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3 MIT affiliates named HHMI Early Career Scientists

New program aims to give researchers flexibility in pursuing potentially transformative ideas

Three scientists at MIT were recently named Howard Hughes Medical Institute (HHMI) Early Career Scientists, part of a new initiative designed to give promising researchers more time and resources to focus on their boldest — and potentially transformative — research ideas.

The three appointed from MIT, among the 50 chosen overall, are Michael Laub, the Whitehead Career Development Assistant Professor of Biology; Peter Reddien, the Thomas D. and Virginia W. Cabot Assistant Professor of Biology and member of the Whitehead Institute for Biomedical Research; and Aviv Regev, an assistant professor in the Department of Biology.

Each HHMI Early Career Scientist will receive a six-year appointment to the HHMI and, along with it, the freedom to explore his or her best ideas without worrying about where to find the money to fund those experiments.

Laub's research focuses on how cells process information and control behavior, and he is analyzing the complete set of genes and proteins involved in cell cycle progression and other signaling pathways in *Caulobacter*, an aquatic bacterium widely distributed in fresh water lakes and streams. His goal is to determine how feedback loops and other design features link these signaling molecules in elaborate molecular circuits. He is also developing new methods for the rational rewiring of signaling pathways in bacteria.

Reddien's work is focused on remaking the freshwater planarian *Schmidtea mediterranea* into a state-of-the-art model organism — one that, like the fruit fly or the mouse, will prove important for understanding fundamental aspects of biology.

Regev, who is also with the Broad Institute of MIT and Harvard, combines

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PHOTO / BRENDAN SMIALOWSKI/UPI

MIT President Susan Hockfield, speaks before U.S. President Barack Obama delivers remarks about investments in clean energy and new technology.

Hockfield, Obama urge major push in clean energy research funding

David Chandler
News Office

At a press briefing at the White House on Monday, March 23, MIT President Susan Hockfield joined U.S. President Barack Obama in calling for a “truly historic” new level of federal funding for clean-energy research.

The event came as Congress prepares to take up the president's budget, which calls for dedicating \$150 billion over 10 years for a new clean-energy R&D and technology fund. This initiative represents “the largest and most important investment in science and technology” by the U.S. government since the Apollo moon-landing program in the 1960s, Hockfield said.

The federal investments made during the Apollo era “spawned a set of technologies that have transformed our lives and workplaces,” she said. “The R&D and technology invest-

ments that President Obama proposes have equally profound potential as an economic catalyst. That would be good news in any economy. But of course today, it provides a lifeline.”

The value of such investments was underscored by a 1997 report from the President's Council of Advisors on Science and Technology, which was chaired by new White House science advisor John Holdren, Hockfield said. That report showed that “every government dollar invested in energy R&D returns 40-fold to the economy — in energy efficiency, energy savings and in new technologies — a 40-to-1 return on investment,” she said.

The new clean-energy technologies to be developed through this research and development funding “will power our long-term prosperity,” Obama said at the briefing. With this new funding proposal, along with \$39 billion in clean-energy research funding and \$20 billion in tax incentives that

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Task Force working groups move from information to planning

Group is completing data gathering, begins work on proposals

David Chandler
News Office

MIT's Institute-wide Planning Task Force, created to find ways to reduce costs and increase efficiencies in the Institute's operations over the next three years, is completing the first phase of its work — gathering data and suggestions from the Institute's students, faculty and staff. The group is now beginning the process of evaluating ideas, prioritizing opportunities and working toward a preliminary report of recommendations by June.

The Task Force, coordinated by Vice Chancellor & Dean for Graduate Education Steven R. Lerman, Associate Provost Martin A. Schmidt, and Vice President for Finance Israel Ruiz, was set up in response to the decline in revenues as a result of the global economic crisis and was charged with exploring ways to maximize efficiency and effectiveness to help reduce MIT's expenses by \$100 million to \$150 million over the next two to three years, starting with the 2011 fiscal year. These reductions will follow an initial \$50 million expense reduction already underway for FY 2010.

Ruiz emphasizes that while the need to reduce costs provided the initial impetus for the Task Force's work, this process represents a chance “to make MIT even a better place, a more efficient place” by finding improved

and more sustainable ways of fulfilling the Institute's core missions of teaching and research. “This is an incredible opportunity for all of us,” he says.

Toward that end, in addition to meeting with various members of the MIT community and outside experts, the group set up an online “Idea Bank” where MIT community members could offer suggestions for savings, and could do so anonymously if they wished. More than 760 suggestions have been collected so far, and weekly reports on the suggestions have been forwarded to the Task Force members.

That process “has generated a lot of leads for the working groups to validate or take on,” Ruiz says. A few basic themes have emerged, such as automation and simplifica-

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PEOPLE

Student named Truman scholar

Natasha ‘Tish’ Scolnik, a mechanical engineering major, wins Truman scholarship.

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Students and the Division of Student Life work together to bring a fresh produce stand to campus.

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tion of various administrative systems and a reduction of printed materials, he says.

The Idea Bank will continue to take new suggestions, although as the Task Force working groups transition to planning and drafting of proposals its members will no longer receive automatic weekly reports, so they are encouraging people to contribute ideas within the next week if possible.

By mid-April, the group aims to have a summary of the Idea Bank suggestions to date, including charts showing the relative amounts of support for different suggestions. The Task Force's preliminary report to the administration is due in June, and its final report in October.

In addition to the Idea Bank itself (<http://ideabank.mit.edu/>), the Task Force maintains a web site (<http://web.mit.edu/instituteplanning/>) that will be regularly updated with summaries of the work of its seven working groups, which are examining specific areas of MIT operations for potential savings. The groups are based on the topics of Space, Education, Research, Student Life, Revenue Enhancement, Human Resources and Benefits, Administrative Processes, Procurement and Information Technology.

Events at MIT



Today

• **The Fascination of Flight Exhibit, opening celebration.** 1-3 p.m. in 14N-130, Maihaugen Gallery. The Fascination of Flight showcases both the dream and the reality of flight through historical materials, archival records, and current collections owned by the MIT Libraries.

• **"Women on the Edge: The Moral Economy of Balancing Low-Paid Work and Family."** Speaker: BC Professor Lisa Dodson. 4:30-6:30 p.m. in 4-370. Dodson's research interests include poverty, teen and single-motherhood, and the widening effects of economic disparity in the U.S.

• **MIT Wind Week Lecture: "Wind Power at GE and the Path to 1/4 of the World's Electricity."** Speaker: Jim Lyons, formerly of GE Wind. 6-7 p.m. in E51-145. Jim Lyons, co-founder of GE Wind and general expert on wind energy, joins MIT Wind Week to talk about how GE ended up getting into the wind business and what it would be like to have a quarter of the world's electricity generated by wind power.

Submit your events!

Log on to events.mit.edu to add your events to MIT's online calendar. Certain events will be selected from the online calendar to be published in Tech Talk each Wednesday.



PHOTO / JOSEPH KISYOKY

Natasha 'Tish' Scolnik, who is working to make it easier for physically challenged individuals in Africa to move around, was awarded a Harry S. Truman Scholarship this year.

MIT junior named Truman scholar

Program aims to nurture next generation of public-service leaders

An MIT junior who is working to make it easier for physically challenged individuals in Africa to move around has been awarded a 2009 Harry S. Truman Scholarship.

Natasha "Tish" Scolnik, a mechanical engineering major from Waccabuc, N.Y., is among approximately 60 students nationwide selected as winners of the \$30,000 graduate scholarship. Awarded each year, the Truman scholarships aim to cultivate college juniors with exceptional leadership potential who are committed to making a difference through careers in government, education or other public-service sectors.

"Tish is one of those rare college students that has already made dramatic improvements upon people's lives: Because of her, amputees in Africa have more freedom than they had before they met her," said Professor Anne McCants, chair of the history section. McCants and Kimberly Benard, MIT's program director for Distinguished Fellowships, nominated Scolnik for the Truman scholarship.

Scolnik became involved in issues of mobility in Africa in her freshman year when she enrolled in mechanical engineering graduate student Amos Winter's class on wheelchair design for the developing world. For several years, Winter has been developing chairs that can be made locally with readily available materials and that work better under the rough conditions — wet, muddy roads and gear-clogging dust, for example — that they face in each location.

Since taking the class, Scolnik has traveled to Africa three times

as an MIT Public Service Fellow to work on various aspects of wheelchair design for local populations. She plans to continue to work during her senior year and perhaps beyond with, and on behalf of, the MIT Mobility Lab, which aims to advance wheelchair and prosthetic technology for the developing world.

Scolnik credited MIT for helping her focus her altruistic energies.

"President Susan Hockfield said that she wanted MIT to be the dream of every child who wants to make the world a better place. For me, that dream has become a reality," Scolnik said. "When I came to MIT, I never imagined that I would end up using the skills I was learning in the classroom to work on wheelchair design in developing countries. But I also can't imagine doing anything more rewarding."

In addition to her work in Africa, Scolnik has led MIT students in community service through MIT's CityDays, a program that pairs 25 freshmen with upperclassmen as an orientation to MIT through public service. She is a certified EMT, and served as the vice chair for Wellness Week for the Undergraduate Association Committee for Student Life. Scolnik also mentors MIT students interested in issues related to life sciences and engineering.

Sally Susnowitz, director of the Public Service Center, has worked very closely with Scolnik throughout her time at MIT and said she was a perfect fit for the Truman scholarship. "Thoughtful, purposeful, inspired, compelling: Tish is a natural leader and a dedicated humanitarian, as well as a truly delightful person," said Susnowitz. "I'm thrilled that she has been selected as a Truman scholar."

For more information on the Truman scholarships, visit <http://www.truman.gov>.

HOCKFIELD: MIT president speaks with Obama at clean-energy event

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were included in the economic stimulus package, Obama said, "we have achieved more in two months in support of a new clean-energy economy than we've achieved in perhaps 30 years." In addition, he said, the initiative will help the nation "end, once and for all, our dependence on foreign oil."

Also speaking at the White House briefing was Paul Holland, who is on the board of a new company called Serious Materials that has re-opened manufacturing plants shuttered by the housing downturn and is using them to produce what Obama

described as "probably some of the most energy-efficient windows in the world."

Hockfield said that the kinds of new breakthroughs likely to be spawned by this federal investment in R&D are exemplified by a variety of projects already under way at MIT. These include innovations that could turn windows into efficient, cost-effective solar cells, new materials that make batteries long-lasting, safe and rapidly charging, "quantum dot" light bulbs that are 500 percent more efficient than incandescent bulbs, and methods for using benign viruses to make clear, non-

toxic, lightweight batteries.

Hockfield said that in addition to the economic impact of these research funds, "these same investments also offer the only route to the breakthrough technologies required to address the daunting challenges of energy security, rapidly accelerating energy demand and climate change. And, as an added bonus, solving these challenges has captured the imaginations and ambitions of young people — students at MIT and across the country, young scientists and engineers passionately committed to inventing a bright, clean energy future."

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News in brief

Missing something? Check MIT's lost and found

Several items of significant value have been turned in to the MIT lost and found recently, and the police department is looking for the rightful owners.

The items waiting to be retrieved include a silver bracelet with diamonds, a silver bracelet wristwatch, a gold wedding band, a blessed Mary medal and a calculator.

Anyone claiming lost and found property at the MIT Police must show positive identification such as an MIT ID card or a driver's license. For more information, contact Sgt. Cheryl Vossmer at 617-253-9755 or crimbite@mit.edu.

The central lost and found is located at MIT Police Headquarters, Building W89, 301 Vassar St. Found items can be delivered to MIT Police Headquarters or to one of the police substations, located in the basement of the Stata Center, Building 32-070-C, or the Student Center, W20-020C, between 9 a.m. and 2 p.m.,

Monday through Thursday. Community members who are unable to deliver items to any of these locations should call the MIT Police at 617-253-9753 and notify the officer to have the item picked up.

New vanpools forming now; seats available on existing routes

A new vanpool between Westborough/Framingham and Kendall Square will begin in April, offering members of the community another money-saving commuting option.

Other vanpools are also forming or have seats available on routes to and from towns such as Andover, Sagamore, Plymouth, Nashua, Tewksbury and Londonderry. For more information or to form a van from your community contact Melissa Zampitella at VPSI, 781-937-0071 or Melissa.Zampitella@vpsiinc.com.

MIT offers a subsidy and pre-tax payroll deduction for vanpool riders; contact Robynn Cruz for details at rcruz@mit.edu.



PHOTO / DONNA COVENEY

Rafael Bras delivers his lecture as the recipient of the 2008-2009 James R. Killian Jr. Faculty Achievement Award.

Bras eyes 'intertwined dance' of land, water, plants

Stephanie Schorow
News Office

If the lesson of this year's Killian Award lecture could be told as a folk proverb, it might be this: Water changes land, land changes plant, plant changes land, land changes water.

Rafael L. Bras — the professor of civil and environmental engineering who is on leave from MIT while serving as dean of the Henry Samueli School of Engineering at the University of California at Irvine — returned to campus this week to give the annual lecture, a tradition now in its 37th year. As winner of the 2008-2009 James R. Killian Jr. Faculty Achievement Award, Bras devoted his March 30 talk to the complex yet elegant relationships among oceans, land, atmosphere and plant life.

Bras drew on his more than 30 years of research in hydrologic science — an interdisciplinary field that he pioneered — to outline formulas and models that explain how landscapes shift over thousands of years. Plants, for example, change the properties of soil to increase moisture, which changes drainage, which, in turn, affects trees and bushes.

"This becomes a really intertwined dance among the vegetation, the landscape, the hydrology and the radiation," said Bras.

Such connections are only recently being fully understood as hydrologic science integrates the study of traditional land hydrology with atmospheric science, ecology and geology. "The land masses did not matter when I went to school here; only the oceans mattered," said Bras '72, SM '74, ScD '75.

But neither water, earth nor sky can be studied in isolation. Deforestation in the Amazon is affecting cloud distribution, Bras said. Shallow clouds tend to form over deforested areas while deep clouds tend to cover forested areas. This may be due to a phenomenon similar to a sea breeze, an uplift created by the cleared spaces between forested areas. About 20 percent of the Amazon is already deforested; many fear additional deforestation may permanently change the area's atmosphere.

"We are at the point — probably for the first time in millions of years — where there are enough of us and we have the technology to alter the earth," Bras said in answer to an audience question about the political ramifications of his research. "There's no doubt in my mind that the atmosphere has been altered. There's no doubt in my mind that large-scale agriculture has changed land surfaces."

As recently as 200 years ago, the oceans and sky seemed immense and unchangeable, Bras said. "They're not — not any longer."



PHOTOS / (L-R) DONNA COVENEY; KELLY LORENZ; MARIA NEMCHUK

From left to right: Michael Laub, the Whitehead Career Development Assistant Professor of Biology; Peter Reddien, the Thomas D. and Virginia W. Cabot Assistant Professor of Biology and member of the Whitehead Institute for Biomedical Research; and Aviv Regev, an assistant professor in the Department of Biology.

HHMI: Three from MIT named Early Career Scientists

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computational and experimental approaches to investigate how complex gene regulation networks rewire themselves in response to genetic and environmental changes. Her studies in yeast will address how these remarkably flexible networks transform over different time scales — from rapid adaptations in response to changing nutrient availability to evolutionary changes in metabolism that have occurred over 300 million years.

HHMI will provide each Early Career Scientist with his or her full salary, benefits and a research budget of \$1.5 million over the six-year appointment. The HHMI will also cover other expenses, including research space and the purchase of critical equipment.

"We saw a tremendous opportunity for HHMI to impact the research community by freeing promising scientists to pursue their best ideas during this early stage

of their careers," said HHMI President Thomas R. Cech. "At the same time, we hope that our investment in these 50 faculty will free the resources of other agencies to support the work of other outstanding early career scientists."

The 41 men and nine women will begin their six-year, nonrenewable appointments to HHMI in September 2009, with an anticipated second Early Career Scientist competition in 2012.

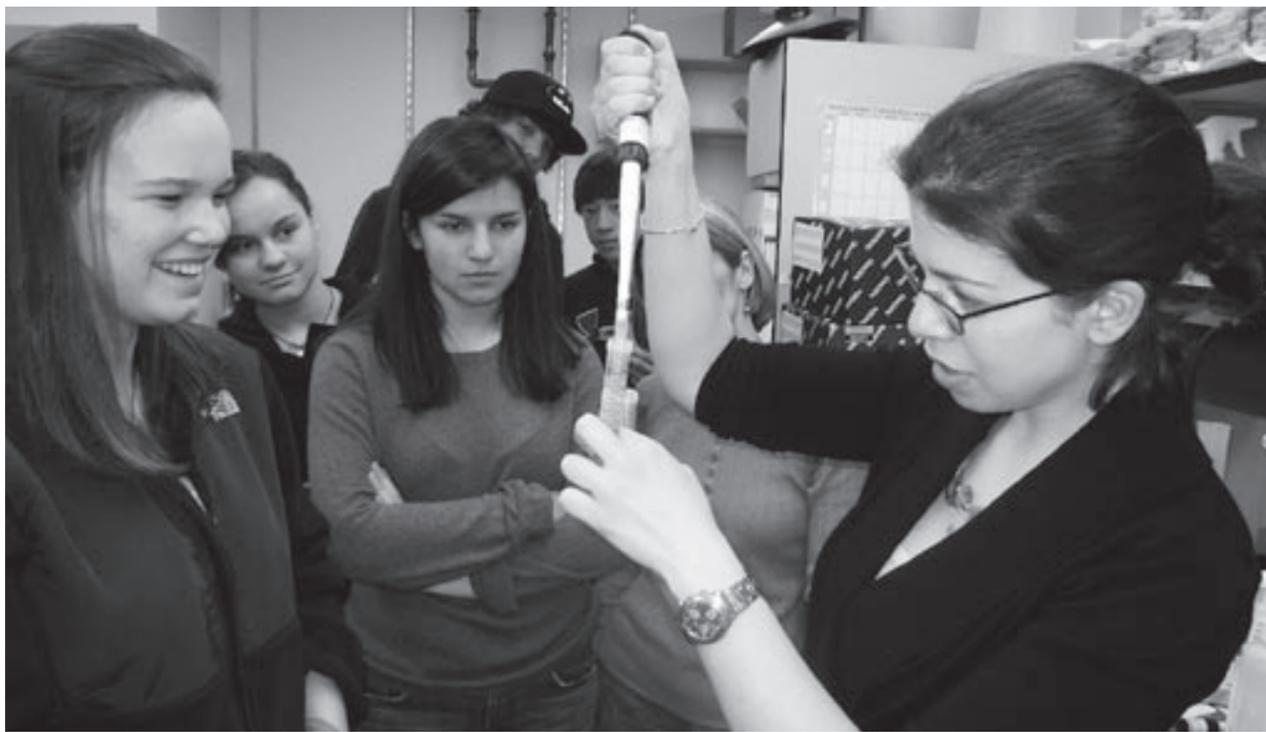


PHOTO / MANDANA SASSANFAR

A fruitful lesson

More than 160 area high school students and their teachers spent a day at MIT during spring break as part of a science outreach program hosted by the Department of Biology. The daylong event featured hands-on activities and lectures, as well as a chance to see scientists working in their labs. Here, Alexandra Naba, an HHMI postdoctoral fellow with the Koch Institute for Integrative Cancer Research at MIT, shows Concord-Carlisle High School students how to isolate DNA from tomatoes.



PHOTO / DONNA COVENEY

Department of Electrical Engineering and Computer Science assistant professors Tomás Palacios, left, and Jing Kong examine oscilloscope traces showing the doubling in frequency of an electromagnetic signal processed through their experimental graphene microchip.

New material could lead to faster chips

Graphene may help shatter communications speed limit

David Chandler
News Office

New research findings at MIT could lead to microchips that operate at much higher speeds than is possible with today's standard silicon chips, leading to cell phones and other communications systems that can transmit data much faster.

The key to the superfast chips is the use of a material called graphene, a form of pure carbon that was first identified in 2004. Researchers at other institutions have already used the one-atom-thick layer of carbon atoms to make prototype transistors and other simple devices, but the latest MIT results could open up a range of new applications.

The MIT researchers built an experimental graphene chip known as a frequency multiplier, meaning it is capable of taking an incoming electrical signal of a certain frequency — for example, the clock speed that determines how fast a computer chip can carry out its computations — and producing an output signal that is a multiple of that frequency. In this case, the MIT graphene chip can double the frequency of an electromagnetic signal.

Frequency multipliers are widely used in radio communications and other applications. But existing systems require multiple components, produce “noisy” signals that require filtering and consume large power, whereas the new graphene system has just a single transistor and produces, in a highly efficient manner, a clean output that needs no filtering.

The findings are reported in a paper in *Electron Device Letters* and in a talk at the American Physical Society meeting by Tomás Palacios, assistant professor in MIT's Department of Electrical Engineering and Computer Science and a core member of the Microsystems Technology Laboratories. The work was done by Palacios along with EECS Assistant Professor Jing Kong and two of their students, Han Wang and Daniel Nezich.

“In electronics, we're always trying to increase the frequency,” Palacios says, in order to make “faster and faster computers” and cellphones that can send data at higher rates. “It's very difficult to generate high frequencies above 4 or 5 gigahertz,” he says, but the new graphene technology could lead to practical systems in the 500 to 1,000 gigahertz range.

“Researchers have been trying to find uses for this material since its discovery in 2004,” he says. “I believe this application will have tremendous implications in high-frequency communications and electronics.” By running several of the frequency-doubling chips in series, it should be possible to attain frequencies many times higher than are now feasible.

While the work is still at the laboratory stage, Palacios says, because it is mostly based on relatively standard chip processing technology, he thinks developing it to become a commercial product “may take a year of work, maximum two.” This project is currently being partially funded by the MIT Institute for Soldier Nanotechnology and by the Interconnect Focus Center program, and it has already attracted the interest of “many other offices in the federal government and major chip-making companies,” according to Palacios.

Graphene is related to the better-known buckyballs and carbon nanotubes, which also are made of one-atom-thick sheets of carbon. But in those materials, the carbon sheets are rolled up in the form of a tube or a ball. While physicists had long speculated that flat sheets of the material should be theoretically possible, some had doubted that it could ever remain stable in the real world.

“In physics today, graphene is, arguably, the most exciting topic,” Palacios says. It is the strongest material ever discovered, and also has a number of unsurpassed electrical properties, such as “mobility” — the ease with which electrons can start moving in the material, key to use in electronics — which is 100 times that of silicon, the standard material of computer chips.

One key factor in enabling widespread use of graphene will be perfecting methods for making the material in sufficient quantity. The material was first identified, and most of the early work was based on, using “sticky tape technology,” Palacios explains. That involves taking a block of graphite, pressing a piece of sticky tape against it, peeling it off and then applying the tape to a wafer of silicon or other material.

But Kong has been developing a method for growing entire wafers of graphene directly, which could make the material practical for electronics. Kong and Palacios' groups are currently working to transfer the frequency multipliers to these new graphene wafers.

“Graphene will play a key role in future of electronics,” Palacios says. “We just need to identify the right devices to take full advantage of its outstanding properties. Frequency multipliers could be one of these devices.”

Team observes genesis of fish shoals

Movement of millions also applies to bird swarms, more

Elizabeth Thomson
News Office

For the first time, MIT engineers and colleagues have observed the initiation of a mass gathering and subsequent migration of hundreds of millions of animals — in this case, fish.

The work, conducted using a novel imaging technique, “provides information essential to the conservation of marine ecosystems that vast oceanic fish shoals inhabit,” the team wrote in the March 27 issue of *Science*.

It also confirms theories about the behavior of large

groups of animals in general, from bird flocks to locust swarms. Until now those theories had only been predicted through theoretical investigations, computer simulations and laboratory experiments.

For example, the team found that once a group of fish reaches a critical population density, it triggers a kind of chain reaction resulting in the synchronized movement of millions of individuals over a large area. The phenomenon is akin to a human “wave” moving around a sports stadium.

“As far as we know, this is the first time we've quantified this behavior in nature and over such a huge ecosystem,” said Nicholas C. Makris '83, PhD '91, leader of the work and a professor of mechanical and ocean engineering. The resulting shoals of migrating fish can extend some 40 kilometers or approximately 25 miles across the ocean.

Makris' principal collaborators on the work include Purnima Ratilal PhD '02, a professor at Northeastern University, J. Michael Jech of the Northeast Fisheries Science Center, and Olav Rune Godoe of the Institute of Marine Research in Norway.

Other collaborators are from MIT, Northeastern and

the Southeast Fisheries Science Center.

Off Georges Bank

The researchers focused on Atlantic herring off Georges Bank near Boston during the fall spawning season. They found that the formation and movement of large shoals of the fish constituted a kind of daily evening commute to the shallower waters of the bank where they spawn under cover of darkness. Come morning, the fish head back to deeper water and disband.

The work was conducted using Ocean Acoustic Waveguide Remote Sensing (OAWRS). In 2006, Makris and colleagues published a paper in *Science* introducing OAWRS, which they invented, and initial observations made with it.

OAWRS allows the team to take images of an area some 100 kilometers (approximately 62 miles) in diameter every 75 seconds. This is a vast improvement over conventional techniques such as fish-finding echo-sounders, which Makris compares to “watching one pixel on a movie

Research in brief



New test can predict spread of breast cancer

Scientists at MIT, the Albert Einstein College of Medicine and Weill Cornell Medical School have developed a test that could help doctors precisely identify which breast cancer patients should receive aggressive therapy, thereby sparing many women at low risk for metastatic disease from undergoing unnecessary and potentially dangerous treatment.

The researchers, including MIT biology professor Frank Gertler, developed the test based on an earlier finding that the co-mingling of three cell types can predict whether localized breast cancer will metastasize, or spread throughout the body. The findings are published March 24 in the online version of *Clinical Cancer Research*.

“This is the first marker that could reliably predict metastatic outcome in a case-controlled study,” says study co-author John S. Condeelis, professor and co-chair of anatomy and structural biology at Yeshiva University's Albert Einstein College of Medicine. “It could dramatically change the way we approach the care of women with breast cancer.”

Blocked enzyme reverses schizophrenia-like symptoms

Researchers at MIT's Picower Institute for Learning and Memory have found that inhibiting a key brain enzyme in mice reversed schizophrenia-like symptoms.

The finding, reported in the March 20 issue of *Cell*, identified how a particular gene controls this brain enzyme. Better understanding of the relationship could lead to new treatments for schizophrenia, the severe brain disorder that affects about 1 percent of the population and is characterized by hallucinations, delusions, poor social and emotional functioning and disorganized thoughts.

The Picower research focused on a gene known as DISC1 (short for “disrupted in schizophrenia 1”), which was first identified in the 1990s by researchers studying the genetic makeup of a large Scottish family with mental and behavioral disorders. DISC1 has since been shown to help brain neuronal cells migrate to their correct positions and to help new neurons grow in the developing brain, but its role was not well understood.

Now, Li-Huei Tsai, the Picower Professor of Neuroscience in MIT's Department of Brain and Cognitive Sciences, and colleagues have shown for the first time that DISC1 directly inhibits the activity of a brain enzyme called glycogen synthase kinase 3 beta, also known as GSK3B.

FLYING CAR TAKES WING

MIT alums' invention makes its first test flights

David Chandler
News Office

A prototype of what is being touted as the world's first practical flying car took to the air for the first time last month, a milestone in a project started four years ago by students in MIT's Department of Aeronautics and Astronautics.

At 7:40 a.m. on March 5, the winged car taxied down a runway in Plattsburgh, N.Y., took off, flew for 37 seconds and landed further down the runway — a maneuver it would repeat about a half dozen times over the next two days. In the coming months the company, a Woburn-based startup called Terrafugia, will test the plane in a series of ever-longer flights and a variety of maneuvers to learn about its handling characteristics.

Aviation enthusiasts have spent nearly a century pursuing the dream of a flying car, but the broader public has tended to view the idea as something of a novelty. Still, such a vehicle could have more practical appeal now that the Federal Aviation Administration has created a new class of plane — Light Sport Aircraft — and a new license category just for pilots of such craft, including Terrafugia's two-seater Transition. The "sport pilot" license required to fly the Transition takes only about 20 hours of training time, about half that required to earn a regular pilot's license.

The street-legal Transition is powered

on land and in the air by a recently developed 100 hp Rotax engine that gets 30 mpg on the highway using regular unleaded gasoline. As a plane, its 20-gallon tank gives it a 450-mile range with a 115 mph cruising speed. The pilot can switch from one mode to the other from the driver's seat, simultaneously folding up the wings and shifting the engine power from the rear-mounted propeller to the front wheels in about 30 seconds.

Speaking at a March 18 news conference in which the Transition's first test flight was announced, Terrafugia CEO and co-founder Carl Dietrich '99, SM '03, PhD '07 said the FAA rule change and the Transition could help transform the way people move around the country — especially in rural areas. "One of the biggest problems pilots have right now is that most of the 5,000 general aviation airports in the U.S. don't have any car rental facilities, or even a cab stand," he said, noting that the Transition could open many of these underused airports to easier, more practical use by private pilots.

The vehicle may also lead to improved safety. "One of the largest causes of accidents is pilots flying in bad weather," he said. With the Transition, a pilot who spotted bad weather ahead could simply land at the nearest airport, fold up the wings, drive through the weather on local roads, and take off from another airport once past the storm.

The first testing of Terrafugia's car-plane concept took place with a one-fifth scale model in MIT's Wright Brothers Wind Tunnel in 2005, while Dietrich and



PHOTO COURTESY OF TERRAFUGIA

The Terrafugia Transition shortly after takeoff during a test run.

his wife, Anna Mracek Dietrich '04, SM '06, now the company's COO, and VP of Engineering Samuel Schweighart SM '01, PhD '05, were all students here, as were two of the other company principals.

The full-sized version being tested now is a proof-of-concept vehicle, to be followed later this year by a production prototype. The company is taking deposits now and hopes to start delivering its first Transitions — or "roadable planes," as the company calls them — in late 2011.

Test pilot Phil Meteer, who was at the controls in Plattsburgh, said that the short

and simple first flight was both "remarkably unremarkable" and vitally important: "Ninety percent of the risk in the total program comes in the first flight, and now we're past that."

A retired U.S. Air Force colonel, Meteer said the plane handled so smoothly in the test flights that all of the possible contingencies he had practiced became irrelevant. "You're in a hypervigilant state" during the initial takeoff, he said, but as he saw how smoothly the flight was going he had a "wahoo moment: none of this is happening!"

3 Questions with Charles Stewart ?

Charles Stewart III, the Kenan Sahin Distinguished Professor of Political Science and head of MIT's Department of Political Science, recently helped to complete the first comprehensive nationwide study that focused exclusively on how American voters experience the administration of elections. The "2008 Survey of the Performance of American Elections," conducted for the Pew Center on the States with support from the AARP and the JEHT Foundation, found that while the vast majority of Americans said that their 2008 Election Day experience went smoothly, many U.S. voters did not cast ballots because of voter registration problems. Stewart took time to discuss some of the survey findings, which were presented before Congress on Thursday, March 26.

Q. How did this survey come about? What was MIT's role in putting it together?

A. MIT took the lead in proposing and designing the survey. It is the culmination of work that began in 2001 with the Caltech/MIT Voting Technology Project. One of the themes we have harped on since then is that the empirical basis for reforming elections in the United States is really thin. We really don't know how voters experience the election process. When the Pew Make Voting Work program came along, it seemed like the perfect opportunity for us to put into practice what we had been advocating for many years. The team we assembled, all researchers related to the Voting Technology Project, had already been doing the most important work in public opinion about how people vote, but it was mostly in bits and pieces. So, this survey allowed us to pool our collective experience and to study a population that was much larger than we had been able to survey before.

Q. Ninety-eight percent of respondents in the survey said it was "very easy" or "fairly easy" for them to find their polling place; another 98 percent said their polling place was run "very well" or "OK, with only minor problems. Does this mean we

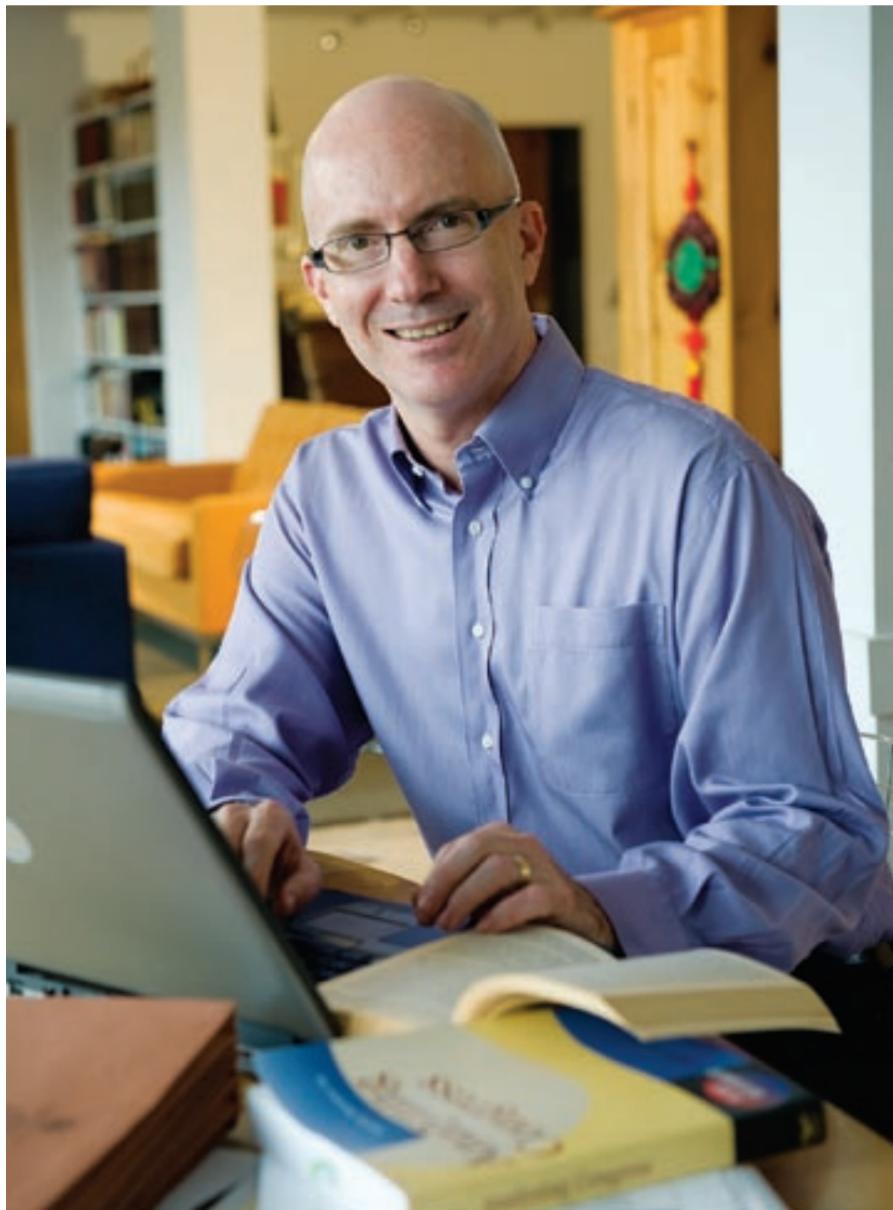


PHOTO / RICHARD HOWARD

Charles Stewart III, the Kenan Sahin Distinguished Professor of Political Science.

"solved" election problems that plagued the process in 2000 and 2004?

A. I would never go so far as to say we've "solved" any problems, but we've made significant strides in addressing the worst problems that were highlighted in 2000, especially the poor quality of voting machines. That problem is well under control, even though there continues to be controversy about electronic voting machines. Having reached the point where the voting machine problem is manageable, we now recognize the much bigger problems with voter registration, voter identification and long lines.

Q. What will you do to build on the results of this study?

A. There are many issues that come out of this study. The first is that we want to be able to continue doing the survey in the future, to provide an ongoing account about how well elections are being run, and to see where we're doing better or falling behind. Second, the survey highlights some problems — especially registration and voter identification — that are currently hot topics. Using this survey as a baseline, we'll be able to track whether state and federal efforts to address these issues are making a difference. Third, there continue to be issues of racial disparities that concern a lot of people. For instance, African-Americans had to wait twice as long in line this year to vote, compared to whites. Why is that? It can't be entirely that African-American communities were so excited about voting for Obama that they turned out in historically large numbers and overwhelmed polling sites. We know that because we are discovering evidence that this problem happened in 2006, as well. A series of challenges are currently being made to the Voting Rights Act before the Supreme Court, and the survey can be used to help provide new evidence about the degree to which African-American voters experience greater hurdles when they attempt to vote.

Understanding our blind spots: Andrew Lo on the current economic crisis

Economists and policy-makers alike are trying to assess why risk-management systems and regulatory constraints didn't kick in before the global economy became so weak. To most, this situation is a shock.

Economist Andrew Lo is less surprised. A professor at the MIT Sloan School of Management, Lo has studied the connections between financial decision-making, neuroscience and evolutionary psychology. His ideas about human behavior in financial markets have attracted the attention of policymakers in Washington who want not only to sort out the current crisis but also to head off future destructive events.

Testifying before the House Oversight Committee last November, Lo discussed how credit crises have been regular occurrences over the past 35 years. "Financial crises are an unfortunate but necessary consequence of modern capitalism," he explained. Financial losses, he added, are a byproduct of innovation, "but disruptions and dislocations are greatly magnified when risks have been incorrectly assessed and incorrectly assigned."

Lo believes that "behavioral blind spots" — evolutionarily hardwired reactions to perceived risks and rewards — are particularly dangerous during periods of economic extreme. That is, during both bubbles and crashes.

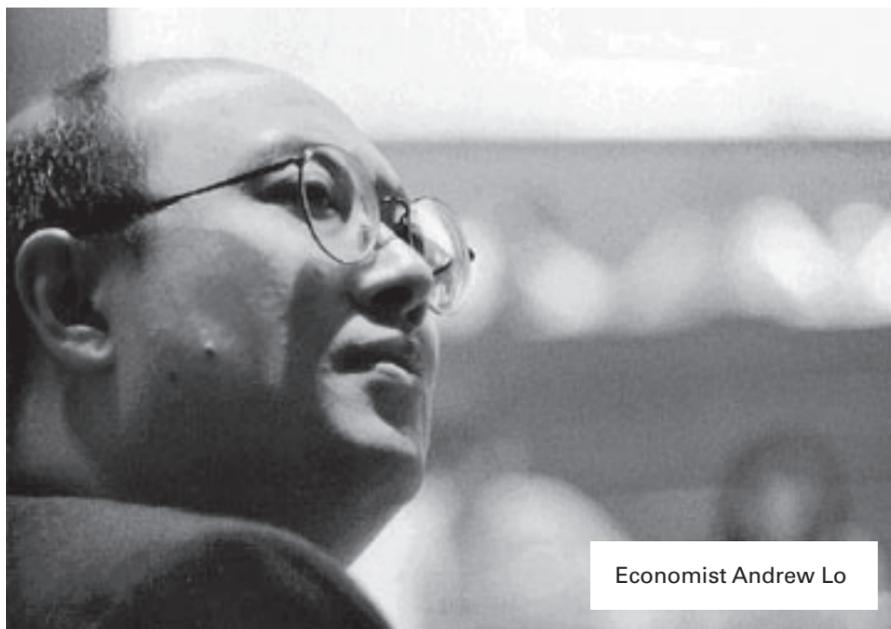
Lo recently shared his thoughts on the financial crisis.

Q. What's the most important implication of the financial crisis?

A. For CEOs and other corporate leaders, the single most important implication is about the current state of corporate governance. Many corporations did a terrible job in assessing and managing their risk exposures, with some of the most-sophisticated companies reporting tens of billions of dollars in losses in a single quarter. How do you lose \$40 billion in a quarter and then argue that you've properly assessed your risk exposures? I don't think it's credible to say it was just "bad luck." If troubled companies want to explain away 2008 as a "black swan," then someone should take responsibility for creating the oil slick that seems to have tarred the entire flock! The current crisis is a major wake-up call that we need to change corporate governance to be more risk-sensitive.

Q. What allowed this crisis to happen? How could so many seemingly smart people be so blindsided?

A. The very fact that so many smart and experienced corporate leaders were all led astray suggests that the crisis can't be blamed on the mistakes of a few greedy CEOs — in my view, there's something



Economist Andrew Lo

fundamentally wrong with current corporate governance structures and the language of corporate management. We just don't have the proper lexicon to have a meaningful discussion about the kinds of risks that typical corporations face today, and we need to create a few field of "risk accounting" to address this gap in GAAP [Generally Accepted Accounting Principles].

Q. Now that the financial landscape has been rearranged, are there things that corporate managers can do to capitalize on the current environment?

A. One of the things companies are surely going to have to deal with over the next year or two is greatly reduced liquidity in the capital markets. Borrowing costs are going to go up, and it's going to be much harder to finance new ventures, so companies will have to be much more creative about rebalancing their pension fund obligations and raising capital to fund operations. Managers should be prepared for some tough times.

At the same time, there's going to be tremendous interest on the part of, say, pension funds in finding new ventures. My guess is that starting this summer, pension funds will begin increasing their allocations to private equity, hedge funds and other alternative investments — assets will be flowing back into risky ventures with a vengeance. The money that's currently in T-bills has got to go somewhere — and anybody who has cash is going to be in a great position. Companies are going to have to find creative ways to tap into these

nontraditional sources of financing.

Q. What kinds of new market opportunities do you see emerging — things that aren't typical?

A. Well, if you think about the kind of dislocation that's affected financial markets, you'll see that much of the current crisis stems from the fact that it's very difficult to get information about the value of certain mortgage portfolios because they're so heterogeneous.

What if there was a service like eBay Inc. that provided a price discovery mechanism for these mortgage pools? An eBay for mortgages or mortgage-backed securities — something that's easy to use and that allows users to value these illiquid securities quickly — could be an extraordinarily valuable service, particularly if it gains any kind of market share (like eBay). It would allow holders of mortgage-related instruments to post their securities online and allow investors to bid on them. It would show prices on a historical basis so bidders could see how a portfolio of mortgages from a particular region of the country traded four months ago. Like eBay, it would provide a wealth of information and, ultimately, liquidity — that's the key.

This interview is adapted from "Opportunities Brought to You by Distress" by Bruce G. Posner and Michael S. Hopkins, which appeared in the March 23, 2009, edition of Business Insight, a joint publishing venture between the MIT Sloan Management Review and the Wall Street Journal. The article is also available at <http://sloanreview.mit.edu/smr/>.

ANIMAL: Team sees animal genesis

Continued from Page 4

screen" while the new technology allows you to "see the entire movie."

Both OAWRS and conventional methods rely on acoustics to locate objects by bouncing sound waves off of them. With conventional techniques, survey vessels send high-frequency sound beams into the ocean. In contrast, the new system uses much lower frequency sound that can travel much greater distances and still return useful information with signals far less intense.

Toward conservation

Makris sees potential in using OAWRS to better monitor — and conserve — fish populations. Large oceanic fish shoals provide vital links in the ocean and human food chain, he explained, but their sheer size makes it difficult to collect information using conventional methods.

Ron O'Dor, co-senior scientist of the Census of Marine Life (CoML), commented that "OAWRS allows us to gather information such as geographical distributions, abundance and behavior of fish shoals and to better understand what constitutes healthy fish populations ... which can be implemented by policymakers to better monitor and improve conservation of fish stocks."

CoML is an international scientific collaboration engaged in a 10-year initiative to assess and explain the diversity, distribution and abundance of marine life in the oceans. It aims to release the first Census of Marine Life in 2010.

Could OAWRS be exploited to find and take more fish illegally, rather than conserve them? Makris believes that it would be virtually impossible. For example, he said, it cannot be used in stealth. "Thieves do not like to work in broad daylight or with the lights on, and OAWRS [essentially] turns the lights on in the ocean making it possible for everyone to see what is happening there and do something about it." He also emphasized that permission from each government would be needed to use it in any nation's territorial waters or in internationally regulated waters.

The work was sponsored by the National Oceanographic Partnership Program, the Office of Naval Research, and the Alfred P. Sloan Foundation, and is a contribution to the Census of Marine Life.

15 students named MIT Arts Scholars

Fifteen undergraduate students have been selected to the MIT Arts Scholars program for the 2009-10 academic year. They will join the 15 Arts Scholars currently in the program.

Established in 1998, the MIT Arts Scholars Program brings together students who are passionate about exploring the diverse array of arts available at MIT and in the Boston area, and interacting with fellow students, faculty artists, and other experts in the art world. The program is structured around monthly excursions or workshops, with an expert in the relevant field of art in attendance.

The new scholars are:

Brian Cass (sophomore, electrical engineering and computer science)
Wendy Chen (junior, brain and cognitive sciences)
Mihati Chintapalli (sophomore, materials science and engineering)
Christine Hazlett (sophomore, biology)
Nicholas Joliat (junior, physics)
Joyce Kwan (junior, electrical engineering and computer science)
Connie Lu (sophomore, civil and environmental engineering)
Leah Nation (sophomore, materials science and engineering)
Tian Ong, (sophomore, chemical engineering)
Trevor Shannon (sophomore, mechanical engineering)
Jonathan Sue-Ho (senior, mechanical engineering)
Emily Suter (sophomore, biological engineering)
Adrianna Tam (sophomore, music and theater arts)
Jingwen Tao (senior, management)
Anna Waldman-Brown (sophomore, physics)

CLASSIFIED ADS

Members of the MIT community may submit one ad each issue. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.

HOUSING/RENTALS

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

Cambridge — Two completely furnished, very comfortable apartments. Walk to MIT. Enclosed yard. No Security Deposit. No fee. 2 BR., available now. \$1750. 1 BR, available May 1, \$1500. johnnatale@verizon.net.

BREWSTER [Cape Cod] Mass. Sweet house on lake, 15 minutes to ocean beaches. Sleeps 6, abuts conservation forest. Private beach, fireplace, screened porch, separate studio/bedroom in the woods. Some June, July, Aug weeks still available. \$1,200/week. Andy, 617-876-6257.

Somerville: 1st floor 5 room apartment 1300.00, available asap. Totally refurbished top to bottom 2 large bedrooms, newly sanded hardwood floors

throughout, new kitchen, fresh paint throughout, includes basement for storage, large front porch and fenced in back yard, 2 minutes to MIT & Boston. Owner occupied, no pets or utilities. First month and security due. Please call Fred or Diane @ 617-628-0405.

For rent: 1 BR condo - Admirals Hill, Chelsea w/ Boston skyline, harbor views. Hardwood floors, d/d, w/d, breakfast bar, high ceilings, parking. Avail. 4/1. \$1050 incl ht/hw. 617.792.6135.

Fabulous, light-filled loft w/expansion possibilities at 243 Bent St. - Unit 8, Cambridge. High ceilings, skylight, south-facing windows. Walk to Kendall Square. Deeded parking outside your door. Low condo fees, taxes. Beautiful courtyard. \$579K. Contact Cynthia Cronin 617.796.2476.

FOR SALE

2 new in packaging Iceberg series 500 molded tables 2' x 4' (retail store price \$50 each) \$30 each. Dick, x-3-2399 or 617-277-4245 or lanza@mit.edu.

Bathroom faucet - polished brass with j-spout drain. Brand: American Standard. Style: Williamsburg. Model # 2904.222.099. See website: www.americanstandard-us.com. Excellent condition. \$50 (paid \$130). Call Cheryl 617-258-5673 or cheryl@mit.edu.



PHOTO / DONNA COVENEY

When will it end?

Several MIT financial experts discussed the economic climate and how it has changed over the last six months during a talk titled 'The U.S. Financial Crisis ... Is There an End in Sight?' held on March 31.

From left to right are William Wheaton, director of the Center for Real Estate; Andrew Lo, Harris and Harris Group Professor, MIT Sloan School of Management; Ricardo Caballero, head, MIT Department of Economics; Bengt Holmstrom, Paul A. Samuelson Professor of Economics, and James Poterba, Mitsui Professor of Economics.

Awards&Honors



Guarente honored as biomedical research pioneer

Leonard P. Guarente, the Novartis Professor of Biology, will be honored on April 6 alongside two other pioneers in biomedical research by the Biotechnology Study Center of the NYU School of Medicine. Guarente is being honored for the discovery of sirtuins, key regulators of longevity in living creatures. Activation of sirtuins by resveratrol, a compound found in red wine, has led to trials of its analogues in the clinic.

Zimmerman repeats as all-around national champion

Capping a successful collegiate career, senior star gymnast Julia Zimmerman won the all-round competition for the second time in three years at the prestigious National Collegiate Gymnastics Association (NCGA) Championship held March 20-21. Earning three more First Team All-American honors for finishing in the top six in the vault, beam and bars, Zimmerman became a 14-time All-American, tying a national record for most All-American honors in the history of the NCGA.

Zimmerman, who became just the second gymnast to capture the all-

around title twice, was named the NCGA Outstanding Senior as voted by the member coaches. She is MIT's 12th individual national champion — in all athletics — in the last six years.

Bartolotta named National Player of the Year

Senior standout Jimmy Bartolotta was selected as the D3Hoops National Player of the Year in addition to honors as First Team All-American. Bartolotta, who holds numerous Institute records and is the NEWMAC's all-time leading scorer, was presented with the coveted Jostens Trophy at the site of the Division III Final Four last week. In addition to earning regional Player of the Year honors from D3Hoops and the National Association of Basketball Coaches (NABC), he was also named ESPN The Magazine Academic All-American of the Year.

Edelman wins Hoeg research award

Elazer Edelman, the Thomas D. and Virginia W. Cabot Professor of Health Sciences and Technology, was recently awarded the 2009 Jeffrey M. Hoeg Arte-

riosclerosis, Thrombosis and Vascular Biology Award for Basic Science and Clinical Research. The award recognizes an established investigator in the prime of his or her career who has made an outstanding contribution to furthering understanding of the pathophysiology of atherosclerosis and/or the development of treatment strategies for its prevention through basic science and clinical research efforts. The award will be presented during the Arteriosclerosis, Thrombosis and Vascular Biology Annual Conference 2009, which will take place in Washington from April 29 to May 1.

Scheib tops list of N.Y. directors

Jay Scheib, an associate professor in the music and theater arts section, was named the number one theater director in New York by Time Out New York, an arts and entertainment publication. He was cited for "forging new ways of seeing drama" by "mixing multimedia with deadpan-cool (and very sexy) actors."

Two RSI students, with physics mentors, win top Intel prizes

Two students from MIT's Research Science Institute (RSI) summer program,

who were mentored by members of the Department of Physics, won top prizes at the Intel Science Talent Search on March 10. Nilesh Tripuraneni took ninth (\$20,000) and Marianna Mao was named among the top 40 (\$5,000). They were mentored, respectively, by physics professor Krishna Rajagopal and astrophysics graduate students Phillip Zukin and Sarah Vigeland.

Associate professor wins Cope Scholar Award

Mohammad Movassaghi, an associate professor in the Department of Chemistry, was recently named a recipient of an Arthur C. Cope Scholar Award, given out by the American Chemical Society to recognize and encourage excellence in organic chemistry. The award includes a \$40,000 unrestricted research grant.

Khoury named chairman of AUB board of trustees

Associate Provost Philip S. Khoury, the Ford International Professor of History, has been named the chairman of the board of trustees at the American University of Beirut (AUB). Khoury will begin his term as chairman on July 1.

Students, DSL team up to bring fresh produce stand to campus

Anne Wilson
MIT Campus Dining

A cooperative effort between students and the Division of Student Life is bearing fruit in the form of a campus produce stand that opened for business on Tuesday, March 31.

The MIT Market will sell fruits and vegetables from noon to 6 p.m. on Tuesdays in the East Campus Courtyard near Walker Memorial. The stand will be run by Russo's, the Watertown-based retailer that won the "Best Produce" category in Boston magazine's 2007 Best of Boston.

Sophomore Vrajesh Modi, an Undergraduate Association Senator from East Campus, proposed the project to Dean for Student Life Chris Colombo in January after working with other students to poll East Campus residents about ways to make fruits and vegetables more accessible and affordable. Modi, who called the fruit and vegetable stand idea a "unanimous choice," then worked with staff in Residential Life and Campus Dining to make the project a reality.

"Ideally, we would like to see the student body at large use this and see it have a positive impact on health and wellness at MIT," said Modi. "We would also like to

see this become a permanent part of the culture and the dining system."

Julie Banda, a health educator at The Center for Health Promotion and Wellness at MIT Medical, advises students to consume five servings of fruits and vegetables a day. She agrees with Modi's hopes for the stand.

"Many students know they need to eat well and want to do so, but cannot overcome the barriers that come along with their hectic schedules and limited budgets," said Banda. "This initiative can help, and I am thrilled to see this happening."

Richard Berlin, director of Campus Dining, said he hopes having the stand on campus will allow students and other community members more convenient access to fresh fruits and vegetables, and indicated that he and Modi had discussed options for additional service days.

"We will continue to assess the program," said Berlin. "If it is well-received, and the demand exists, we will look to open the operation on Fridays as well."

For more information about MIT Campus Dining, MIT Residential Life and the Division of Student Life, visit <http://studentlife.mit.edu>. To learn more about Russo's, visit <http://www.russos.com>.



PHOTO / ANNE WILSON

Kelly Ran, a sophomore in the Department of Mechanical Engineering, shops at East Campus' new produce stand during its first day of operation on Tuesday, March 31.



BACK TO SCHOOL

Video artist Viola, winner of McDermott award, samples new technologies during weeklong residency at MIT

Video artist Bill Viola tries out the 'wall' in the Tangible Bits lab with the help of graduate student Jamie Zigelbaum.

PHOTO / DONNA COVENEY

Stephanie Schorow
News Office

More than 35 years ago, Bill Viola jolted the contemporary art world with a new kind of artistic expression: electronic images and sounds that explored themes of love, death and rebirth. Today, the title "video artist" could be claimed by any kid with a camera, but the label rightfully belongs to Viola, who harnessed the potential of high-definition technology to produce evocative and startling snippets of video for museums and installations.

Like many artistic revolutionaries, Viola is now old school. He has exhibited at the Museum of Modern Art, New York, the Guggenheim Museum, New York, and the J. Paul Getty Museum, Los Angeles. In 1997, the Whitney Museum of American Art staged: "Bill Viola: A 25-Year Survey."

His latest honor is the Eugene McDermott Award in the Arts, given by MIT's Council for the Arts, which brings a \$75,000 stipend and a chance to spend a week on campus. Which is why, earlier last month, Viola could be seen rushing through the corridors of MIT, wearing a black turtleneck and jeans and carrying a bulging backpack that helped him blend with students and faculty. While admitting he is a self-described "tech head" who delights in new gadgets, Viola used his weeklong residency to both revel in new technologies and rail about its pitfalls. "There is a danger in a place like MIT of having too much head work and not enough heart work," he later explains.

On his first day on campus, the 58-year-old Viola has willingly accepted an agenda that seems wildly overscheduled; he seems anxious to interact with as many people as possible. In the space of a few hours, he plays games at the GAMBIT Lab, talks photography with Frédo Durand, associate professor in the Department of Electrical Engineering and Computer Science, takes a tea break and visits the Tangible Media Group, before dashing off to a Visual Arts Program and dinner with faculty.

In a cramped office, where every surface is covered with lenses, camera bodies and cords, Durand hands Viola a modified lens that can capture different depths of field in one shot. He then shows Viola on a computer how to choose which section of a photo to put in focus. Viola sees the potential immediately: in the future,

photographers may not have to make quick decisions about focus, lighting, shadows and other issues during shoots but instead deal with them later while processing photos on their computers.

Durand and Viola discuss the ethics of altering photographs and whether future cameras will become mere "input devices" for computers. Viola's wife and artistic partner, Kira Perov, who is accompanying him, blurts out, "When are we going to

take pictures with our eyes?"

Everyone laughs, but Durand takes the question somewhat seriously. "I'm sure it will happen," he says. Viola expresses his worries that technology has allowed photographers to alter images too much. People tend to believe a photograph reflects reality unlike, say, a painting; yet photos may be no more real than any other form of artwork, he says. Still, both he and Durand agree that the popularity

of programs like Photoshop have taught the public not to accept all images at face value.

Viola leaves Durand's office reluctantly but is soon engaged by the objects in the Tangible Media Lab and the work of Hiroshi Ishii, the associate director of the Media Lab and the Muriel R. Cooper Professor of Media Arts and Sciences. The lab has created perfume bottles that are "filled" with music. Pulling a stopper out of a bottle triggers a riff of classic music or jazz. "How did you get those musicians into those little bottles?" Viola asks, with only a hint of smile. Actually, the bottles utilize a seemingly invisible interface that Ishii believes could be introduced into household objects. Viola opens another bottle, which is silent — a glitch, Media Arts and Science graduate student Jamie Zigelbaum explains, adding, "The musicians got out."

Moving to another area, Viola runs his fingers through the fine gravel of what looks like a wired sandbox. This is "Sand-Scape," an interface for designing landscapes through computational simulations. A computer projects contour lines representing wind and shadows onto the sand's surface. As Viola manipulates the sand, the projected lines change, illustrating in a very concrete way how changing a land surface will alter its microclimate. Explains Ishii, "It bridges the gap between the digital world and the physical world." Perov takes a turn digging into the sand. "It's like a Zen garden," she says. "It reminds me of what the Buddha said: 'When foot feels floor, foot feels foot,'" Viola adds.

Viola is pleased at how the lab has turned touch into a computer interface.

"I think Hiroshi is on to something extremely powerful," he says. "The average person — certainly not the people who work here — has a mistrust of technology. If you can't see it, if you can't touch it, they don't quite believe it, and they don't quite trust it."

By the end of the residency, Viola — like so many visitors to MIT — says he has seen the future. But he is not sure all of it works. Once, he says, he was like other MIT students, eager to use the latest imaging technology. "Now, I tend to talk a lot less about technology and a lot more about the use of that technology, which ultimately is about human moral, ethical and spiritual decisions."



PHOTOS / (A) DONNA COVENEY, (B) L. BARRY HETHERINGTON

ABOVE: Muriel R. Cooper Professor of Media Arts and Sciences Hiroshi Ishii shows video artist Bill Viola around some of the projects in the Tangible Bits Lab.

BELOW: Viola shows clips from his work during the 2009 Eugene McDermott Award in the Arts presentation.

