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 prosurvival hormones, epidermal growth factor (EGF) and insulin. TNF and EGF induce conflicting prosurvival and prodeath 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 researchers 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.

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 counterintuitive 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.

“The work we did provides the first big picture of how these two key factors interact in time and space,” said Sorger. “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 other,” he said.

In drug development, we want to identify the really important hubs in the network, work on them first. That’s the key to figure out the most critical point in the cell cycle for the drug to intervene. This work will help accomplish that goal.”

Professor Sorger, at a moment in the world where new scientific discoveries are made, reminds us of this phrase: “With what we now understand about the interactions between these two factors, we should aim for increasing the therapeutic value from these drugs.”

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 laser to the right place.

Now “perfect mirror” technology, developed by MIT researchers, is being used 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, lungs, 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 only up to a centimeter beyond their placement, jeopardizing organs close to the tumor, including the heart.

“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 about laser surgery while he was working with OCW since the beginning.”

OpenCourseWare marks 5 years

Deborah Halber
News Office Correspondent

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 using the OCW to teach courses — and students are finding the information they need for [a metallurgical engineering course].

“I went to OCW because I 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 Harald Albinson, 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 on OCW.
U.S. News ranks Engineers tops
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 together today, 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 on Thursday, March 23, in Kirsch Auditorium. Singer received this year’s Killian Award was established by Killian, former MIT president and chair of the selection committee. Singer is one of the rare mathematicians who is able to communicate with theoretical physicists in their own language and engage them in genuine collaboration. 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 adapt 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 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 the index 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 calculates this number in terms of the geometry of the surrounding space.”

In the 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 verdicts, drunk 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 the 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 chair of the selection committee. 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 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.”

I’d be spending the next four years,” Rizos said of his experience.

The annual CPW provides accepted stu- dents and their parents with an open pass to MIT for four days. They can attend lectures, courses and events during the spending time on the campus that may become their home this fall. The potential students stay in campus housing for a weekend and attend classes as a current student whose interests match their own. Admissions officers also participate in the match between MIT and the students, said Jennifer Riken, who is the director of recruitment in the admissions office. Since 1971, 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 for accepted students and other events than ever before,” Riken said. Preference is invited to explore.

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

Freshman Alexis Dale, who hails from Massachusetts’ South Shore, attended CPW last year. She encouraged potential students to attend CPW as soon 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 Simha Branson 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 Simha Branson that the Institute was the right place than ever before,” Riken said. Preference is invited to explore.

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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 "conga" they use seems to be a flood of viruses, MIT scien-
tists report.

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

The work will be reported in two arti-
cles in the March 24 issue of Science. A dual master's degree candidate in city planning and a CEER graduate student, suggest that gene-
swapping in ocean microbes resembles the "conga line" among disease-causing bacteria. In an ocean with rapidly changing conditions, it would offer marine microbes a diverse palette of potential gene combinations, each of which would suit the particular environment. This should allow the overall population to persist despite complex and unpredictable environmental changes.

"The postulate that lateral gene trans-
fer is an important mechanism for local specialization in the oceans," they wrote in the Woods Hole Oceanographic Institution and Chisholm.

The paper from Chisholm's labora-
y concept in detail as a "virtual photosynthesizer." Chisholm's research could convert the sun's energy into food and nutrients. "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. "The OmniGuide can convert the sun's energy into food and nutrients. In Ahmedabad, for example, there are 12.4 miles of road and polled 350 pedestrians. "It was so important that we put it in local input," Krambeck said.

Using the criteria, which assessed the condition of walking paths, traffic manage-
ment at intersections and timing of traffic lights, the volunteers found Ahmedabad to be "a very inhospitable place for pedes-
trians." The volunteers reported animal waste in the streets, unsaved surfaces, poor drainage and litter, all of which render the streets unsuitable, said Krambeck, who helped create a proposal for the World Bank to upgrade the city's pedestrian accessibility. She said she hopes her find-
ings will be incorporated in the upgrade planning project set to begin in 2006.

As of now, the index ranking the cities is a work in progress. "Krambeck started 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 in management 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 walkability in what she termed the overall safety, security, economy and conven-
ience of traveling by foot.

Krambeck developed a tool to assess walkability in cities around the globe. Questions included: How easy is it? Are there benches to relax along the way? Are there accessible public rest-
rooms? Is there ample walking coverage to stay out of the sun and rain? Are the 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, Havana, Bangkok, Manilla, and Karachi while Krambeck led field tests in Alexandria, Va., and Washington, D.C., followed by a full-scale pilot in Ahmeda-
bad, 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.

Grad student judges walkability of cities

Sasha Brown

Developing cities need to do more to address the needs of pedestrians, accord-
ing to MIT graduate student Holly Kram-
beck, who is working on a walkability tool — from concept to paper to patient

In Ahmedabad, for example, there are no urban design guidelines for walking paths. Further, the various laws for pedes-
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Scientists and scholars specializing in various fields of science, 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, created by a team of researchers at MIT in 2005 for treating patients who identify themselves as black.

Reinhard Goethert, principal research associate in architecture, is director of the Special Interest Group in Urban Settlement (SIGUS) at MIT. The group will provide expertise in design, structural 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 Goethert said. The team addressess like jets that we can’t understand in traditional cell biology. Working as a team, teams of researchers, a concept unusual in traditional science in the 21st Century" and “’Frozen typing the Future: Scientists’ Expectations of the History and Culture of Science and of African and Afro-Caribbean Americans at Harvard University, will deliver the keynote address on Saturday. His topic is “The Molecular Reinscription of Race.”

"BiDil and Race.”

Other talks include “Ashkenazi Jews: Overburdened and Overexposed?”

"Imperialism, Race and Therapeutics,” and “Genotyping the Future: Scientists’ Expectations About Race/Ethnicity and Genetica in the 21st Century” and “Frozen Moments” in the Harvard 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.”

Evelyn Hammonds, professor of history and science of and African and Afri-Caribbean-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.
Student photo exhibit offers perspectives on Eastern Europe

In a joint exhibition opening Thursday, April 6, at the Wiesner Student Art Gal- lery, architecture graduate students Vikto- rija Abolina and Natalya Nilina explore their native lands in Eastern Europe through the lens of a camera. For each the viewer is different.

Inspired by the older wooden struc- tures of the Latvian capital Riga, Abolina uses black-and-white photographs to cre- ate “The Portrait of Place.” “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 in their texture, light and composition of small details.” Abolina said that she tries to explore in her photog- raphy one of the essential issues in archi- tecture: “how the individuality of spaces relates to those who inhabit it.”

Nilina, who was born in Moscow,-leans more toward social commentary in “Van- ishing Landscapes of Socialism.” Created with Jeff Silva, at a MIT Video Productions, the exhibition is a video mono- tage 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, show- ing how these very generic spaces have become independent desolate residents, unused to social crisis caused by population decline and despondency.

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

New Energy Posters

The MIT Energy Club is organ- izing 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-realted business plans are eligible for this session. Students who want to present posters may email David Danielson at danielson@mit.edu to reserve a slot. Energy related student titles and co-authors.

Summer Abroad

An information session for stu- dents interested in studying abroad will be held Thursday, April 20, from 3 to 5 p.m. in Room 1-277. Two informa- tion sessions on foreign school options 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 for- eign-scholarship-advice@mit.edu.

Student photo exhibit offers perspectives on Eastern Europe

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

Developed by MIT’s Center for Trans- portation & Logistics (CTL), the simul- ation will involve the disruption of an outbreak of avian flu that shuts down a fictional manufacturing facility. The plant closure will ripple through the chain as other companies and government react to the news.

A panel of executives will respond in real time to the unfolding emergency, which will be broadcast by phone and pre- scribed news bulletins delivered by a facil- itator. The exercise is part of CTL’s larger, day-long annual simulation titled “At the Crossroads of Supply Chain and Strategy: Simulating Disruption to Business Recov- ery.”

CTL Director Yossi Sheffi said the cen- ter devised the event to help companies thinking about contingency plans for glo- bal disruption. “There is a lot of creativity here, including filmmaking and research and world- wide exploration,” Nilina said. “The (archi- tecture) department is truly committed to the social issues in architecture and urban planning,” she adds.

“The Portrait of Place” and “Van- ishing 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 7-258), also through April 26.

Student photo exhibit offers perspectives on Eastern Europe

“In my work, I try to explore in my photos the character of the place and the people who inhabit it,” Abolina said. Adding that she is drawn to sites that are “rich and beautiful in their texture, light and composition of small details.” Abolina said she tries to explore in her photog- raphy one of the essential issues in archi- tecture: “how the individuality of spaces relates to those who inhabit it.”

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Microbes function as a system in which they have not only to inspire others. Sensemaking, vision and communication to develop a creative vision and to communicate in order to understand the details of this phenomenon in Prochlorococcus. This inability to see the complete picture typifies the assembly of the MIT Lead- ership Center and the Museum School was designed to show how the biological and the business worlds can merge to become better leaders by engaging the right sides of their brains.

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

MBA students from the MIT Sloan School of Management work on a cartoon storyboard for the Museum School’s Animation Program, the National Science Foundation and the Department of Energy’s Joint Genome Institute.

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. Pots 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.”

Sloan students explore the artistic side of business
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.


**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**

**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.

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.

**OPENCOURSEWARE**

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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 visited 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 mirror 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 Tria Yudho Harjoko, an architecture professor at the University of Indonesia in Depok.

“Critical thinking and creativity demand the liberal learning and information,” he said. “But also I believe that it’s not simply the information that’s valuable, but also the glean it offers into how MIT has structured its teaching and research to become such a prestigious institution.”

**Kunle Adejumo**

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

**Maria Karamitso**

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