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Energy Research Council issues report

Deborah Halber
News Office Correspondent

The Energy Research Council, charged by MIT President Susan Hockfield last June with exploring how MIT can help meet the global energy challenge, released its 50-plus-page report today, thrusting MIT into a new era of energy research, education and campus initiatives.

The report, which culminates almost a year of effort by 16 faculty members from all five MIT schools, calls for an energy-focused laboratory or center with its own research space to be established within five years, and an independent steering organization to carry out MIT's new energy initiatives.

The Energy Research Council (ERC)

recommends “a multifaceted approach to increasingly urgent energy issues,” according to the report submitted this week to the president by ERC co-chairs Ernest J. Moniz, the Cecil and Ida Green Professor of Physics and Engineering Systems and co-director of the Laboratory for Energy and the Environment, and Robert C. Armstrong, the Chevron Professor and head of the Department of Chemical Engineering.

In writing the report, the ERC solicited input from faculty members, students and staff, as well as from alumni and key industry leaders. An Industrial Liaison Program Industry Energy Workshop in December 2005 provided information on



how MIT can work best with industry on energy-related topics.

Hockfield is reviewing the report and is expected to decide which of its recommendations the Institute will act upon.

In conjunction with the release of the report, the Institute is sponsoring today's daylong “MIT Energy Forum: Taking on the Challenge” in Kresge Auditorium. The forum will feature talks by 19 MIT faculty members, including members of the ERC and others whose work represents some of MIT's many areas of energy-related research in science, technology and policy.

“The need for new global supplies of affordable, sustainable energy is perhaps

the single greatest challenge of the 21st century,” the report states. “Increasing tension between supply and demand is exacerbated by rapidly escalating energy use in developing countries, security issues facing current energy systems and global climate change. These converging factors create an unprecedented scenario requiring a multifaceted approach to increasingly urgent energy issues.”

Research and education goals

The ERC's three-pronged approach spans research, education and campus-based programs. It calls for a broad three-part initiative in:

- basic science and technology to help

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PHOTO / DONNA COVENEY

At MIT's Morphodynamics Laboratory, research scientist James Buttles adjusts the inflow valve of a sediment-laden, gravity-driven current flowing in an experimental channel. Observing how the sediment is deposited in and around the channel is providing new insights into the structure of oil-rich, sediment-filled channels found deep under the seafloor.

Lab work may aid oil recovery

Nancy Stauffer
Laboratory for Energy and the Environment

Work in an MIT lab may help energy companies withdraw millions of additional barrels of oil from beneath the seafloor.

Typically, companies recover only 30 percent to 40 percent of the oil in a given reservoir. Since a single reservoir may contain a billion barrels total, increasing that “recovery efficiency” by even a single percentage point would mean a lot of additional oil.

Toward that end, Assistant Professor David Mohrig of earth, atmospheric and planetary sciences and Carlos Pirmez, a research geologist from Shell International Exploration and Production Inc. have been examining one type

of geological formation of interest to industry — channels filled with highly permeable and porous sedimentary deposits that extend deep below the seafloor.

These structures form when sediment-laden currents flow off the continental shelf and into channels on the deep-ocean floor, dropping sand, silt and clay as they go. Over many thousands to millions of years, the channels can become filled with porous sandstone covered by impermeable mud — a perfect trap for oil and gas that seep up from below.

Over the past 20 years, energy companies have withdrawn significant amounts of oil from such buried channels. But they could extract even more if they understood

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ERC co-chair sees ‘remarkable challenge’ ahead

Technology Review chief correspondent David Talbot recently interviewed Energy Research Council co-chair Ernest J. Moniz about the council's thinking and its recommendations. The following is an excerpt of that interview. For full text, visit www.technologyreview.com.

David Talbot
Technology Review

Q. Headlines these days are full of talk about \$3-a-gallon gas. What are the fundamental energy issues facing the world today?

A. As we cast it in our report, there are three major drivers. The first is simply the supply and demand equation, particularly driven by developing and emerging economies. One sees in most projections a doubling of energy use by mid-century, and a tripling of electricity use by mid-century. This is a staggering problem or challenge, particularly when you realize that today, 86 percent of primary energy comes from fossil fuels, and conventional oil production may be peaking.

The second driver is security: the security of oil supply, and also nuclear proliferation. And third is environmental, especially climate change. If society gets serious about controlling greenhouse-gas emissions, this would be the most profound challenge to the structure of our energy supply, because that supply is based on fossil fuel. Controlling carbon dioxide, while also doubling energy use, is a rather remarkable challenge to contemplate.

Q. What is the timetable for the R&D and deployment to get the job done?

A. It's useful to think in terms of a 50-year timetable. For doing something about climate change, these next 50 years are critical. Fifty years is also the characteristic time for major changes of the energy supply system, if you look at the transition from wood to coal — then oil coming in, then gas coming in.

Well, if we have a challenge we need to meet in 50 years, and it takes 50 years to turn over the energy sys-

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ARTS

A BEAUTIFUL MIND

Staged readings and new films delve into the life of math genius Srinivasa Ramanujan.

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MIT CELEBRITIES

Talented members of the community join forces for a Bank of Boston Celebrity Series concert.

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NEWS



INNOVATION AWARDS

The MIT-Lemelson Program awards \$500,000 to James Fergason, whose work led to the creation of liquid crystal displays.

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RESEARCH

HOPE FOR ALZHEIMER'S

A ‘cocktail’ of dietary supplements, developed at MIT, holds promise for the treatment of Alzheimer's disease.

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VISIONARY WORK

Brain researchers identify a molecule that prevents the usual effects of visual deprivation.

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Lemelson-MIT awards prizes for innovation

The Lemelson-MIT Program announced today that its \$500,000 prize — the largest cash prize given in the United States for invention — will be presented to James Ferguson, whose work with liquid crystals paved the way for multiple innovations, including digital watches and computer monitors.

The \$100,000 Lemelson-MIT Lifetime Achievement Award will go to Dr. Sidney Pestka, chair of the Department of Molecular Genetics, Microbiology and Immunology at the University of Medicine and Dentistry of New Jersey Robert Wood Johnson Medical School, for his seminal work on interferons.

In 1958, Ferguson started his work at Westinghouse Research Laboratories, where he began experimenting with liquid crystals. Although he neither discovered liquid crystals nor was the first to experiment with them, he said he was “the first guy who saw what they were really good for.”

Now Ferguson holds more than 130 U.S. patents and more than 500 foreign patents. His work paved the way for digital watches, mood rings and computer monitors, among other things.

“James Ferguson’s inventions are directly responsible for the creation of a multibillion-dollar liquid crystal display industry that employs millions of people around the world,” said Merton Flemings, director of the Lemelson-MIT Program, which gives the annual award.

“But those are not his only contributions to society,” Flemings said. “He is also a staunch advocate for independent inventors and has dedicated countless

hours to this cause. We recognize his outstanding achievements in the awarding of this year’s \$500,000 Lemelson-MIT Prize.”

In 2001, Ferguson founded Ferguson Patent Properties. The company is currently developing three new liquid crystal display (LCD)-based technologies.

In addition to his impact on today’s consumer electronics industry, Ferguson also champions the interests of independent inventors.

The secretary of commerce appointed Ferguson to the first Patent Public Advisory Committee in 2000. He advised the U.S. Patent and Trademark Office on policy and operational issues, and he helped develop a quality improvement program that is still in effect today.

Meanwhile, Pestka’s work led to groundbreaking treatments for chronic hepatitis B and C, multiple sclerosis and some cancers.

“Dr. Pestka’s interferon discoveries and subsequent inventions have made a profound impact on medicine and health care,” said Flemings. “His work has opened doors to new treatments for millions of people who suffer from devastating diseases and it has fueled the multibillion-dollar biopharmaceuticals market.”

Dr. Harold L. Paz, former dean of Robert Wood Johnson Medical School in Piscataway, N.J., considers Pestka’s work to be “a critical catalyst in the development of the biotechnology industry.”

Both Ferguson and Pestka will receive their awards today during a private ceremony at the Museum of Contemporary Art in Chicago.



PHOTO COURTESY/ LEMELSON-MIT PROGRAM

James Ferguson has been named the 2006 winner of the \$500,000 Lemelson-MIT Prize, the largest cash prize in the United States for invention. Ferguson’s work led to the creation of liquid crystal displays.



PHOTO COURTESY/ LEMELSON-MIT PROGRAM

Dr. Sidney Pestka has been named the 2006 winner of the \$100,000 Lemelson-MIT Lifetime Achievement Award for his groundbreaking research on interferons. His work has led to the development of antiviral treatments for chronic hepatitis B and C, multiple sclerosis and cancers.

CIS welcomes former Sri Lankan PM

Sarah H. Wright
News Office

Ranil Wickremesinghe, a Sri Lankan attorney who served twice as prime minister of his country and currently serves as leader of its opposition party, has joined MIT’s Center for International Studies (CIS) for discussions on the politics of the Indian Ocean region and conflict resolution in general.

Wickremesinghe, 57, is renowned for his pivotal role in negotiating a 2002 ceasefire with the Liberation Tigers of Tamil Eelam, known as the Tamil Tigers, a minority group with a history of violent protests and bombings.

“It is an exceptional opportunity for the MIT community to have Ranil here. He provides us with experience and insights. We hope and trust he will benefit from his visit as much as we are,” said John Tirman, CIS director. Wickremesinghe will be at MIT through May 15.

The decades-old conflict between Tamils and the majority Sinhalese community has resulted in more than 64,000 deaths



Ranil Wickremesinghe, former prime minister of Sri Lanka, is visiting MIT.

in Sri Lanka, which was known as Ceylon until 1972. Even before negotiating the ceasefire, Wickremesinghe advocated a political end to the 20-year-old civil war — including rewriting the Sri Lankan constitution to establish a federal system of government and grant the Tamils regional autonomy.

Wickremesinghe unsuccessfully sought the office of president of Sri Lanka in 1999 and in 2005; victors in both elections accused him of being too lenient with

the Tamils.

In December 2004, when more than 30,000 Sri Lankans were killed by the tsunami that devastated much of South Asia, civil conflicts rose anew. Nearly \$3 billion in aid had to be shared among a coalition of Sinhalese, Tamils and Muslims, and the coalition broke down.

Since then, the former foreign minister has been assassinated and explosions, rioting and a suicide bomb attack have occurred.

In December 2005, acting as the country’s opposition leader, Wickremesinghe met with Sri Lanka’s president, Mahinda Rajapakse, to initiate a new peace process.

Wickremesinghe served as prime minister from 1993 to 1994 and again from 2001 to 2004. He has also served as minister of youth affairs and employment, minister of education and minister of industries.

He is married to Maithree Wickremesinghe, a senior lecturer in the Department of English at the University of Kelaniya. A researcher in gender and women’s studies, she is currently affiliated with Harvard.

Starting Friday, May 26, people who now pick up their MBTA pass at the Parking Office will pick up passes at the new parking office in the Student Center. People who pick up their pass at Copy Tech will be switched to the Stata Center lobby pick-up location.

To change your pick-up location, visit commuting.mit.edu.

OBITUARIES

Steven Groves

A memorial service will be held Sunday, May 7, for Steven Groves, a physicist at Lincoln Laboratory, who died Monday, March 27. He was 72.

The service will begin at 3 p.m. at the First Parish Unitarian Universalist Church, 7 Harrington St., Lexington, Mass.

For obituary information, visit web.mit.edu/newsoffice/2006/obit-groves.html.

Merrill Smith

Merrill Wadsworth Smith, associate head librarian of MIT’s Rotch Library, died April 4 at her home in Sherborn after a long battle with ovarian cancer. She was 64.

A memorial service will be held at the MIT Chapel on Saturday, May 13, at 3:30 p.m.

Smith joined MIT in 1978 as the head of the Rotch visual collections. From 1983 to 1985, as the videodisc project director for the Aga Khan Program for Islamic Architecture, she led early efforts to use digital technology for image management and delivery. In 1988 Smith was promoted to the position of associate head of Rotch Library.

She earned a bachelor’s degree from Rutgers University in 1963 and a master of library science degree from the University of Denver in 1966.

She is survived by her husband, Allen Smith of Sherborn, and a brother, Geoffrey Holmes Wadsworth.

Donations may be made to Dana Farber Cancer Institute, 10 Brookline Place West, 6th Floor, Brookline, MA 02445.

NEWS YOU CAN USE

Blood drive

A blood drive will be held at MIT today and Thursday, May 4, from noon to 6 p.m. in La Sala de Puerto Rico. For more information or to make an appointment, visit web.mit.edu/blood-drive/www/. All donors will receive a free T-shirt.

Parking Office move

The Parking and Transportation Office will move to W20-022, in the Stratton Student Center, on Monday, May 8. The office at E32-105 will close for moving on Friday, May 5, at 1 p.m. and reopen at 8:30 a.m. on May 8 in the new location.

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Experts discuss alternatives to oil

Sarah H. Wright
News Office

Americans may be addicted to oil, as President Bush charged in his 2006 State of the Union message, but that addiction can be managed if international security issues and technological advances are part of the treatment plan, according to two experts on different aspects of petroleum's power in the United States.

Barry R. Posen, the Ford International Professor of Political Science, and Ernest J. Moniz, the Cecil and Ida Green Professor of Physics and Engineering Systems and co-chair of the MIT Energy Research Council, discussed how U.S. fuel consumption can persist during the forum, "Are We Too Dependent on Middle Eastern Oil?" held Friday, April 28, in Room E51-335.

Posen opened the forum by challenging those in the crowded room to ask, "Who is this 'we'? There's one oil market. It's not how much the U.S. imports from any one country; it's that, if one country goes 'off-market,' all industrial countries feel it."

A specialist in grand strategy, Posen pointed to the geopolitical and topographical significance of the world's oil supply. "If the world's oil came from the North Sea, there would be no conversation. But the Persian Gulf is a funny place: Middle Eastern countries are not stable market democracies, and oil itself feeds nasty domestic politics," he said.

"Oil importers face two sets of problems — local politics and cash floating around in volatile areas. Ever since former President Jimmy Carter warned that an attack on a Gulf state would be treated as an attack on the U.S., we have poured military money, power and lives into the Middle East. My question is, is the game worth the candle?" Posen said.

Moniz, who is also co-director of the MIT Laboratory for Energy and the Environment (LFE), served as undersecretary of the U.S. Department of Energy from October 1997 to January 2001.

He picked up the addiction thread, describing the United States as a dependent consumer of oil whose dependence is "almost certain to grow in the next 20 years" thanks to the need to fuel transportation.

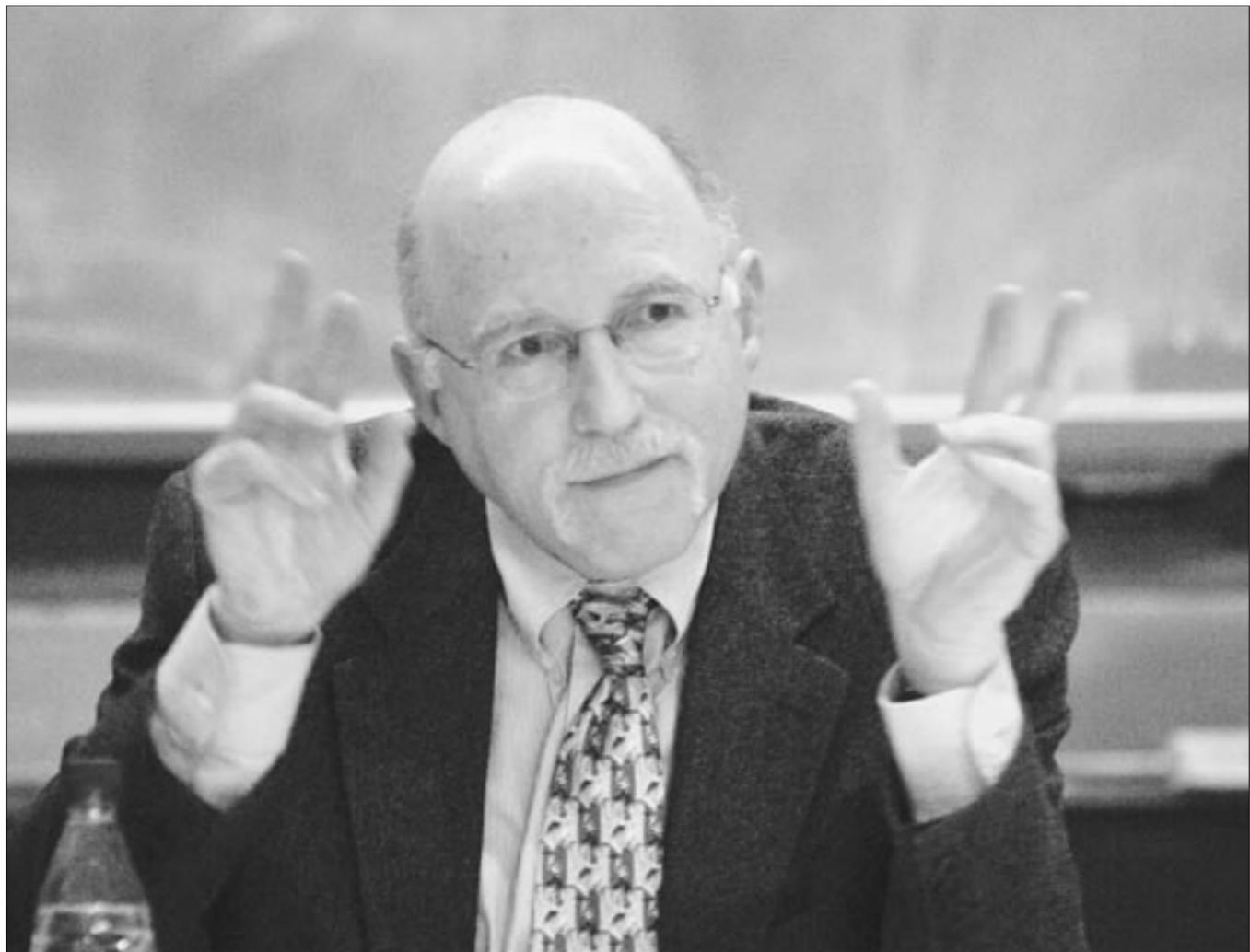


PHOTO / DONNA COVENEY

Barry R. Posen, the Ford International Professor of Political Science, discussed the question 'Are We Too Dependent on Middle Eastern Oil?' on Friday, April 28.

In addition, "ongoing tight market conditions are likely to persist, ensuring that our dependency on oil will drive prices higher," he warned.

Moniz offered an ambivalent response on whether the United States is "too dependent" on Middle Eastern oil.

"We are too dependent on Middle Eastern oil, in the sense that Saudi Arabia may soon produce 12 million barrels a day, so their stability is critical for the global oil

market," he said.

On the other hand, the consequences of dependency are judged by what options are available. "We have significant reserves to handle modest disruptions, the market functions fairly well, and for the long term we have the capability through technology and policy to manage demand and to produce alternative fuels — although perhaps not the will to do so meaningfully until the situation is still

worse," he said.

Moniz emphasized the important difference between the oil-dependent transportation fuels sector and the relatively elastic power sector, with its "considerable fungibility with fuels, including coal, gas and nuclear."

He also called for harmonization of environmental regulations among regions and countries to make more efficient use of oil products.

MIT dean presents prizes for sustainable projects

Scott Campbell
School of Architecture and Planning

In April, 700 guests from 50 countries convened in Bangkok for the culmination of a global three-year competition sponsored by the Switzerland-based Holcim Foundation for Sustainable Construction and five of the world's leading technical universities, including MIT.

Adèle Naudé Santos, dean of MIT's School of Architecture and Planning, presented \$1 million in awards to the best sustainable projects. Santos headed a 14-person jury made up of leading architects, engineers and professors from 10 different countries.

Joint winners of the Holcim Gold were an urban integration project in Caracas, Venezuela, and the design for a new main railway station in Stuttgart, Germany. The winners were selected from 15 finalists from all continents, following regional contests involving more than 3,000 entries from 118 countries.

Criteria for the awards ranged from environmental and aesthetic quality to the high ethical and economic standards that the Holcim Foundation has defined in collaboration with its partner universities in Europe (ETH Zurich), North America (MIT), Latin America (USP São Paulo), Africa/Middle East (Wits Johannesburg) and Asia



PHOTO / HOLCIM FOUNDATION
Dean Adèle Naudé Santos presents the Global Holcim Awards in Bangkok last month.

Pacific (Tongji Shanghai).

In announcing that two competing finalists were awarded equal first prizes of \$300,000, Santos said that both projects were outstanding: "Although engaged with intrinsically different cultural challenges, and therefore subject to different possibilities, both projects were considered by the jury to be equal in their embodiment of the aspirations of the Holcim Awards."

Caltech physicist foresees 'End of the Age of Oil'

Deborah Halber
News Office Correspondent

Fact or myth: \$3 a gallon is an outrageous price to pay for gasoline.

Myth, according to David L. Goodstein, author of the 2004 book, "Out of Gas: The End of the Age of Oil." Goodstein, vice provost and professor of physics and applied physics at Caltech, spoke at a Friday, April 28, colloquium sponsored by the MIT Center for Materials Science and Engineering and the Department of Materials Science and Engineering.

At 75 cents a liter, gasoline is "one of the cheapest liquids you can buy. We pay twice as much for a bottle of drinking water," he said.

Goodstein did not downplay the seriousness of the approaching oil shortage. In the 1950s, when geophysicist M. King Hubbert came up with a simple way to predict the lifetime of a natural resource, the oil companies pooh-poohed his theory. But the latest data show that the Hubbert peak is accurate. The world's petroleum production is at its maximum right around now and will soon start a steep decline.

"We've created a trap for ourselves," Goodstein said. "We're totally dependent on oil. The oil will run out. The question is, 'When?'" No one knows for sure, but Goodstein predicted the age of fossil fuels will come to an end sometime in this century, radically changing civilization as we know it.

Right now, there is no obvious successor to fossil fuels as the No. 1 fuel source. There may be a lot of coal in the ground, but it would have to be mined at a rate around five times faster than it is now to be a viable oil substitute, he said. Also, coal does not burn cleanly and worsens the greenhouse effect.

"The president of the United States ought to challenge us to break the fossil fuels habit," he said. "No one has challenged us to do that yet."

Solar energy has potential, but a land-mass half the size of California would have to be covered with photovoltaic cells to generate the same amount of energy produced by fossil fuels, Goodstein said. Solar and nuclear options both face significant social and political hurdles; nevertheless, "nuclear energy has to be part of the solution," he said. Biomass — a throwback to 200 years ago when people "grew something and burned it" for fuel — will also be critical.

Goodstein said a combination of fuel conservation through hybrid vehicles, more-efficient buildings and factories and "feebates" — fees for gas-guzzling cars — will provide short-term solutions.

While global warming is not all bad — Goodstein pointed out that if some global warming had not occurred during the Earth's existence, we would not be here — global warming tied to greenhouse gases is causing unpredictable changes at an increasingly rapid rate. "We're doing an uncontrolled experiment with the climate of Earth," he said.

ENERGY

Continued from Page 1

transform the global energy systems of the future;

- technology and policy to make today's energy systems effective, secure and environmentally responsible; and
- the design of technology and systems for a rapidly developing world.

These research thrusts would include expanding and refocusing existing MIT work on topics such as solar power, nuclear power systems, the science and policy of climate change, electro-chemical storage and conversion, biofuels, multiscale modeling and simulation, subsurface science and engineering, energy-efficient buildings and transportation technology and systems.

In education, the ERC recommends an integrated set of options developed to incorporate interdepartmental and interschool interests. An initial priority is an energy minor (or minors) for undergraduates. The current review of the General Institute Requirements that all students take before graduating is an opportunity to "consider how energy subject matter could be included in the undergraduate common curriculum," the report said. A newly created Energy Education Task Force would be in charge of coordinating MIT-wide educational initiatives.

Walk the talk

There are many opportunities for improving energy efficiency in the MIT campus infrastructure, the report said.

"Improving campus energy management will lower energy use and cost, reduce emissions and provide an important learning environment for faculty, students and staff," according to the report. "The ERC recommends a comprehensive assessment of the trade-offs, benefits and costs of different approaches to reducing campus energy use."

Options include creating a revolving loan fund to support energy-saving projects with reasonable payback periods. Such projects would enable faculty and students to use the MIT campus as a laboratory for energy efficiency and conservation, the authors wrote.

Energy, past and future

MIT has a long history of tackling energy issues. As early as 1882, when MIT President William Barton Rogers uttered his legendary last words of "bituminous coal," MIT understood energy's significance in society. Over the decades since its founding, the Institute has pushed the envelope of research and policy by creating laboratories, experimenting with materials and processes and investigating the underpinnings of public opinion, while advancing scientific and technological education to produce generations of alumni who have taken the MIT show on the road.

The original MIT entity to bring together energy work in the sciences, engineering and management was the Energy Laboratory, established in 1972. "For three decades, the Energy Laboratory conducted research, educated students and performed public service in support of economically sound, globally conscious and environmentally responsible energy policies and technologies," the ERC report said.

Its successor, the Laboratory for Energy and the Environment (LFEE), was created in 2001 by merging the Energy Lab and the Center for Environmental Initiatives. The broadened scope of the LFEE brought together researchers from all over MIT "to collaborate on problem-solving and innovative management in support of a sustainable future," according to the 2003-2004 Report to the President.

The ERC report proposes a new organizational structure to lead energy research: an MIT Energy Council that would repre-



PHOTO / RICK FRIEDMAN

President Susan Hockfield announced a new energy initiative in her inaugural address last May. Today, MIT's Energy Research Council released its recommendations in a 50-plus-page report.

ERC site launches

The Energy Research Council (ERC) web site, featuring a comprehensive overview of energy initiatives on campus, launches today (web.mit.edu/erc/).

In addition to posting continually updated listings of energy news and upcoming campus events, the site will spotlight individuals' research in a variety of energy-related fields; list student groups and laboratories involved in energy research; describe campus initiatives geared toward making MIT more energy efficient; provide links to local and global energy news coverage featuring MIT faculty and staff; and present energy "factoids."

The site links to EnergyClasses, a web-based tool that identifies MIT classes that revolve around or include energy research, policy or technology in their curricula (energyclasses.mit.edu). Eventually, the education section of the ERC web site will include descriptions of available energy-related Undergraduate Research Opportunities Program projects and potential funding available for student energy research.

The research section of the web site highlights the considerable depth and breadth of Institute initiatives by dividing the work of the hundred-plus MIT faculty members involved in energy research into four searchable categories: "Where it comes from," "Making it available," "Better ways to use it" and "Impact on people and the planet."

— Deborah Halber

sent the five schools and work toward creating within five years a permanent energy laboratory or center with central research space. LFEE would become part of this new entity, which will "help MIT to maintain a single, clear interface to the world on energy."

Auto expert offers advice on fuel conservation

Nancy Stauffer

Laboratory for Energy and the Environment

It will take decades for new technology to have a substantial impact on the staggering consumption of fuel for personal transportation, Professor John Heywood told the audience at an MIT Energy Club seminar on April 26.

But some seemingly minor changes in personal behavior can make a difference right away, said Heywood, the Sun Jae Professor of Mechanical Engineering and director of the Sloan Automotive Laboratory at MIT.

Based on population and economic growth, by 2050 there will be three times as many cars, vans, pick-up trucks and SUVs as there are now — some 2 billion worldwide. At today's level of fuel consumption per car, that's unsupportable.

"To offset the increase in number of cars, we really need to cut fuel use per vehicle by a factor of three or four," Heywood said.

Technology can help. "Evolutionary improvements" in the technologies we know — for example, more-efficient engines and transmissions and lighter, more-streamlined designs — can make changes that add up significantly, he said. More "radical transitions" might involve vehicles running on

biofuels and fuel cells and hydrogen.

But it'll be a long time before new technologies significantly reduce overall fuel consumption, Heywood said.

"I'm not saying that hydrogen is a waste of time, but don't expect it to have a serious impact in a decade," he said. "People who are working on it seriously estimate that only between 2015 and 2020 will we really know whether it's a market-competitive technology."

Heywood emphasized that cutting fuel use today — by such obvious methods as carpooling, taking the subway and even "driving less aggressively" — can make a difference.

"None of these measures alone is going to save us from our appetites, but several of them together could," he said.

Heywood stressed that the key is for each of us to take responsibility. He told the audience how he trained himself to turn off lights whenever he leaves a room. Each time he reminded himself, "By turning the light off, there's

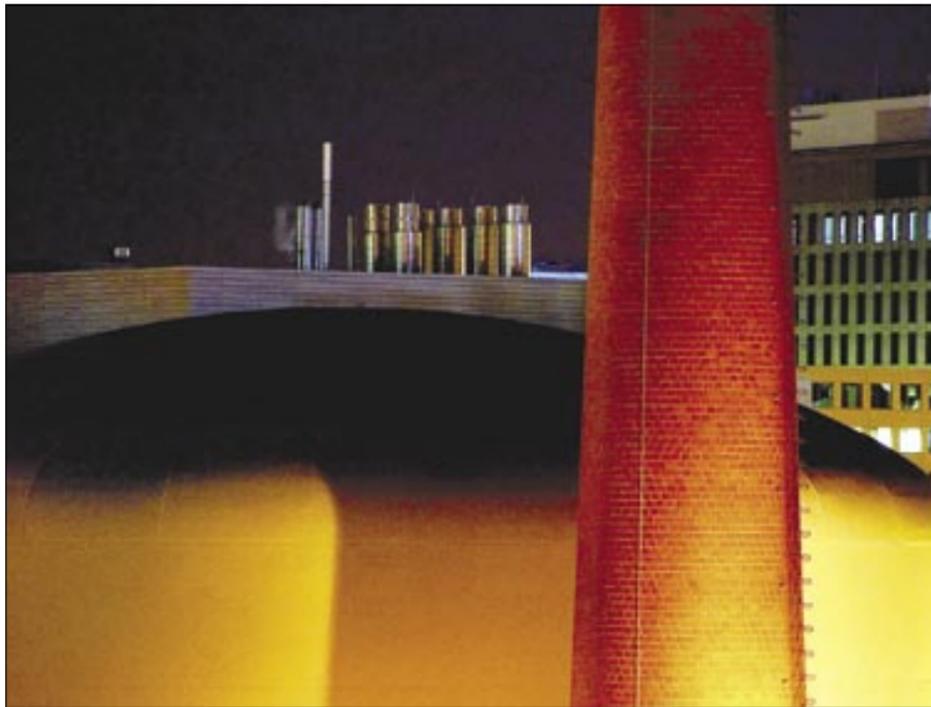
less carbon dioxide going into the atmosphere that'll be around for a hundred years."

"We've got to take that same sort of personal commitment and attitude into our car-buying habits and our driving behavior," he said.



FILE PHOTO / DONNA COVENEY

Professor John Heywood, pictured at a 2005 talk on the future of the car, discussed fuel efficiency and conservation at an MIT Energy Club seminar on Wednesday, April 26.



What's your reaction?

This photo of MIT's nuclear reactor, taken from the top of West Garage, is part of 'Up on the photographs by Judith M. Daniels on display at the Rotch Library through Tuesday, May 30. Dana is a research and administrative assistant in the School of Architecture and Planning.

MIT Energy Research Timeline

Source: Energy Research Council

1865

MIT is founded on the vision of teaching science principles as a basis for technological innovation to help solve global problems.



1882

MIT President William Barton Rogers dies while speaking at Commencement exercises. His last words are said to be "bituminous coal."

1908

William Coolidge, Class of 1896, produces ductile tungsten for incandescent lamps.



1925

Vannevar Bush develops the "network analyzer," a system for setting up miniature versions of large electrical networks to model and study electric power systems.



1928

The Fuels Research Laboratory in chemical engineering pioneers turbulent flame structures, radiative heat transfer and furnace design.



1929

The Sloan Automotive Laboratory at MIT is founded by Professor C. F. Taylor as a major laboratory for automotive research.



1938

Advanced energy incineration to world.



1939

Professor the world energy large n an ele



FILE PHOTO / DONNA COVENEY

Solar panels on top of the Hayden Memorial Library soak up the afternoon sun on Monday, Nov. 14, 2005, the day MIT celebrated the completion of its largest solar installation. The Energy Research Council's report calls for MIT to continue to improve campus energy management.

Students prepare for Solar Decathlon

Project continues MIT's legacy in solar power research

Scott Campbell

School of Architecture and Planning

MIT is one of 20 university teams selected to compete in the 2007 Solar Decathlon, sponsored primarily by the U.S. Department of Energy. The team will receive \$100,000 in seed funds over the course of two years to design and develop an energy-efficient house that provides all the domestic needs for a small urban family — including sufficient energy to power an electric car — using only the power of the sun. Further financial support for construction and transportation is being sought from industrial sponsors.

Headed by Andrew Scott, associate professor of architecture, the exploratory workshop this spring involved about a dozen students from architecture, building technology, electrical and mechanical engineering and materials science.

First conducted in 2002, and again in 2005, the Solar Decathlon is an international competition challenging college teams from around the globe to blend aesthetics and modern conveniences with maximum energy production and optimal efficiency. In the fall of 2007, students from U.S. universities — as well as from schools in Canada, Germany and Spain — will transport their solar houses to the competition site on the National Mall in Washington, D.C., and rebuild them there in a solar village. The houses, and the sponsors' exhibits, will be open to the public.

The purpose of the competition is to challenge students to think in new ways about energy, to increase public awareness about renewable energy and energy efficiency and to help move solar energy technologies to the marketplace faster.

MIT's participation in the contest continues a long-standing legacy of research at the

Institute into solar powered houses, beginning in 1938 when Godfrey Lowell Cabot gave MIT a gift to be used for the development of "the art of converting the energy of the sun to the use of man." The endowment enabled the creation of MIT's Solar Energy Research Project, a 50-year effort involving the design and construction of six experimental or prototypical solar houses.

Solar I, completed in 1939, was the first house in America to be heated by the sun's energy. A single-story house-like structure on the MIT campus, Solar I used solar radiation as a heat source for the winter, but projects were also conducted on summer air conditioning and power generation.

A series of solar houses followed. Solar V was erected in 1978 on the MIT campus and used as an experimental studio/classroom by the Department of Architecture. Unlike the first four solar houses, Solar V did not require mechanical equipment such as solar collectors, pumps or fans: All elements of solar heating were incorporated into the building materials.

The sixth solar house, the Dover Sun House, was different from the others. Sponsored by Boston heiress and sculptress Amelia Peabody, the house heating unit was designed by Maria Telkes, a researcher in MIT's Department of Metallurgy, and instead of water, the heat storage material was Glauber salts (sodium sulfate decahydrate). Architect Eleanor Raymond drew up the plans for the five-room house and a cousin of Telkes' lived in the house with his wife and child for three years, at which point the system failed.

The Solar Decathlon is sponsored by the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy, in partnership with its National Renewable Energy Laboratory, the American Institute of Architects, the National Association of Home Builders, BP, the DIY Network and Sprint.

MONIZ

Continued from Page 1

tem, that defines a challenge that you must begin to meet today. The energy challenge is — if not *the* primary area — certainly *one* of the primary areas for the application of science, engineering and policy to meet real human needs.

Q. *What are the Energy Research Council's recommendations for how MIT conducts research and educates students?*

A. Hopefully we can contribute much more strongly to solving these energy challenges. We suggest that we think about the problem along three lines. One is a set of basic science and engineering activities that will hopefully lead to transformational energy technologies down the road. It may be decades until these are fully realized in the energy marketplace. This consists of areas such as solar power, potentially an enormous resource, but faced with many technical and economic challenges. And it would include biofuels, batteries and fuel cells, and so on. These are all areas where we have significant research today at MIT, a good foundation for building up research programs.

The second area is improving today's energy systems. It's very appropriate for a university to be involved in basic research that may take a long time to influence the marketplace. But it is also important to get from here to there. We need to better deploy and use today's energy systems, mainly fossil fuels. We simply must use these resources more efficiently. We also need to advance nuclear power technology

so as to address public concerns.

The third area emphasizes the global nature of energy challenges, including those in developing countries. Research includes topics from the science and policy of climate change to building efficiency, transportation systems and urban design. For example, we would bring together our experience with passenger vehicle systems, with our supply-chain expertise to design the world's freight systems of the future.

Q. *How do these proposed research efforts differ from what is happening now at MIT?*

A. This adds to and supplements what is going on today with multidisciplinary programs, as opposed to individual investigator programs. Energy, inherently, is not just one discipline. We believe MIT has been especially strong in being able to mount these kinds of research efforts and focus on solving hard problems across disciplines. Clearly there are many energy initiatives at many universities, but we believe this is one of the distinguishing features that MIT can bring to the table. We also have an especially strong history of working with industry; many of these initiatives will, by definition, require a close collaboration with industry. And we have a strong history of technology innovation and entrepreneurial spirit. We want to capture that in our energy initiative.

Q. *How much funding will these efforts need, and where will the funds come from?*

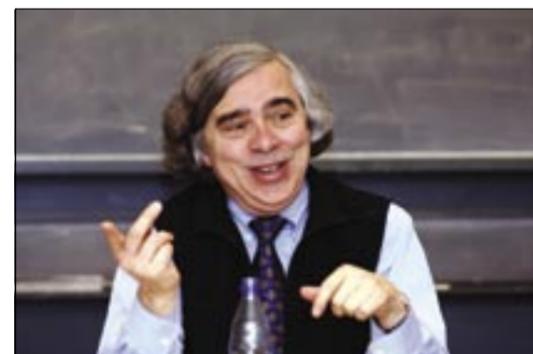


PHOTO / DONNA COVENEY

Professor Ernest J. Moniz, pictured at a talk he gave Friday, April 28, is the co-chair of the Energy Research Council. The other co-chair is Professor Robert C. Armstrong.

A. Obviously we will need to gather the resources from some combination of donors, industry and government. The costs are notional at the moment, but clearly if you are supporting a multi-faculty program, we are talking one to several million dollars per year, for a number of years, for each research focus area. And clearly, different parts of the agenda will be more attractive to different kinds of funders. This will take time to build up, so we suggest a phased-in approach, over a five-year time period.



PHOTO / JUDITH DANIELS

Roof,' an exhibit of Daniels is an adminis-

<p>MIT researchers create new materials that may improve electric vehicle batteries</p> <p>1998</p>	<p>The Energy Research Council, created by MIT President Susan Hockfield in 2005, releases its recommendations on how MIT can best help meet the world's energy challenges.</p> <p>2006</p>	<p>MIT produces the Solectria V solar racecar, which holds the world speed record of 90 mph for solar cars.</p> <p>1988</p>	<p>The Department of Nuclear Energy is established with 100 graduate students. MIT's nuclear reactor dedicated to research starts operation.</p> <p>1958</p>	<p>MIT recruits atomic energy experts from WWII to launch the field of nuclear science and engineering.</p> <p>1946</p>
<p>The Microsystems Technology Laboratories shrink jet engines to the size of a coat button. Micro gas turbine engines under development spin a million times per minute to produce enough electricity to power a PDA or cell phone.</p> <p>2004</p>	<p>Institute Professor Mario Molina shares the Nobel Prize in chemistry for the discovery that chlorofluorocarbons deplete the Earth's protective ozone layer.</p> <p>1995</p>	<p>The Energy Lab is created at MIT to provide a unique organizational structure for energy-related work.</p> <p>1972</p>	<p>Lead-free gasoline is invented by Vladimir Haensel of the Class of 1937.</p> <p>1947</p>	<p>Professor Hoyt C. Hottel builds the first solar house on MIT's "back lot."</p> <p>1940</p>

Readings, films portray math genius

Mary Haller
Office of the Arts

The intellectual life of the self-educated Indian mathematician Srinivasa Ramanujan and his tumultuous relationship with University of Cambridge Professor G.H. Hardy have inspired stage and screen writers with ties to MIT.

Ramanujan (1887-1920), who pioneered theories that startled leading mathematicians of his time, was discovered and brought to England by Hardy, who recognized his brilliance and supported his work. Despite some remarkable mathematical achievements, their relationship was torn by cultural differences and opposing ideas about intuition and logic.

On May 15 and 16, Catalyst Collaborative at MIT, a joint project of the Institute and Underground Railway Theater (URT), will present a free staged reading of "Partition," a fantasy by Ira Hauptman about the

two mathematicians.

Boston actor, playwright and director Jon Lipsky will direct the Catalyst readings, which will be held May 15 at 7:30 p.m. in Room 10-250 and May 16 at 7:30 p.m. at Cambridge Family YMCA Theatre, 820 Massachusetts Ave. For more information, call x3-2341.

Ramanujan was also the subject of a 1991 biography, "The Man Who Knew Infinity," written by Robert Kanigel, director of MIT's Graduate Program in Science Writing.

Kanigel's book is the focus of two films currently in the works. Hollywood screenwriter/director Matthew Brown and producer Edward R. Pressman ("Thank You for Smoking" and "Reversal of Fortune") have acquired the film rights to Kanigel's book, with production beginning in the fall, and British actor and writer Stephen Fry will co-direct a second film on it with Indian filmmaker Dev Benegal.

Ramanujan and Hardy had an "unlikely

relationship," Kanigel said. "Yet they were brought so close together by a shared love for a discipline, mathematics. There is something beautiful just in the thought of differences of culture, religion, age, education and upbringing eradicated — mostly, anyway — by a higher intellectual kinship. It makes for a rich and layered story."

Kanigel will lead open discussions following the "Partition" readings. Assistant Professor Kiran S. Kedlaya, of MIT's math department, will join Kanigel for both discussions, and Hauptman will participate on May 15.

Citing the film, "A Beautiful Mind," and the television show, "Numb3rs," Kedlaya described the renewed interest in Ramanujan as "part of a larger cultural trend in which mathematics, which has long been deprecated as a lifeless intellectual exercise, is being rediscovered as the intensely human endeavor that it actually is."

MISTI awards fellowships

The MIT International Science and Technology Initiatives (MISTI) program announced the recipients of the 2006 Anthony Sun Fellowship Awards at its annual Faculty Club gala on Wednesday, April 26.

The awards, which cover summer internship expenses for several outstanding MIT students enrolled in MISTI, are sponsored by Anthony Sun, a member of the MIT Corporation.

MISTI trains MIT students for substantive internships and research opportunities at companies, universities and research centers in seven countries. During the last 10 years, MISTI has placed more than 1,700 MIT students in labs and companies from Beijing to Berlin.

This year's Sun Fellows are: Scot Frank (China), Thuy-Tien Le (France); Anna Labno and Bao Truong (Germany); Elizabeth Clay (India); Antonella Alunni (Italy); Xin-Louie Huang and Denver Thomas (Japan); and Joshua Nelson (Mexico).

Congratulating the winners — and other MISTI students — MISTI Director Suzanne Berger, the Raphael Dorman and Helen Starbuck Professor of Political Science, said, "For someone who wants to be a manager, a scientist or a political scientist, it's absolutely essential to understand that process of knowledge creation happens in different ways in different places around the world. Observing this firsthand via your internships is one of the ways in which MISTI will help you to become truly global professionals."

In addition to its programs in China, France, Germany, India, Italy, Japan and Mexico, MISTI has begun organizing internships in Africa and in Spain.

Professor Frank Wilczek of physics, who won the 2004 Nobel Prize, delivered the keynote at the MISTI dinner. He encouraged students to make the most of international collaborations like those offered by MISTI.

For more information, visit web.mit.edu/misti.



PHOTO / DONNA COVENEY

Wheel fun

Manuel Balderas (S.B. 2002), left, shows graduate student Ming Tang of electrical engineering and computer science how to fix his bike out in front of Stata Center as part of MIT's Earth Day activities on Thursday, April 27. The day also featured performances and booths with earth-friendly ideas, plant cuttings and more.

Dancers, composers team up for Boston Celebrity Series

Rebecca Rice, a dancer and choreographer who teaches modern dance at MIT, will present the world premiere of "Deep Dances," a work set to music composed by Institute Professor John Harbison, on Saturday, May 6, at 8 p.m.

Rice's company, Rebecca Rice Dance, mixes modern dance and classical ballet. Dancers for the upcoming performance include Cydney Nielsen, a graduate student in biology, and Michelle Machon, a graduate student in brain and cognitive sciences and 2004 MIT graduate.

The concert will also include "Echoes" (2004), a piece choreographed to MIT lecturer Elena Ruehr's "Shimmer" (1997).

Rice's troupe will perform as part of the renowned Bank of Boston Celebrity Series. Their concert will be held at the Tsai Performance Center (Boston University, 685 Commonwealth Ave., Boston).

Rice has a sterling modern dance pedigree — her grandmother studied with Ruth St. Denis and Ted Shawn, and her aunt was Merce Cunningham's lead dancer for 20 years. Her company is known for its eclectic, vivid style.

Cello e Basso, composed of cellist Emmanuel Feldman and double bassist Pascale Delache-Feldman, will perform live music for the Harbison compositions for "Deep Dances" and "Stratas" (2004), a dance created to Harbison's 1994 composition "Suites for Solo Cello," as well as other works on the program.

Tickets range from \$17-\$30. For more information, contact Jack Wright, at (617)



PHOTO / LOIS GREENFIELD

MIT dance teacher Rebecca Rice and her company, Rebecca Rice Dance, will perform the world premiere of 'Deep Dances,' a work set to music composed by Institute Professor John Harbison.

598-3212 or jw@celebrityseries.org. For tickets, call (617) 482-6661 or visit www.celebrityseries.org.



PHOTOS / BRIAN HEMOND

Going, going, gone

A piano drops from the top of Baker House on Thursday, April 27, in a rite of spring that marks the last date to drop classes.

2006 MIT Sloan Private Equity Symposium

**A Winning Formula:
Driving Success in Private Equity Through Operations**
<http://www.mitvcpce.com/symposium>

Lunch Address

- David Rubenstein
Co-Founder, The Carlyle Group

Welcome Address

- Jon Luther
Chairman and CEO, Dunkin' Brands

Afternoon Address

- Bill Janeway
Vice Chairman, Warburg Pincus

Please visit the symposium website for full list of participants:
<http://www.mitvcpce.com/symposium>

**Friday, May 5th, 2006
Cambridge, MA**

Study offers new hope for Alzheimer's patients

Anne Trafton
News Office

MIT brain researchers have developed a "cocktail" of dietary supplements, now in human clinical trials, that holds promise for the treatment of Alzheimer's disease.

For years, doctors have encouraged people to consume foods such as fish that are rich in omega-3 fatty acids because they appear to improve memory and other brain functions.

The MIT research suggests that a cocktail treatment of omega-3 fatty acids and two other compounds normally present in the blood could delay the cognitive decline seen in Alzheimer's disease, which afflicts an estimated 4 million to 5 million Americans.

"It's been enormously frustrating to have so little to offer people that have (Alzheimer's) disease," said Richard Wurtman, the Cecil H. Green Distinguished Professor of Neuropharmacology at MIT, who led the research team. The study appears in the May 9 issue of *Brain Research*.

Wurtman presented the research at the International Academy of Nutrition and Aging's 2006 Symposium on Nutrition and Alzheimer's Disease/Cognitive Decline in Chicago on Tuesday, May 2.

The three compounds in the treatment cocktail — omega-3 fatty acids, uridine and

choline — are all needed by brain neurons to make phospholipids, the primary component of cell membranes.

After adding those supplements to the diets of gerbils, the researchers observed a dramatic increase in the amount of membranes that form brain cell synapses, where messages between cells are relayed. Damage in brain synapses is believed to cause the dementia that characterizes Alzheimer's disease.

If the successful results obtained in gerbils can be duplicated in the ongoing human trials, the new treatment could offer perhaps not a cure but a long-term Alzheimer's treatment similar to what L-dopa, a dopamine precursor, does for Parkinson's patients, said Wurtman, a professor in the Department of Brain and Cognitive Sciences.

"It doesn't cure Parkinson's, but what it does do is to help replace something that's missing. It's not permanent, but it has had an enormous impact on people who have Parkinson's," he said.

The new potential treatment offers a different approach from the traditional tactic of targeting the amyloid plaques and tangles that develop in the brains of Alzheimer's patients. Until recently, most researchers believed these plaques and tangles caused the cognitive decline. But the failure of this hypothesis to lead to an effective treatment for Alzheimer's disease has caused some scientists to theorize

that, though the plaques and tangles are always associated with the disease, they may not be the main cause of the dementia, nor the best target for treating it.

Instead, the new research focuses on brain synapses, where neurotransmitters such as dopamine, acetylcholine, serotonin and glutamate carry messages from presynaptic neurons to receptors in the membranes of postsynaptic neurons. In Alzheimer's patients, synapses in the cortex and hippocampus, which are involved in learning and memory, are damaged.

After the dietary supplements were given, the researchers detected a large increase in the levels of specific brain proteins known to be concentrated within synapses, indicating that more synaptic membranes had formed, Wurtman said. Synaptic membrane protein levels rose if the gerbils were given either omega-3 fatty acids or uridine plus choline. However, the most dramatic upsurge was observed in gerbils fed all three compounds.

"To my knowledge, this is the first concrete explanation for the behavioral effects of taking omega-3 fatty acids," said Wurtman.

Choline can be found in meats, nuts and eggs, and omega-3 fatty acids are found in a variety of sources, including fish, eggs, flaxseed and meat from grass-fed animals. Uridine, which is found in RNA and produced by the liver and kidney, is not

obtained from the diet. However, uridine is found in human breast milk, which is a good indication that supplementary uridine is safe for humans to consume, Wurtman said.

Recent studies by the researchers at MIT, and by scientists at the University of Cambridge in England, showed that either uridine or omega-3 fatty acids can promote the growth of neurites, which are small outgrowths of neuronal cell membranes. That further supports the hypothesis that omega-3 fatty acids increase synaptic membrane formation, said Wurtman.

Alzheimer's patients in the clinical trials, which will involve multiple medical centers, are being given a drink that contains the compounds under study, or a taste-matched placebo.

"If it works as well on the brains of people with Alzheimer's disease as it does in laboratory animals, I think there will be a lot of interest," Wurtman said.

Other authors on the paper are Ismail Ulus, Mehmet Cansev, Carol Watkins, Lei Wang and George Marzloff of MIT's Department of Brain and Cognitive Sciences. Ulus and Cansev also work at the Uludag University School of Medicine in Turkey.

The research was supported by the National Institutes of Health, the Center for Brain Sciences and Metabolism Charitable Trust, and the Turkish Academy of Sciences.

SAND TABLE

Continued from Page 1

the channels' internal structure.

"If we could understand how they develop, then we would also understand a great deal about what they're composed of — the distribution of clay, silt, sand and even gravel that they're built out of," Mohrig said. With a better understanding of porosity and permeability within a channel, companies could more accurately determine how much oil is present, where it is located and how quickly it can be withdrawn.

Researchers have been re-creating the formation of submarine channels in Mohrig's Morphodynamics Laboratory using a 5-meter-square sand table.

The experiments have yielded results that the collaborators call "counterintuitive." On a map, the sinuous submarine channels look like meandering surface rivers. However, they exhibit behaviors that are markedly different and — to us surface-dwellers — totally unexpected.

The behaviors stem from differences in density. Water in a river is about a thousand times denser than the fluid it flows through — air. As a result, a flow tends to remain confined to its riverbed, escaping over the banks only rarely. In contrast, the current running through a submarine channel may be only 10 percent denser than the seawater around it. Thus, the current can spill out of its channel more easily and frequently than a river might.

That difference explains several unexpected findings. For example, at times the bottom of the current slashes almost all the way up the edge of the channel and then back down again. And at bends, the current may go straight, pouring up and over the bank and dropping its sediment outside the channel — an outcome with important implications for energy companies as they plan to drill.

Because of their close and continuing involvement in the scientific investigation, the Shell researchers are prepared to put the research findings to practical use. "The experiments that David is doing have never really been done before, so we're learning new things about how channels are put together," Pirmez said. "We're getting new ideas, new concepts that may change the way we think about the subsurface."

The result should be improved predictions, reduced uncertainty and more efficient recovery from these oil-rich submarine formations.

This research was supported by Shell International Exploration and Production Inc. through the MIT Department of Earth, Atmospheric and Planetary Sciences.



PHOTO / DONNA COVENEY

Three members of the team that found growth factor prevents the effects of visual deprivation in the brain pose in the lab. They are, from left, Daniela Tropea, a postdoctoral fellow at the Picower Institute for Learning and Memory; Mriganka Sur, head of the Department of Brain and Cognitive Sciences; and Gabriel Kreiman, a postdoctoral fellow with the McGovern Institute for Brain Research.

Brain researchers see visual role for growth factor

Deborah Halber
News Office Correspondent

Researchers at MIT's Picower Institute for Learning and Memory have identified an insulin-like growth factor that prevents the usual effects of visual deprivation in the brain.

This key molecule may one day provide a way to manipulate connections among neurons in the developing brain, and possibly even in the adult brain. Researchers may use it to repair brain cell connections lost or damaged through injury or diseases such as Alzheimer's, or to treat such conditions as autism.

The work was reported April 22 in the advance online edition of *Nature Neuroscience*.

A team of scientists led by Mriganka Sur, the Sherman Fairchild Professor of Neuroscience and head of the Department of Brain and Cognitive Sciences at MIT, found that insulin-derived growth factor 1 (IGF1) prevents the physiological effects that occur when visual input is shut down to one eye.

In a well-known experiment conducted in the 1960s, Harvard researchers David Hubel and Torsten Weisel, who later won the Nobel Prize, found that depriving neurons of stimulation from one eye led to those neurons being reassigned to the non-deprived eye.

With the addition of IGF1, "there is no loss of deprived eye connections or gain of non-deprived eye connections," Sur said. "We hope that this growth factor will turn out to be equally important for other kinds of developmental and even adult plasticity," he said, referring to the brain's ability to change in response to stimuli.

Sur's co-authors are postdoctoral fellows Daniela Tropea and Gabriel Kreiman; research affiliates Alvin Lyckman and Sayan Mukherjee; postdoctoral associate Hongbo Yu; and graduate student Sam Horng.

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

MIT EVENT HIGHLIGHTS MAY 3-7

			
Science/Technology	Performance	Architecture/Planning	Humanities
			
Music	Exhibit	Reading	Special Interest
			
Business/Money	Film	Sports	Featured Event



'Soft Materials'

This still from Daria Martin's 16 mm film 'Soft Materials' is part of 'The Choreographic Turn,' on display at the List Visual Arts Center from May 4 to July 9. The exhibit features works by Martin and Peter Wetz, in collaboration with William Forsythe.

WEDNESDAY
May 3

 **Artist Behind the Desk Spring Craft Show**
9 a.m.-5 p.m. Lobby 10.

 **Artist Behind the Desk Concert**
Performance by soprano Katherine Drexel, administrative assistant in chemistry. Noon. Killian Hall.

 **"10 Days in Tehran—Nuclear Weapons, Policy and Theory"**
Talk by James Walsh, Center for International Studies. Noon. E38, 6th floor conference room. 253-7529.

 **"China: Development With Equity"**
Talk by Lu Mai, secretary general of the China Development Research Foundation. 2:30-4 p.m. Room E38-615. 253-8306.

 **MIT Chamber Orchestra**
Dante Anzolini, music director. 7 p.m. Killian Hall. 253-2826.

THURSDAY
May 4

 **"The Choreographic Turn"**
Works by Daria Martin and Peter Wetz, in collaboration with William Forsythe. Exhibition includes two video installations offering new modes of experiencing the art of bodies in motion. Opening reception: 5:30-7:30 p.m. List Visual Arts Center. 253-4680.

 **"9 Evenings Reconsidered: Art, Theatre and Engineering, 1966"**
This exhibition revisits the historical performance event, "9 Evenings: Theatre and Engineering," which originally took place in 1966 and featured artist/engineer collaborations. Opening reception: 5:30-7:30 p.m. List Visual Arts Center. 253-4680.

 **"The Threepenny Opera" Auditions**
MIT Gilbert & Sullivan Players. Prepare one song in English and bring two copies of the sheet music. May 3 and 4. 7-10 p.m. May 3 in Student Center West Lounge and May 4 in Room W20-407.

FRIDAY
May 5

 **Cinco de Mayo Mixer**
Annual Cinco de Mayo student-faculty mixer. 4-6 p.m. Hart Nautical Gallery. 253-4349.

 **Benefit Concert by David M. Bailey**
The musician and brain tumor survivor performs to raise funds for benefit concert for The Healing Exchange Brain Trust. 7 p.m. Bartos Theater.

 **MIT Festival Jazz Ensemble: "Supreme Influences"**
Frederick Harris, music director, with special guests John Carlson on the trumpet, John Dirac on the guitar and poet William Corbett. \$5. 8 p.m. Kresge Auditorium. 253-2826.

 **"Julius Caesar"**
Threadbare Productions inaugural production. \$10 suggested donation. May 4-5 at 6 p.m.; May 6-7 at 2 p.m.; May 11-12 at 5:30 p.m.; May 13-14 at 2 p.m. MIT Stata Center Amphitheater.

SATURDAY
May 6

 **Emerson Scholar Student Recitals**
Noon and 1:30 p.m. Killian Hall. 253-2826.

 **Curator's/Artists' Talks**
Talk by curator Catherine Morris and artists' talks by Daria Martin and Peter Wetz, moderated by Bill Arning. Presented in conjunction with "9 Evenings" at the List Visual Arts Center May 4-July 9. Bartos Theater. 1 p.m. 253-4400.

 **MITHAS Concert**
Ken Zuckerman on the sarod; Dominique Vellard, medieval vocalist; Anindya Chatterjee on the tabla; and Keyvan Chemirani on the zarb. \$18, \$14 MITHAS members, \$10 students, MIT students free. 7:30 p.m. Kirsch Auditorium. 258-7971.

SUNDAY
May 7

 **Bulgarian Folk Singing/Dancing Workshop**
Bulgarian folk singing and dancing workshop with guest teachers/musicians Yordanka and Georgi Iliev. \$10, free for MIT and Wellesley students. 1-4 p.m. Room W20-407. 253-FOLK.

 **Student Recital**
Solo harp and two-piano repertoire. 2 p.m. Kresge Auditorium. 253-2826.

 **Gallery Talk**
Talk by List Visual Arts Center staff, presented in conjunction with "9 Evenings" at the List Visual Arts Center May 4-July 9. 2 p.m. List Visual Arts Center. 253-4400.

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

EDITOR'S CHOICE

ENERGY FORUM

Forum showcasing MIT energy research and an analysis of MIT's strengths in contributing solutions to the world energy crisis.

May 3

Kresge Auditorium
9 a.m.-6:30 p.m.

SPRING CRAFT FAIR

MIT Women's League sale of jewelry, pottery, handknit children's items and more, including the League's cookbook. May 4 and 5.

May 4

9 a.m.-5 p.m.
Lobby 10

"CHICAGO"

Musical Theatre Guild production. May 4-6. \$12, \$9 MIT faculty/staff, senior citizens, students, \$6 MIT/Wellesley students.

May 4

Kresge Little Theater
8 p.m.

The MIT Energy Forum: Taking on the Challenge



One planet. One future. Engage. Contribute ideas, research, passion — energy.

Wednesday
May 3, 2006
Kresge Auditorium, W16

Opening Remarks
9:00 am – 9:20 am
President Susan Hockfield

Overview of the Energy Research Council Report
9:20 am – 9:50 am
Professor Ernest J. Moniz

Panel Session I
Science and Technology for a Clean Energy Future
10:00 am – 11:15 am

Morning Summary
11:15 am – 11:30 am
Provost L. Rafael Reif

Lunch and MIT Energy Club Poster Presentation
11:30 am – 1:00 pm

Panel Session II
Improving Today's Energy Systems
1:00 pm – 2:15 pm

Panel Session III
Energy for a Rapidly Evolving World
2:45 pm – 4:00 pm

Question and Answer Session
4:00 pm – 4:30 pm

Receptions
Plasma Science and Fusion Center, NW17
Sloan Automotive and Electrochemical Energy Laboratories, Building 31
5:00 pm – 6:30 pm

web.mit.edu/erc/forum

