, Race and Therapeutics," and "Mongrel Nation: Race, Genetics and the Law."

Panel discussions will include "Genotyping the Future: Scientists' Expectations About Race/Ethnicity and Genetics in the 21st Century" and "'Frozen Moments' in the HapMap: Ethnographic Speculations on Race and Biomedicine."

Troy Duster, past president of the American Sociological Association and author of "Backdoor to Eugenics," will deliver the keynote address on Friday. His topic is "The Molecular Reinscription of Race."

Evelynn Hammonds, professor of history of science and of African and African-American Studies at Harvard University, will deliver the keynote address on Saturday.

For more information and to register, visit web.mit.edu/csd/conference.htm.

Housing designed with Louisiana woes in mind

Sarah H. Wright
News Office

An MIT expert in settlement housing is leading an effort to rebuild part of hurricane-ravaged Louisiana.

Reinhard Goethert, principal research associate in architecture, is director of the Special Interest Group in Urban Settlement (SIGUS) in architecture and planning, a group working on a housing design and building initiative in the bayou region near Houma, southwest of New Orleans, where hurricane floods destroyed many homes last summer.

The group will provide expertise in design, structural, lifting and environmental issues, family issues and volunteer management.

"Managing volunteers in a bayou building project means doing a lot of teaching," Goethert said.

SIGUS is working jointly with Oxfam America and the Terrebonne Readiness and Assistance Coalition (TRAC), a Louisiana-based nongovernmental organization, on a housing design and building initiative called LIFT House.

Goethert, who teaches courses on urbanization, design and housing in developing countries, has developed settlement housing programs throughout the world, most recently in areas of Indonesia destroyed by the tsunami. He has received a United Nations Habitat Scroll of Honor for his "outstanding contributions in community action."

Goethert and Joel Turkel, lecturer in architecture, are advising the MIT SIGUS team, which includes three architecture students, two urban planning students and three advisors from the department's Building Technology Section.

The LIFT House collaboration is devel-



ILLUSTRATION / NON ARKARAPRASERTKUL

MIT's Special Interest Group in Urban Settlement has developed a modular unit house that accommodates different family sizes, is tailored to bayou culture and stands on flood-resistant stilts.

oping concepts for housing to be built during the summer. The SIGUS team addresses what types of houses to build, how to build them (including how to hoist them onto flood-proof platforms, 8 to 10 feet above ground) and how best to balance management of unskilled and semi-skilled volunteers and community participation and stability while meeting necessary construction and building codes.

"The less skilled the volunteers, the

more supervision they need. We have to come to grips with the reality, learned in previous hurricanes like Andrew, that the quality of construction matters: You have to use nails, not staples, for example. You have to do what works, not what seems to work," Goethert said.

SIGUS has developed a modular unit house that accommodates different family sizes, is tailored to bayou culture and is built on flood-resistant stilts; a guide to

site management and supervision of volunteers; and another guide comparing the rates at which various stages of construction can be accomplished relative to the varying skill levels of volunteers.

Goethert and his MIT colleagues have produced materials for use by Oxfam, TRAC and other recovery-based organizations, so the Institute's contribution to recovery in the Gulf Coast region will be both long-term and sustainable.

CANCER

Continued from Page 1

gles to keep the cells alive and dividing to repair the damage.

In every cell, genes create proteins, the building blocks of life. Besides carrying out the functions of keeping the cell alive, some proteins such as TNF and EGF work as signals, turning on or off other genes. In a cascade effect, the proteins from these genes may affect still more genes. What's more, a single protein behaves differently at different points in time: A protein may do one thing early after stimulation and something else later on.

Researchers want to be able to predict how cells will respond to tiny molecular changes that spur them to develop, multiply or die. If researchers knew exactly how much of a certain protein was needed to kill a cancer cell and exactly when in the cell's life cycle it would be most lethal, drugs could be custom-designed to destroy malignant cells while leaving normal cells intact, Yaffe said.

But for many cell-decision networks,

there is simply not enough information about the signaling proteins and reactions to construct a believable model that would allow accurate predictions to be made. Can you design an effective model without measuring every one of the tens of thousands of proteins in a cell?

Hidden connections

"There are a lot of variables and a limited set of observations," Lauffenburger said of cell biology. "How can you abstract what's going on underneath the surface? We're never going to have complete knowledge, but the question was, could we construct a model that admits that we don't know everything, but we know enough to do something useful?" Lauffenburger is head of MIT's Biological Engineering Division and is the Whitaker Professor of Bioengineering.

To answer that question, the team used an engineering approach typically applied to manufacturing or software. "At some point, we need to bring new tools to bear on complexity, and those new tools

are engineering-based mathematical and numerical tools," Sorger said. "Just as we can engineer extremely complicated systems like jets that we can't understand in their totality just by looking at them, we can do the same thing in biology." Modeling signaling pathways with computers is one of the tactics of MIT's Center for Cell Decision Processes.

"Models store our aggregate biological knowledge in a tractable way and are used to identify which proteins and pathways are most critical for mediating cell responses," Yaffe said. The research team plugged measurements of thousands of signaling proteins gathered in painstaking laboratory experiments into the models, providing a "firm theoretical grounding" to intuit how protein network interactions affect cell behavior, Yaffe said.

Yaffe divided cell signals into two major dimensions that can be plotted on a graph with a stress/death axis and a survival/growth axis. Where the conflicting factors fall on the graph determines whether the cell upon which they are acting lives or

dies. "Our study gives us a broader functional sampling of a lot of things at the same time," he said.

Using this new approach involves teams of researchers, a concept unusual in traditional cell biology. Working as a team, computational scientists remain in close touch with their laboratory-based collaborators. Interdisciplinary scientists working at the interface of biology and computation is the way of the future, according to Kevin A. Janes, graduate student in biological engineering and one of the study's co-authors.

The payoff is high. Combining broad protein-based measurements and computation reveals the big picture, uncovering connections between spheres of biology previously believed to be distinct. "We are finding that things that once appeared to be biologically independent are closely connected," Sorger said. "We are not just collections of independent parts."

This work is supported by the National Institutes of Health and the Whitaker Foundation.

Student photo exhibit offers perspectives on Eastern Europe

In a joint exhibition opening Thursday, April 6, at the Wiesner Student Art Gallery, architecture graduate students Viktorija Abolina and Nadya Nilina explore their native lands in Eastern Europe through the lens of a camera.

For each the focus is different.

Inspired by the older wooden structures of the Latvian capital Riga, Abolina uses black-and-white photographs to create "The Portrait of Place."

"I portray the character of the place and the people that inhabit it," Abolina said, adding that she is drawn to places that are "rich and beautiful with their texture, light and composition of small details." Abolina said that she tries to explore in her photography one of the essential issues in architecture: "how the individuality of spaces relates to the people who inhabit it."

Nilina, who was born in Moscow, leans more toward social commentary in "Vanishing Landscapes of Socialism." Created with Jeff Silva, a specialist at MIT Video Productions, the exhibit is a video montage of scenes from Belgrade, Bucharest, Berlin, Leipzig, Halle and Moscow and footage from the Moscow archives from the 1950s and 1960s depicting the large housing estates erected under socialist regimes.

Nilina's photographs of the massive housing projects also set a mood, showing how these very generic spaces have become less desirable residences, vulnerable to social crisis caused by population decline and unemployment.

Both Abolina and Nilina, who did not know about each other's work until their exhibits were paired by Wiesner Gallery curators, credit the support they've received from MIT for their nontraditional projects.



PHOTO / VIKTORIJA ABOLINA

'The Portrait of Place' is part of a collection of black and white photos by Viktorija Abolina depicting life and architecture in Latvia, on display at the Wiesner Student Art Gallery from April 6-26. See related photo on page 8.

"There is a lot of creativity here, including filmmaking and research and worldwide exploration," Nilina said. "The [architecture] department is truly committed to the social issues in architecture and urban planning," she adds.

"The Portrait of Place" and "Vanishing Landscapes of Socialism" are on

view through Wednesday, April 26, in the Wiesner Student Art Gallery, Stratton Student Center, 2nd Floor. A concurrent exhibition by Nilina and her brother, Nilin ("Nilin & Nilina: Past Through Different Lenses") is on view at the Rotch Library Gallery (Room 7-238), also through April 26.

OBITUARIES

Steven H. Groves

Steven H. Groves, a physicist at Lincoln Laboratory for more than 40 years, died at Lahey Clinic on March 27 after being hit by an SUV on his daily bicycle commute to Lincoln Lab. He was 72.

Groves was known for his breakthrough research on the band structure of gray tin, published in 1963, the year he earned his Ph.D. from Harvard University. After a year as a research fellow at Harvard, he joined Lincoln Laboratory, where his work on crystal growth and semiconductor materials led to the fabrication of diode lasers and high-gain and high-speed photo detectors.

Born in Madison, Wis., Groves received his bachelor's degree from Antioch College in Ohio in 1957. He was an avid outdoorsman and enjoyed kayaking, skiing, biking and playing with his grandchildren.

He was looking forward to celebrating his 50th wedding anniversary in England in July with his wife, children and grandchildren.

He is survived by his wife, Anne DeCecco Groves; a son, Eric Groves of Acton,

Mass.; a daughter, Katherine Groves of Paradise Valley, Ariz.; two brothers, Thomas Groves of Naperville, Ill., and Roderick Groves of Albuquerque, N.M.; a sister, Susan Groves of Berkeley, Calif.; and four grandchildren.

A memorial service will be held in May. Donations may be made to the Wilderness Society, 1615 M St. NW, Washington, DC 20036.

Doris S. Evans

Doris S. Evans, former head of MIT's alumni office, died Feb. 18 at the Sawtelle Hospice House of Reading. She was 100.

Born in Calais, Maine, in 1906, Evans moved to Boston at a young age. She enjoyed reading and listening to music.

She is survived by a niece, Corinne Magnuson of Melrose; two nephews, Donald Leeman and Richard Leeman of Clearwater, Fla.; and many great- and great-great-nieces and nephews.

Donations may be made to the VNA of Middlesex-East Sawtelle Family Hospice House, 360 Haverhill St., Reading, MA 01867.

NEWS YOU CAN USE

Energy poster session

The MIT Energy Club is organizing an energy poster session for student research, to be held Friday, May 12, from 5 to 7 p.m. in the Stata Center. Posters on scientific and engineering research, policy research and energy-related business plans are eligible for this session. Students who want to present posters may e-mail David Danielson at ddaniel@mit.edu to reserve a slot. E-mails should include poster title and co-authors.

Study abroad

An information session for students interested in studying abroad will be held Thursday, April 20, from 3 to 5 p.m. in Room 1-277. Two information sessions for foreign scholarships will be held Monday and Tuesday, April 24 and 25, from 4 to 5:30 p.m. in Room 5-134. For more information, contact studyabroad@mit.edu or foreign-scholarship-advice@mit.edu.

Simulation set to test response to avian flu

MIT will stage a real-time simulation of an avian flu outbreak to show how global supply chains are severely disrupted by such emergencies. Leaders from business, government and academia are expected to attend the event, which will take place on Tuesday, April 11, at the Cambridge Marriott Hotel.

Developed by MIT's Center for Transportation & Logistics (CTL), the simulation will involve a hypothetical outbreak of avian flu that shuts down a fictional manufacturing facility. The plant closure will ripple through the global supply chain as other countries and companies react to the news.

A panel of executives will respond in real time to the unfolding emergency, which will be shaped by prompts and pre-scripted news bulletins delivered by a facilitator. The exercise is part of CTL's larger, day-long annual symposium titled "At the Crossroads of Supply Chain and Strategy: Simulating Disruption to Business Recovery."

CTL Director Yossi Sheffi said the center devised the exercise to get companies thinking about contingency plans for global disruptions such as an avian flu pandemic. "In this interconnected world where supply chains span the globe, companies must examine what actions they will need to take to protect employees, customers and the operational integrity of the enterprise in the event of a global emergency," said Sheffi.

For more information visit ctl.mit.edu/index.pl?id=4895.



Graduate Housing Opportunity

Positions Available for live-in Resident Advisors for MIT's Fraternities, Sororities, and Independent Living Groups. **Applications are due by April 19, 2006**, and are available online at: <http://web.mit.edu/slp/fsilg/ra.shtml>

Description: A Resident Advisor is expected to serve as a mentor, guide, and resource for students and to serve as a liaison between the chapter and the Dean's Office. The RA is expected to know and educate FSILG students about MIT policies, applicable Chapter and/or Fraternity/Sorority headquarters policies, and common sense safety practices. Training is provided.

Remuneration: All Resident Advisors receive free room and board. In addition, some organizations may include a small stipend. Each Resident Advisor is furnished with a single room in the chapter facility.

Qualifications: A BA or BS and/or graduate enrollment at an accredited institution are required.

CLASSIFIED ADS

Members of the MIT community may submit one classified ad each issue. Ads can be resubmitted, but not two weeks in a row. Ads should be 30 words maximum; they will be edited. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.

VEHICLES

2001 Subaru Legacy, <65,000 miles. Very good condition, dark green. \$9K. Please contact ehendrix@mit.edu.

FOR SALE

White Maytag heavy duty washing machine, 2 speed, super capacity, 9 cycles, excellent condition. Washer is located in North Reading, Mass. \$175. Call Cheryl at 617-258-5673.

HOUSING

Apt. avail. May 6-June 20, furnished, 1 BR, study, DSL, w/d, a/c, deck w/ view of Boston skyline,

elevator, 10 min. walk to campus, one person preferred, no smoking/pets. 617-803-2202.

Bedford near Lexington: Beautiful new 1,450 sq ft, 2 BR, 2 bath, w/d, hdwd flrs, a/c, cable, util. inc., nr conservation & Minuteman Trail, Middlesex College, bus, \$1,700/mo. Contact Beth 781-687-9672, bamarcus@alum.mit.edu.

Wanted: summer sublet July & Aug. for responsible younger retired couple. Will also consider house sitting. Call Marilyn 508-789-3229 or 239-466-6072.

VACATION

2 BR cottage on pristine Lake Maranacook, Maine. 270 ft. sand beach. Photos and ref. avail. at MIT. Time in June, July, Aug. \$750/wk. Tom King, 408-376-4336.

3 BR cottage at Wadleigh Pond, Lyman, Maine. Golf, historic Portland & Kennebunkport nearby. Fully equipped. Quiet area, beautiful sunsets. Ideal spot for relaxation. \$950/week. Contact maturner@mit.edu. Pictures avail.

New 2 BR house in midcoast Maine overlook-

ing 13 acres of meadow, woods. Peaceful, relaxing. On tidal river near lakes, scenic harbors. Great canoeing, kayaking. \$600/week. 617-661-9119.

Cape Breton, Nova Scotia. Summer rental - 3 BR farmhouse on 100 gorgeous waterfront acres on the Cabot trail near Baddeck. \$750/week. Contact rgmark@mit.edu.

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

STUDENT EMPLOYMENT

Positions for students with work-study eligibility.

SUMMER 2006 - CCLR seeks talented & creative individual w/ strong research & policy skills to assist communities & organizations achieve sustainability through land recycling & brownfield redevelopment. Summer fellow will research the effectiveness of recent efforts & formulate proposals on additional steps the

legislature & administration can take to further incentive brownfield redevelopment in CA. Ideal candidate will have strong legislative & policy analysis experience, writing, editing, analytical & communication skills. E-mail resume to evan.reeves@cclr.org. \$15/hr.

SUMMER 2006 - Media & Technology Charter High School (MATCH) seeks committed, caring & enthusiastic individuals to tutor its Summer Academy. Looking for English, math, science & history tutors. MATCH is changing lives & reversing underachievement in inner-city teens. Summer Academy runs 5 weeks from July 17 to Aug. 17. There is mandatory training, one full day & one 3-hour session, before Academy starts. Academy meets Monday-Thursday, from 7:45 a.m. - 1 p.m. Contact Bob Hill bob.hill@matchschool.org. \$17/hr.

MISCELLANEOUS

Wanted: Danish Modern, Scandinavian, & Eames style Teak or Rosewood furniture from 1950s-1980s. Will give your furniture a good home. Contact Aaron at 617-547-4459 or adschwartz@alum.mit.edu.

MICROBES

Continued from Page 4

microbes function as a system in which they have not only co-evolved with each other, but also with the chemistry and physics of the oceans. These three – chemistry, physics and biology – are tightly linked as a system, meaning you can't change one without altering the other two."

Such work is based on the discovery that seawater is absolutely loaded with invisible microbes. In trying to understand how this microbial system works, the MIT team has focused on *Prochlorococcus* as a model.

The team's studies are showing that all *Prochlorococcus* strains "are very closely related, yet they display quite an array of physiologies, and astounding genetic diversity on top of that," Chisholm said. It's becoming clear, too, that "this genetic diversity is at the heart of the extraordinary stability of *Prochlorococcus* in the oceans, which maintains steady population sizes over vast regions" of the sea.

The collective *Prochlorococcus* community merely adjusts internally, with different groups (genome types) waxing and waning in relative abundance, depending on who is most fit under ever-changing circumstances.

But how do they do it?

"We decided to let the cells tell us what is most important to them" by doing a systematic survey of relative abundances among six different types, or clades, of *Prochlorococcus* across vast environmental gradients in the oceans, Chisholm said. "We found first that two clades are orders of magnitude more abundant than all of the rest, and that temperature appeared to be very important in determining their distributions." Subsequent laboratory experiments with the cultured strains confirmed this idea.

Further analysis showed that most of the genetic differences between the two super-abundant strains are concentrated in a few "genomic islands," small zones where different kinds of genes get swapped in and swapped out, known among molecular geneticists as "hot spots" for gene exchange.

The distributors or carriers of new genes, they suspect, are the massive numbers of viruses also known to exist in seawater, some of which are adept at infecting ocean microbes such as *Prochlorococcus*. Such viruses, which carry genes of their own and sometimes transport odd genes picked up from an earlier host, are the most likely means of exchange – a natural way to get genes out of old cells and into new ones.

In essence, what all this means is that "our image of ocean microbes and their role in planetary maintenance is changing," Chisholm said. "We no longer think of the microbial community as being made up of species that have a fixed genetic makeup. Rather, it is a collection of genes, some of which are shared by all microbes and contain the information that drives their core metabolism, and others that are more mobile, which can be found in unique combinations in different microbes.

"So it is these unique combinations of genes that create the diversity we see, and which allow microbes to flourish in all environments on Earth," she added. "And if we can understand the details of this phenomenon in *Prochlorococcus*, the simplest free-living organism, it should be very helpful toward understanding the diversity in all of life."

Additional MIT authors of the Science papers are Allison Coe, Nathan P. McNulty, Matthew S. Sullivan, Adam C. Martiny, Claudia Steglich (now at University Freiburg, Germany), and Professor Edward F. DeLong. Collaborators E. Malcolm S. Woodward and Kerrie Barry are from the Plymouth Marine Lab (U.K.) and the Department of Energy's Joint Genome Institute.

Major support for this research came from the Gordon and Betty Moore Foundation Marine Microbiology Program, the National Science Foundation and the Department of Energy.

MIT novelist Lightman compares science, writing

Sarah H. Wright
News Office

MIT physicist and acclaimed novelist Alan Lightman gave a talk recently on his twin careers in science and writing, urging students to "find something you love, something you are passionate about, something that you feel compelled to do."

Lightman's award-winning fiction includes the novels "Einstein's Dreams" and "The Diagnosis." Last year, he published "A Sense of the Mysterious," a series of essays exploring the power of metaphor and imagination in science and the different uses of language in science and in literature.

Lightman's talk, titled "The Physicist as Novelist," was delivered Monday, March 6, in Evansville, Ind. In it, he traced how he found two fields — science and art — and two methods of inquiry to feel passionate about.

Describing himself as "fortunate to make a life in both and even to find creative sympathies between the two,"



In seeking truth, both the novelist and the scientist invent.

Alan Lightman
Novelist and physicist

Lightman sketched both the differences and the "substantial common ground of the physicist and the novelist."

One difference, he said, is in the way writing works in each field. In science writing, as in expository writing, "it is excellent form to begin each paragraph with a topic sentence. A topic sentence names the idea of the paragraph.

"But in fiction writing, a topic sentence is usually fatal. Because the power of fiction writing is emotional and sensual, you want your reader to be blindsided, to let go and be carried off to that magical place. Every reader will travel differently, depending on his own life experiences. Telling your reader at the beginning how she is supposed to feel about something cancels the trip," he said.

But that "substantial common ground" encompasses more than technique, according to Lightman, for scientists and artists alike seek beauty, simplicity, truth and the fleeting, powerful elixir: inspiration.

"You've all seen paintings or heard musical compositions where you felt that not a single brush stroke or note could be changed. The same is true of Maxwell's theory of electromagnetism, or Einstein's theory of gravity, or Weinberg's theory of the weak force. Nothing can be changed without destroying the entire theory," he said.

As for truth, "both the novelist and the scientist are seeking truth — for the novelist, truth in the world of the mind and the heart; for the physicist, truth in the world of force and mass. In seeking truth, both the novelist and the scientist invent," he said.

More common ground between science and art is the source and shape of invention, said Lightman.

"An experience that that scientist and artist share, a most extraordinary experience, is the creative moment,"



Alan Lightman, MIT physicist and novelist, described his dual career paths at a recent lecture in Evansville, Ind.

said Lightman, whose first experience with that moment occurred when he was a graduate student in physics working on an unsolved research problem.

"The physical sensation was that my head was lifting off my shoulders. I felt weightless. I was floating. And I had absolutely no sense of my self. I had a strong sense of seeing deeply into this problem and understanding it," he said. In fact, after months of work, he had solved his research problem.

Lightman, an adjunct professor of humanities, has taught at MIT since 1989, when he was appointed professor of science and writing and senior lecturer in physics. He co-founded the MIT Graduate Program in Science Writing in 2001.

In November, he will be presented the 2006 medal for contributions to science and society from Sigma Xi, the scientific research society.

Sloan students explore the artistic side of business

Two MBA students are huddled over a table with a camera suspended above them. They shift magazine cut-outs of an egg and an infant, left, right, upside down. "I think a little bit of the yellow ... this is nice." "We can cut the black out." "Let's cut it." "Brilliant, brilliant." "OK. Move on."

A last peek at the computer monitor and Lilly Zhu hits the spacebar to record one frame of what will become the 9-second animation, "The Origins of Love."

Not your typical day at the MIT Sloan School of Management.

During Sloan Innovation Period last week, Zhu and Kielo Ahomaa were among 12 MBA students who made an animation, created a cartoon storyboard and discussed color theory at the School of the Museum of Fine Arts, Boston. Museum School graduate students and faculty members guided their explorations.

This first-time collaboration between the MIT Leadership Center and the Museum School was designed to show MBA students how to become better leaders by engaging the right sides of their brains.

Deborah Ancona, faculty director of the MIT Leadership Center, notes that similar tasks face artists and leaders. "Leaders need to make sense of new environments, to develop a creative vision and to communicate in order to inspire others. Sensemaking, vision and communication are just as critical in visual art," Ancona said.

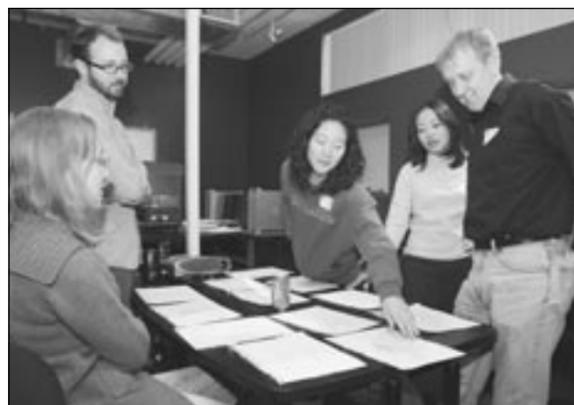


PHOTO / L. BARRY HETHERINGTON

MBA students from the MIT Sloan School of Management work on a cartoon storyboard at the School of the Museum of Fine Arts (SMFA) on Tuesday, March 21, during Sloan Innovation Period. Pictured, from left, are Kielo Ahomaa, Tom Marquet (a Museum School student), Eun-Joung Lee, Lilly Zhu and Corey Halverson.

Introducing the all-day workshop on Tuesday, March 21, Museum School faculty member David Kelley pointed

out that the traditional approach to fine art emphasizes expression and aesthetics. Twenty-first-century artists, he said, are more likely to approach art as creative problem solving.

The Sloan Innovation Period course, called "21st Century Visual Arts Workshop for Business Leaders," was structured with this concept of problem solving in mind.

For example, the MBA students grappled with communications obstacles while creating a cartoon storyboard. Two teams worked from each end of the story, trying to meet in the middle.

Plots twisted and turned. Fish jumped from airplanes. The mysterious woman was revealed to be a spy. "Maybe in the end, it's not our bearded friend's fault," mused a student. The studio hummed with laughter, talk about transitions, speculation about what the other team meant.

This inability to see the complete picture typifies many business situations, the students said. "When two companies are merging, you know that you have to meet in the middle but the stories can miss each other — as in our case," said first-year student Ahomaa. "We had to work really hard to make the story line make sense somehow."

Ahomaa, who arrived at the workshop protesting that she was "not artistic," raved about the day. "I learned a lot. Every session was thoughtfully linked with business. There is a clear connection."

MIT EVENT HIGHLIGHTS APRIL 5-9



PHOTO / NADYA NILINA

This photograph of the Stalin Allee housing project in Berlin, taken by architecture graduate student Nadya Nilina, is part of an exhibit called "Vanishing Landscapes of Socialism" on display at the Wiesner Student Art Gallery from April 6-26. See related story on page 6.

WEDNESDAY
April 5

"Fenway Bento Box"
Collaborative exhibition of mixed work by the members of the Fenway Arts and Creative Writing Group. Open 24 hours. Wiesner Student Art Gallery. 253-7019.

Hibur: MIT-Techon Link's Lecture Series
Talk by Institute Professor Mildred Dresselhaus titled, "Addressing Grand Energy Challenges Through Nanoscience." 11 a.m. Room 9-057. 253-2982.

Artist Behind the Desk: Readings
Karyn Crispo Jones will read from her new collection of poems and Will Goodell will read poems and selections from a novel in progress. Noon. Killian Hall.

Biomedical Engineering Society Lecture
Talk by Professor Angela Belcher of materials science and engineering and biological engineering. 7-8:30 p.m. Room 56-614.

THURSDAY
April 6

"Repairing the Damaged Brain with Computation: The Development of a Neural Motor Prosthesis"
Talk by Professor Michael Black of Brown University. 4-5:30 p.m. Room 32-123. 253-8924.

Communications Forum: TV News in Transition
Talk by Juju Chang of ABC News and Neal Shapiro, former president of NBC News. 5-7 p.m. Room E15-070. 253-3521.

MIT Writers Series: Barbara Goldoftas
Presentation by the author of "The Green Tiger: The Costs of Ecological Decline in the Philippines." 5:30 p.m. Room 14E-304. 253-7894.

History, Theory and Criticism of Architecture and Art Forum
Talk by Partha Mitter, University of Sussex. 6 p.m. Room 3-133. 258-8438.

FRIDAY
April 7

4th Annual Prokopoff Violin Concert
MIT students perform violin music chosen from the extensive collection of Stephen Prokopoff. Noon. Room 14E-109. 253-5686.

Submission Deadline for Schnitzer Prize in the Visual Arts
Three prizes will be awarded to registered MIT students, based on a body of work. Submit to Student Art Association, W20-429. Noon-5 p.m. 253-7019.

Arts Scholar Application Deadline
Admission open to rising sophomores, juniors, seniors and graduate students regardless of major. Room E15-205. 5 p.m.

Advanced Music Performance Concert
Soprano Elisabeth Hon performs. 5 p.m. Killian Hall. 253-2826.

SATURDAY
April 8

"Vanishing Landscapes of Socialism" and "The Portrait of Place"
Joint exhibition of graduate student work. Open 24 hours. Wiesner Student Art Gallery. 253-7019.

Emerson Scholar Student Recitals
Strings at 1 p.m. Winds at 3 p.m. Killian Hall. 253-2826.

MITHAS Concert OS
Thyagarajan, Carnatic vocal. \$18, \$14 MITHAS members, \$10 students, MIT students free. 7:30 p.m. Kirsch Auditorium. 258-7971.

MIT's 4th Annual Battle of the Bands
Ten bands compete. \$12 general admission, \$8 MIT/Wellesley students, \$3 pre-frosh. 8 p.m. Stratton Student Center. 314-5269.

SUNDAY
April 9

Emerson Scholar Student Recitals
Winds at 3 p.m. Strings at 5 p.m. Killian Hall. 253-2826.

Gallery Talk
Talk by List Visual Arts Center staff in conjunction with "America Starts Here — Kate Ericson and Mel Ziegler 1985-1995." 2 p.m. List Visual Arts Center. 253-4680.

Go Online! For complete events listings, see the MIT Events Calendar at: <http://events.mit.edu>.
Go Online! Office of the Arts website at: <http://web.mit.edu/arts/office>.

EDITOR'S CHOICE

CAMPUS PREVIEW WEEKEND 2006
Admitted students of the Class of 2010 come to campus.

Apr. 6

MIT SHORT FILM FESTIVAL
A selection of the most recent European short films. April 7-9.

Apr. 7

Room 10-250
7 p.m.

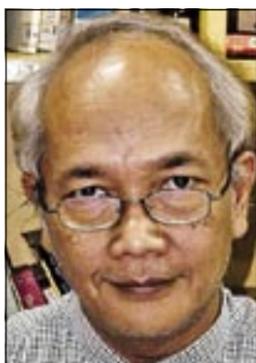
FORUM USA CAREER FAIR
The Embassy of France, in partnership with the MIT France Program, holds annual Forum USA career fair.

Apr. 8

Stata Center
8:20 a.m.-6:30 p.m.



Capt. Kevin Gannon
Roughly 3,000 sailors and civilians serve under the command of Capt. Kevin Gannon, who has used OCW to access MIT Sloan School of Management course materials. "OCW has definitely accelerated our ability to train," he said.



Triatno Yudo Harjoko
This professor and colleagues at the University of Indonesia at Depok study OpenCourseWare offerings to try to understand how they are designed. "It's not simply the information that's valuable, but also the glimpse it offers into how MIT has structured its teaching and research to become such a prestigious institution."



Benjamin Goff
Goff, a software maintenance engineer at Robins Air Force Base in Warner Robins, Ga., is a serious weather buff. He has used OpenCourseWare to explore many of the courses in the MIT Department of Earth, Atmospheric and Planetary Sciences.



Kunle Adejumo
A Nigerian engineering student, Adejumo uses OpenCourseWare to supplement his studies at Ahmadu Bello University in Zaria, Nigeria.

OPENCOURSEWARE

Continued from Page 1
on the OCW web site at <http://ocw.mit.edu>. There have been nearly 20 million unique visits to MIT OCW content since Oct. 1, 2003. In February alone, there were an average of more than 36,000 visits to the site daily. "We're getting traffic from virtually every country on earth. From a very simple but profound idea, OCW has grown into a global movement" now used daily by thousands of people worldwide, according to Jon Paul Potts, communications manager for OCW. Visitors include educators elsewhere (17 percent), students everywhere (32 percent) and a huge audience defined as "self learners" (49 percent). The program has won numerous awards, including the 2005 Tech Museum of Innovation Laureate, honoring the use of educational technology to solve global problems, and the Computerworld Laureate, honoring OCW as the best IT education initiative of 2004. The impact of OCW is indeed global, with nearly 80 mir-

ror sites of OCW installed on university campuses around the world. MIT course materials have been translated into Chinese, Spanish, Portuguese and Thai. And, more than 50 other universities and colleges have launched their own OCW projects, offering their own course materials free, via the Internet, to anyone, in various languages. The growing list includes major universities and other learning centers in the United States, plus many more in China, Spain, Portugal, Japan, France and Vietnam. One educator from Indonesia summed it up: "I was surprised that such a renowned university as MIT would freely give access to almost all of its educational information to the world," said Triatno Harjoko, an architecture professor at the University of Indonesia in Depok. "Critical thinking and creativity demand the liberalization of learning and information," he said. "But I also believe that it's not simply the information that's valuable, but also the glimpse it offers into how MIT has structured its teaching and research to become such a prestigious institution."



Maria Karamitsou
A civil engineering student at Aristotle University of Thessaloniki in Greece, Karamitsou tapped OCW for help on a research project about the behavior of water.