Neuroscientists locate brain regions that fuel attention
Work could aid treatment of ADD

Deborah Halber
News Office Correspondent

MIT junior who launched a program to help Sri Lankan victims of rape and incest has won a 2007 Harry S. Truman Scholarship, which she vows to use for graduate study in sustainable development.

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MIT reveals the tangle under turbulence

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Picture the flow of water over a rock. At very low speeds, the water looks like a smooth sheet skimming the rock’s surface. As the water rushes faster, the flow turns into turbulent, roiling whitewater that can overturn your raft.

Turbulence is important in virtually all phenomena involving fluid flow, such as air and gas mixing in an engine, ocean waves breaking on the shore, or a cliff and air whipping across the surface of a vehicle. However, a comprehensive description of turbulent fluid motion remains one of physics’ major unsolved problems.

Researchers have long suspected that there’s a hidden but coherent structure underlying turbulence’s messy complexity, but there has been no objective way of identifying it, said MIT research group leader George Haller, professor of mechanical engineering, who also heads Morgan Stanley’s Mathematical Modeling Center in Hungary.

The researchers report that they have visualized for the first time a convoluted tangle of swirling water jets that force water from below into a rotating tank of fluid. They see the resulting complicated flow with luminous buoyant particles. When illuminated with a laser, the minuscule polystyrene spheres were visible as they raced around the vortexes and jets.

While the particles looked cool, “most important to our analysis were the particles’ velocities, which we monitored using high-speed cameras.” The researchers say they have developed a way to identify the material building blocks of a turbulent flow. Haller said.

“Turbulence is the key to understanding all of nature’s chaotic dynamics,” Haller said.

The work, which has roots in an MIT undergraduate and co-author Thomas Peacock, assistant professor of mechanical engineering at MIT, involved using two different stops on the FM radio dial for different types of attention. “It’s as if the brain regions—the prefrontal cortex and the sensory cortex—play different roles in these different modes of attention,” said study co-author Earl K. Miller, Picower Professor of Neuroscience.

What’s more, when you focus your attention, the electrical activity in these two brain areas oscillates at different frequencies. “It’s as if the brain is using two different stops on the FM radio dial for different types of attention,” said study co-author Earl K. Miller, Picower Professor of Neuroscience.

See ATTENTION
Page 4

Engineer, humanitarian wins Truman Fellowship

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See ATTENTION
Page 4
Douglas receives Black History Maker award

Dr. Frank Douglas, professor of the practice at the Harvard-MIT Division of Health Sciences and Technology and executive director at the Center for Biomedical Innovation in the MIT Schools of Mathematics, Engineering and Science, is one of five recipients of the Associated Black Charities’ 2007 Black History Maker Award.

Douglas will receive the award at an April 11 dinner ceremony in New York City. Douglass is a respected innovator in pharmaceutical research and development, has made significant contributions to the field, and is a leading proponent of market launch of more than 20 drugs in his 25 years in the pharmaceutical industry.

In his current role leading MIT’s Center for Biomedical Innovation, Douglass’ mission is to transform the discovery, development, manufacture and distribution of cost-effective therapeutics and devices.

Among his many awards are the Heart of the Year Award from the Chicago Heart Association and the Louis B. Russell Memorial Award from the American Heart Association, both for Douglas’s development of high blood pressure screening and cost-effective treatment for black Americans in Chicago.

After graduating cum laude from Lehigh University, Douglas earned a Ph.D. in physical chemistry from Stanford University and a Ph.D. in chemical engineering from Cornell University.

Douglas’s Black History Maker Award is named for Percy L. Julian, who, despite prejudice and social obstacles, became an outstanding organic and natural chemist. Julian was the first African American to earn a Ph.D. from the University of Chicago and to use synthetic routes to synthesize human hormones.

The Associated Black Charities is a federation of 14 member agencies who deliver health and human services to New England’s minority communities.

The other 2007 award recipients are Carla Harris, a managing director at Morgan Stanley; David A. Paterson, lieutenant governor of New York; Tony Dungy, head coach of the Indianapolis Colts; and Lowell Smith, head coach of the Chicago Bears.

Ellison is Palm Professor of Economics

Professor Glenn Ellison, a leader in the fields of economic theory, industrial organization and financial economics, has been named the inaugural holder of the Gregory K. Palm 70 Professorship in Economics.

The new professorship was endowed by Gregory K. Palm, a 1970 graduate of the MIT economics department and a member of his visiting committee. He graduated from the joint D.B.A.-M.B.A. program at Harvard and subsequently clerked for Judge Henry Friendly of the 2nd U.S. Circuit Court of Appeals and for Supreme Court Justice Lewis Powell. Palm is currently the general counsel at Goldman Sachs in New York and a member of the firm’s management committee.

Palm, who received his Ph.D. from the MIT economics department in 1992, taught at Harvard for two years before joining the MIT faculty in 1994. In the MIT department, Palm created and directed the field of financial economics, and his molecular wire inventions will be part of the MIT’s new Eureka Fest, scheduled for May 2-5.

Eureka Fest, inspired by the Eureka! magazine that announced the birth of MIT, will be a multidisciplinary celebration of innovation at MIT and throughout the Massachusetts area.

Ellison’s contributions in industrial organization include one of the classic studies of cartel behavior, a detailed analysis of the pricing behavior of the 19th-century New York-Chicago railroad cartel, as well as more contemporary studies of pricing policy. In collaboration with his wife, MIT economics senior lecturer Sara Ellison (Ph.D. 1995), he has explored the behavior of Internet shoppers and sellers. This work highlights the role of buyer search behavior in online marketplaces, and it also demonstrates the importance of tax avoidance as a motive for Internet purchases.

Ellison has also made important contributions in financial econometrics. In particular, he has studied incentive and agency problems in the mutual fund industry. He has demonstrated that mutual fund managers change the risk profile of their investments in order to attract the highest amount of money in the place in the top echelon of fund performers for a given year. Managers at funds that are just outside the top ranks as the year-end approaches take greater risks than comparable managers at funds that are already in the top ranking positions, or than managers at funds that are already virtually assured a low ranking.

Ellison has been an active contributor to the educational mission of the MIT economics department, winning the department’s graduate teaching award five times in the last dozen years. He also served as editor of Econometrica, the premier economics journal, and as editor of Economic Theory.

The MIT researchers call their discovery the "Lagrangian skeleton" of turbulence because their particle-based approach is motivated by the work of 19th-century mathematician Joseph Louis Lagrange. "Lagrangian development of mathematical tools still used today for calculating mechanical and fluid motion," said Haller.

Among many applications, the new results promise to aid in the modeling of clear air turbulence that causes those unexpected jolts in airplanes; they may also have important implications for air traffic control. "Most certainly, they will lead to more accurate 'airspace management' running in a bowl of spaghetti," Haller said.

This work was supported by the National Science Foundation, the Air Force Office for Scientific Research and the Office of Naval Research.
MIT Tech Talk

NEWS

April 4, 2007

PAGE 3

Institute admits 1,533 students to the Class of 2014

MIT has admitted 1,533 students from 50 states and 46 countries to the Class of 2014 in an unusual year that saw both an increased number of applicants and an increased freshman class size, with nearly 60 more students admitted than last year. The target size for the incoming class is 1,020—up from 1,005 last year.

The Institute’s acceptance rate fell to an all-time low of 12 percent of applicants, who numbered 12,441.

It was very, very hard to select such a small number of students in such a diverse applicant pool,” admitted Admissions Marilee Jones said.

The admissions office is anticipating a yield of 60.5 percent—consistent with last year’s yield—which will allow them to admit 10 of the 519 students who have been placed on the waitlist. Forty-eight percent of those admitted to the Class of 2014 are women and 21 percent are underrepresented minorities. Of students ranked in their high school, 49 percent are valedictorians and 90 percent are in the top five percent of their class.

Last year, the acceptance rate was nearly 26 percent for women and 10 percent for men. The acceptance rate for all applicants was 13 percent in 2006, with the number of male applicants nearly tripling the number of female applicants. Acceptance rates for the classes of 2008 and 2009 were similar to those in 2006.

MIT does not have quotas for the number of male or female students accepted. The only quotas the admissions office employs are for international students: Foreign students are limited to 6 percent of the incoming classes.

When Jones first began working in the admissions office in 1979, the undergraduate population was 17 percent female. That number rose to 36 percent by 1998 when Jones was named dean of admissions. The Class of 2010, which entered last fall, was 45 percent female.

Faculty team will develop initiative on race issues

A core team of faculty representing all five of MIT’s schools has been appointed to develop the Institute’s new initiative on faculty race issues, Provost L. Rafael Reif announced in a letter to the faculty emailed today.

The members of the new core team are Professors Emery N. Brown (science), Paula T. Hammond (engineering), Leslie K. Norford (architecture and planning), Christine Ortiz (engineering), Marcus A. Thompson (humanities, arts, and social sciences) and JoAnne Yates (MIT Sloan).

“This new initiative will provide the background necessary to allow us to develop effective mechanisms to strengthen the representation and career experiences of underrepresented minority faculty at MIT. I expect this initiative to bring about real and measurable change at MIT and to make the Institute a leader and a model in minority faculty recruitment and retention,” Reif wrote.

As announced in February 2007, the initiative will study how race affects the recruitment, retention, professional opportunities and collegial experiences of underrepresented minority faculty members at MIT, Reif noted.

The core team will “consult closely with the MIT minority faculty, with leaders of the MIT community and with the faculty broadly to define the process and determine the resources required for a comprehensive, rigorous and systematic study of these issues, and I have asked the core team to review its recommendations with the minority faculty and with the Council on Faculty Diversity before submitting them to me by the end of this academic year,” Reif stated.

“We anticipate that the initiative will be similar in scope and methodology to a colleague at MIT and the across the nation—to our earlier studies of gender equity in the faculty, which began with the study of women in the School of Science (1999) and went on to include the other four schools in reports released almost exactly five years ago,” Reif wrote.

Reif noted that suggestions on the new initiative may be sent to facultydiversity@mit.edu. — Sarah H. Wright

FELLOWSHIP

Continued from Page 1

Johnson decided to create a program to help the girls make their own jewelry both for extra income and a sense of ownership.

"I'm really excited about coming back, not only because I love MIT but also (because) I can't wait to get more students involved," she said.

Whitney-Johnson returns to Sri Lanka in May 2006 to continue work on the project she named "Emergo." She also applied for an import license so she could bring the girls' work to the United States for sale.

"I love MIT but also (because) I can't wait to get more students involved," she said. She hopes to host an MIT seminar on how to design living spaces for the girls. "There is a huge need in Sri Lanka for homes for these mothers," she said. She is anxious to get more students interested in public service work, something that has profoundly affected her MIT experience.

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Computer model mimics blink of a human eye

Computers can usually out-compute the human brain, but there are some tasks, such as visual object recognition, that the brain performs easily yet are very challenging for computers. To explore this phenomenon, neuroscientists have long used rapid categorization tasks, in which subjects indicate whether an object from a specific class (such as an animal) is present or not in the image. Now, MIT researchers report that a computer model designed to mimic the way the brain processes visual information performs as well as well as humans do on rapid categorization tasks. The model even tends to make similar errors as humans, possibly because it so closely follows the organization of the brain’s visual system.

"The work, which appears in the online early edition of the Proceedings of the National Academy of Sciences this week, could lead to better artificial vision systems and augmented sensory prostheses. We have not solved vision yet," Poggio cautioned, "but this model of immediate recognition may provide the skeleton of a theory of vision.

For cognitive neuroscientists, these results add to the convergence of evidence about the feed-forward hypothesis for rapid categorization. "We could be on the right track," Poggio said, "but this is a big step forward in understanding how humans see," said Oliva. "For me, it's putting light in the black box of the visual cortex."

Poggio and his colleagues have long used computer models designed to mimic the way the brain processes visual information. This year, they showed that a computer model could mimic the way the brain processes visual information and drive new experiments to explore brain mechanisms involved in human visual perception, cognition and behavior.

"We have not solved vision yet," Poggio cautioned, "but this model of real-time recognition may provide the skeleton of a theory of vision.

This research was supported by grants from the National Institutes of Health, Defense Advanced Research Projects Agency, Office of Naval Research and National Science Foundation.
Pulsing light quiets overactive neurons

Anne Trafton
News Office

scientists at the MIT Media Lab have invented a way to reversibly silence brain cells using pulses of yellow light, offering the prospect of controlling a brain's normal nervous activity when it occurs in diseases such as epilepsy and Parkinson's disease.

Researchers have used a specific technique to stimulate neurons by shining blue light on them, or with blue and yellow light the researchers can now exert exquisite control over the stimulation and inhibition of individual neurons.

Learning more about the neural circuits involved in epilepsy could help scientists develop devices that can predict when a seizure is about to occur, allowing treatment (either shock or light) to be administered only when necessary, Boyden said.

The technique also offers a way to study other brain diseases, as well as normal brain circuitry, offering insight into which brain regions and neurons contribute to specific behaviors or pathological states, Boyden said.

The halorhodopsin gene was originally discovered in the 1980s, but Boyden didn't think its full potential had been explored.

"If you are patient and think carefully about what you want to do, you can find a molecule that is very close to what you want, and with a little bit of luck it will turn out to work," Boyden said.

"The halorhodopsin work is one of the first projects from the Media Lab Neuroengineering and NeuroMedia Group, which was formed about six months ago to enhance the Media Lab's study of the brain-body relationship," Xue Han said.

The Media Lab has been interested in studying the interface between people and the brain, Boyden said, "but now people are getting interested in the interface between bodies and brains in the home).

"The research was funded by an anonymous donor, the MIT Media Lab and the Helen Hay Whitney Foundation."

Child's play shows cause and effect

Deborah Halber
News Office Correspondent

It's not child's play to Laura E. Schultz, assistant professor of brain and cognitive sciences at MIT, to figure out what child's play is all about.

Schultz spoke March 21 at an MIT Museum Soap Box event, "Twisting the Twists: Explorations of Children's Causal Learning." Soap Box is a series of salon-style, early-evening conversations with scientists and engineers in the news, a public forum for debate about ideas in science and technology.

The theory of cause and effect is fundamental to our understanding of the world. However, despite almost universal agreement on the role of cause and effect, little is known about how children's play might support accurate causal learning, Schultz said.

"One of the deep mysteries of cognitive science is how we predict the future and how we explain the past and intervene in the present," she said. "But we know that opening even perverses our emotional lives when we speculate about why someone has a certain expression on her face or why a friend or colleague said what he did."

Causation in a nutshell: If you change this, all else being equal, something else changes. From earliest infancy and across all species, action and effect are correlated. Anyone who owns a pet knows that an animal quickly learns that opening a certain food container means dinner is on the way.

Statistical evidence is one factor that contributes to our rich beliefs about the universe. Our prior expectations and beliefs

Infectious diseases to be first focus of Singapore-MIT Alliance for Research and Technology (SMART)

Elizabeth Thomson
News Office

Infectious diseases will be the focus of the first research group through the proposed Singapore-MIT Alliance for Research and Technology (SMART) Center, the Singapore National Research Foundation (NRF), which will sponsor the center. The goal is to develop an integrated, cutting-edge research program to study the biological processes of infectious diseases, as described in a fact sheet released by Singapore's Research, Innovation and Enterprise Council.

"It will focus on infectious diseases of importance to Singapore, Asia and the world. These diseases are respiratory syncytial virus, influenza, tuberculosis and malaria."

Professor Jianhua Chen of the Department of Biology will head the group, which will comprise eight MIT faculty members and 17 researchers from universities, industry and institutes in Singapore.

"This research activity aligns with the future programs of SMART, will strengthen and expand ongoing educational and research collaborations between MIT and Singapore," said Subra Suresh, Ford Professor of Engineering at MIT and MIT team leader for SMART.

SMART will serve as an intellectual hub for interactions between local and global researchers in Singapore at the frontiers of science and technology. SMART is the first of several world-class centers planned by the NRF in the international Campus for Research Excellence and Technological Enterprise.

MIT has worked with Singapore for eight years through the Singapore-MIT Alliance. Plans for MIT and Singapore to formalize SMART are expected to be completed in the next several months.
Lack of fuel may limit U.S. nuclear power expansion

Limited supplies of fuel for nuclear power plants may thwart the renewed and growing interest in nuclear energy in the United States and other nations, says an MIT expert on the industry.

Over the past 20 years, safety concerns dampened all aspects of development of nuclear power. No new reactors were ordered and there was investment neither in new uranium mines nor in building facilities to produce fuel for existing reactors. Instead, the industry lived off commercial and defense contracts, which are now nearly gone. Worldwide, uranium production meets only about 65 percent of current reactor requirements.

That shortage of uranium and of processing facilities leaves a gap between the potential increase in demand for nuclear energy and the ability to supply fuel for it, said Thomas Neff, a research affiliate at MIT's Center for International Studies.

"Just as large numbers of new reactors are being planned, we are only starting to emerge from 20 years of underinvestment in the production capacity for the nuclear fuel to operate them. There has been a nuclear industry myth; they didn't take a long-term view," Neff said. For example, only a few years ago uranium inventories were being sold at $10 per pound; the current price is $87 per pound.

Neff has been giving a series of talks at industry meetings and investment conferences around the world about the nature of the fuel supply problem and its implications for so-called "nuclear renaissance," pointing out both the sharply rising cost of nuclear fuel and the lack of capacity to produce it.

Currently, much of the uranium used by the nuclear industry is mined in such countries as Australia, Canada, Namibia and, most recently, Kazakhstan. Smaller supplies are sourced in the western United States, but the United States is largely reliant on overseas supplies. The United States also relies on Russia for half its fuel, under a 'towards to ploughshares' deal that was signed in 1994. This deal is converting about 20,000 Russian nuclear reactors to fast reactors.

"Getting a new reactor online means a lot of years," Neff said. "It takes several years after the fuel is loaded to begin producing power. There are currently three to four years in Europe and Japan, and five to six years in the United States, depending on regulatory issues." Neff said. "The United States is not alone in this. The situation is the same in Japan and the European countries." Neff said. "The United States is not alone in this. The situation is the same in Japan and the European countries. The current problem is that the nuclear industry is fragmented and regional, and it is not able to provide a stable supply of fuel to meet the demand."

Neff said that "nuclear renaissance" is a misnomer. "The nuclear industry has never been renaissance, it has always been a 'swords to ploughshares' industry," Neff said. "The industry has never been able to provide a stable supply of fuel to meet the demand."

"The guiding principle of the new collaboration is that the ecosystems are allowed to self-organize as in the natural world," said Follows, a principal research scientist in MIT's Department of Earth, Atmospheric and Planetary Sciences (EAPS), lead author on the paper and creator of the model. "The fact that the phytoplankton that emerge in our models are analogous to the real phytoplankton gives us confidence.

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Teaching was the focus of the March 21 faculty meeting, where the faculty con- tinued its discussion of the recommenda- tions of the MIT Task Force on the Under- graduate Experience.

If approved, the changes to MIT's undergraduate curriculum would be the most far-reaching of the past half-century.

Among other recommendations, the task force called for a series of actions that task force members believe would improve the quality of undergraduate education at MIT.

Charles H. Stewart, department head and professor of political science, and Dean for Undergraduate Research J. Kim Vandiver, believe that students need to become more engaging as teachers and more involved in mentoring students. They noted the many hours of work that number of faculty that currently advise first-year students—instead of changing the requirement for the role of students to earn two separate undergraduate degrees versus two separate first-year degrees.

Other items that "excited faculty inter- est" when they were presented during the task force’s meeting on March 14 were actions that task force members believe would improve the quality of research and the need to improve undergraduate education by transitioning spaces and develop new ones to accom- modate the increased hands-on learning and research that students want and the report.

There are currently 66 faculty mem- bers assigned to advise first-year students, serv- ing around half of the incoming class. The faculty discussed whether students need more of a mentoring relationship with their advisors than a guidance counselor relationship. Faculty discussed whether advisor relationships should be considered when student course are reviewed to come up to create incentives for advisors to advising to their already busy schedules.

"We realized we had great teaching at MIT, while viewing the challenges during an advisor, he outlined a proposal to change an approach in which level courses were reserved for material that gave students "the big picture and got students excited" and "provided a framework" for the rest of the knowledge being presented in the class.

Reactions, Vandiver said, could become more geared toward helping stu- dents make sense of the catalog and require that students be more involved in the actual work of helping them understand their degree programs.

The faculty heard discussion of a pro- posed faculty advisorship in the Department to the Engineering to the Department of Bio- medical Engineering. Thomas Magnanti, dean of the School of Engineering, said that a five-year review of the division, which was presented in spring 2006, rec- ommended that the division eventually become a "new institute," which is expected to be approved at a future meeting.

Stewart read a resolution on the death of professor M. Meyer, political science profes- sor, in national security issues and passionate advocate of global biodi- versity, at a conference in Dec. 10, 2005. "As a scholar and courageous human being, Steve was one of the most important people in our lives," said. "Let the faculty record its moral principle of loss and sympathy to his family and friends.

The faculty held a moment of silence in Meyer’s memory. The faculty expressed its concern over the lack of diversity among faculty candidates and the need to increase the number of underrepresented groups in the faculty.

Continued from Page 4

Continued from Page 5

In the value of our approach.”

Grimsson and his colleagues to share what fit for survival in any particular area. Some students who are interested in the model completed its 10-year virtual evolution—which did five different parallel models— is that the phytoplankton community with members that are character- istic of observed phytoplankton commu- nities, including plants similar to proclo- roococcus that are extremely abundant in the warm midlatitude Atlantic and Pacific oceans.

Chisholm said this is the first major change in the way scientists approach ocean models in many years. He believes it will serve to break down disciplinary barriers between the physical and biologi- cal communities.

The Paradigm Consortium of the National Science Foundation, the National Science Foundation, the Department of Energy, the Gordon and Betty Moore Foundation, and the MIT Global Habitat Longevity Award provided funding for a major effort to enhance.

Chisholm, Follows and Putnickian plan to use this new type of model to look in more detail at what shapes the habitats of the phytoplankton and to link this to other, larger scientific issues about oceans, the plants and creatures living in them and global climate.

"It’s just the beginning,” said Chisholm. "Now we can begin to ask the really big question about the role of oceanic microbes in global processes. This will help guide deci- sions about the regional distribution of the slops in this era of global change.”

Vehicles


For sale


PRC (2002) 1999 Jeep Wrangler. Red w/ tan interior, 11,300 miles. 4x4 runs great. Camper top, full load of extra's. Some work. $3,000 Offer. E-mail Kevin at a330046@mit.edu.

Miscellaneous

Typical want to work on book in mathemati- cal physics. Professor in LaTeX. Required. Pays rate of $5 per page completed. Typed page. Contact N. Prakash at 617-490-6746.

Sharper Image Ionic Breeze Quartz Air Purifiers, ionic. In good condition. Some work. $30.00 Offer. E-mail Kevin at a330046@mit.edu.

From MacDull, $3,000. Contact Robert at 617-332-8251 or rgunder@mit.edu.

2005 Honda Odyssey. Contact 617-332-8251 or rgunder@mit.edu.

Classifieds

1990 Honda Accord. Contact 617-332-8251 or rgunder@mit.edu.

1999 Isuzu Trooper. Contact 617-332-8251 or rgunder@mit.edu.

1989 Ford Explorer. Contact 617-332-8251 or rgunder@mit.edu.

1998 Honda Civic. Contact 617-332-8251 or rgunder@mit.edu.

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1995 Honda Civic. Contact 617-332-8251 or rgunder@mit.edu.

1999 Dodge Neon. Contact 617-332-8251 or rgunder@mit.edu.

1998 Ford Mustang. Contact 617-332-8251 or rgunder@mit.edu.

1996 Ford Contour. Contact 617-332-8251 or rgunder@mit.edu.

1992 Saturn SC1. Contact 617-332-8251 or rgunder@mit.edu.

1993 Toyota Corolla. Contact 617-332-8251 or rgunder@mit.edu.

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McG Jacobs of the MIT history section makes a point during a recent colloquium about the 1970s of crisis.

During the energy crisis of the 1970s, many people believed that fully loaded tankers lingered just offshore, waiting for oil prices to go up. It was an era in American history, said McG Jacobs, Class of 1947 Career Development Associate Professor, when “the dominant cultural and social events came together to create a perfect storm.”

Jacobs spoke at a Science, Technology and Society colloquium March 19. A political historian, Jacobs said she is writing a book on the energy crisis because it provides a good example of how chaos can erupt when there is a disconnect between what citizens expect and how government reacts. For anyone who owned a car in 1973, it’s hard to forget the long lines at the pumps, the “sold out” and “no gas today” signs, the rationing and the gas station attendants who carried guns for self-protection.

What caused the crisis was the Organization of Arab Petroleum Exporting Countries’ (OAPEC, which was the Arab members of OPEC plus Egypt and Syria) embargo on shipping petroleum to nations that supported Israel in the Yom Kippur War between Israel, Syria and Egypt.

About the same time, OAPEC members agreed to use their leverage over the price-setting mechanism for oil to quadruple world oil prices, after attempts at negotiation with the major oil companies failed.

The problem worsened, Jacobs said, because most people didn’t believe the crisis was real. “They believed it was a temporary period caused by big oil to reap high profits, and they also blamed government,” she said.

Americans were not prepared for an energy shortage. They drove cars like the 1950 Cadillac Coupe de Ville, 5,000-pound “living room on wheels,” and took the presence of cheap and abundant energy for granted. The Department of Energy didn’t exist yet because energy was not the major issue of the day.

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Researchers at HST have developed a device that allows them to control the distance between cells. The cells are placed on combs, which can be fully separated (left), locked together with combs in contact (middle) or slightly separated (right).

HST device draws cells close—but not too close—together

Elizabeth Dougherty
Harvard-MIT Division of Health Sciences and Technology

In a popular children’s game, participants stand as close as possible without touching. But on a microscopic level, coaxing cells to be very close without actually touching one another has been among the most frustrating challenges for cell biologists.

Now MIT researchers led by Sangeeta Bhatia, associate professor of electrical engineering and computer science at the Harvard-MIT Division of Health Sciences and Technology (HST) and Brigham and Women’s Hospital, have solved the problem with a novel device. The work promises to allow researchers to perform cellular experiments that were previously impossible.

Bhatia and HST postdoctoral associate Elliot Hui describe the device in the March 27 issue of the Proceedings of the National Academy of Science. Hui is first author of the paper.

The new device, a microelectromechanical system (MEMS), allows biologists to physically arrange cells to be either touching, close but not touching, or completely separated from one another. Further, they can change that configuration at will. And the device works without the use of tools such as the microscopes or robotic control arms typically required by MEMS devices.

Because cells communicate via signals transmitted both through the touching of cell membranes and through soluble molecules that flow between separated cells, biologists need to vary the spacing of cells to study their interactions. Also, since some signals induce a cell to change its internal programming, it is important for biologists to be able to rearrange cells over time to learn which signals spur change and which don’t.

In the past, researchers erected chemical “moats” around cells in an attempt to keep them close but separate over time. However, cells invariably bridge the divide.

“They are very good at crossing the moat,” said Bhatia, who performed several such experiments in graduate school.

Bhatia and Hui’s first thoughts about how to solve this cellular space and time problem involved another child’s game: plastic puzzles with squares that slide around on a grid. They wondered if they could put different cells on each square and then move them around.

This idea quickly evolved into an elegant tool designed expressly for biologists.

The device involves two separate comb-shaped pieces coated with living cells. These two pieces can click together at two settings: One allows cells on the edges of the combs to touch, the other maintains a gap of 80 micrometers across four cell widths. The assembly is geared so that switching between these two settings involves a movement of two micrometers, an amount controllable by the human hand.

The device could be very useful in exploring embryonic development, since cell-cell interactions dictate development of major organs over time, and cancer, in which supporting cells are thought to play a role in tumor formation.

The research was supported by the National Science Foundation, the National Institutes of Health and the David and Lucile Packard Foundation. Hui was supported by a Ruth L. Kirschstein National Research Service Award.

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Natural polyester makes new sutures stronger, safer

A major mathematical feat by a team of 18 scientists, including two from MIT, has received a commendation from Congress, one week after the work was made available to the public on the Internet.

On Tuesday, March 27, Rep. Jerry McNerney (D-Calif.) read a statement to Congress about the work, which involved mapping one of the largest and most complicated structures in mathematics. If written out on paper, the calculation describing this structure, known as $E_8$, would cover an area the size of Manhattan.

This graphic, based on a drawing by Peter McMullen, shows one visualization of the $E_8$ group recently mapped by mathematicians.

Congress commends $E_8$ math team

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