At MIT forum, Markey announces energy bill hearings

Congressman says energy research could address jobs, climate and security

David Chandler
News Office

At a policy forum hosted by MIT on Monday, April 13, Rep. Edward Markey (D-Mass.) announced that he and Rep. Henry Waxman (D-Calif.) will begin a series of high-level hearings next week in Washington to help refine the details of a clean energy bill they introduced two weeks ago.

The legislation, which was the focus of Monday's forum, aims to spur the development of clean energy and reduce global warming emissions by establishing national standards for renewable energy and energy efficiency, and by putting a cap on carbon dioxide and other heat-trapping emissions.

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Institute Professor John Deutch to be honored

Will be feted for 40 years of service

On the occasion of his 70th birthday, Institute Professor John Deutch is being honored with a symposium this Thursday in 10-250, featuring talks by leading figures from academia and government who have worked with him through the years.

In addition to his 40 years as a member of MIT’s faculty, initially in the Department of Chemistry (which he chaired), and then as dean of science and as provost, Deutch served several stints in government, most notably as the director of central intelligence during the Clinton administration. He also has been posting at Research Director of Defense and the Department of Energy. He earned his SB and PhD in chemical engineering from MIT.

The symposium in his honor, running from 2 p.m. to 5:30 p.m., will include talks by and former government officials including Secretary of Commerce George P. Shultz of Harvard, former Secretary of Defense and Head of Energy James R. Schlesinger, former Secretary of Defense Harold Brown, former National Security Advisor Brent Scowcroft, and former White House Chief of Staff John Podesta.

The event will be followed by a reception in the Bush Room, and is being sponsored by the Office of the Provost, the School of Science, the Department of Chemistry, and the MIT Energy Initiative.

'Slice of MIT' blogs on Institute culture

'Slice of MIT', a blog hosted by the MIT Alumni Association, presents daily doses of MIT culture — discoveries, alumni stories and campus happenings — gathered by staff, students, faculty and, soon, by guest alumni contributors such as photography/illustrator Owen Franken ’68.

The growing Slice of MIT (alum.mit.edu/slicefruit) blogroll includes the Running a Hospital blog by Paul Levy ’72, MCP ’74 as well as Climate Progress, an insider’s view of science and politics by Joe Romm ’82, PhD ’87. Jason Smithson ’04 writes about making a living playing poker on “Taking a Shot while Correlate” by Lou Levy ’72, MCP ’74 as well as Climate Progress, an insider’s view of science and politics by Joe Romm ’82, PhD ’87.

Institute Professor John Deutch

Conrad, Doyle named Guggenheim fellows

Professor Janet Conrad of physics and Associate Professor Patrick Doyle of chemical engineering are among the 180 artists, scientists and scholars awarded fellowships by the John Simon Guggenheim Memorial Foundation.

The foundation selects fellows on the basis of “stellar achievement and expectation of promise for continued accomplishment.” The latest fellows, announced this week, come from a field of 3,000 applicants and range in age from 29 to 70.

Conrad will use her fellowship to work on a new detector for large liquid argon experiments at MIT and Fermilab in Batavia, Ill., while Doyle will work on the development of soft functional microparticles.

Each fellow receives a grant adjusted to his or her needs, taking into consideration other resources and the purpose and scope of his or her plans.

Faculty meeting agenda for April 15

A regular meeting of the faculty will take place at 3-10 p.m. on Wednesday, April 15, in Room 10-250. The agenda includes:

• Vote to change Section 1.91 of the Rules and Regulations of the faculty
• Vote to approve a new version of 8.02 and changes to Section 2.84 of the Rules and Regulations of the Faculty
• Motion to implement changes to the HASS Requirement
• Presentation on the new interdisciplinary minor in energy and motion on the governance structure
• Report from the Committee on Disciple
• Presentation on changing the September student holiday
• Report from the Edgerton Award Selection Committee
• Motion to untable the April 16, 2008, motion on speaking privileges
• Remarks from the president
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MIT Tech Talk

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FORUM: Energy bill hearings at policy forum

Continued from Page 1

of President Barack Obama’s cabinet will be among the initial witnesses. President Susan Hockfield, in introducing Markley at the event, noted that the new bill “frames the problem vividly and proposes the kind of comprehensive, large-scale, market-based answers that the situation demands.” She added that it contains “powerful levers for change” that “we hope will support clean energy research, development and deployment.”

Given that solving the intertwined issues of energy, climate change, security and economic growth represents what is “perhaps the greatest challenge of this century,” Hockfield said MIT is an especially appropriate place to be launching such a discussion.

“At MIT, we like hard problems,” she said. “We are ready and eager to help in the invention and implementation of solutions.”

The event also featured remarks by John Holdren ’65, SM ’66, Obama’s new director of the Office of Science and Technology Policy, and by Carol Browner, Obama’s assistant for energy and climate change. They were joined by bestselling author on energy issues Daniel Yergin, and by MIT Energy Initiative Director Ernest J. Moniz.

Holdren said the world is getting most of the energy it requires from sources that are wrecking the environment it requires. But he believes that climate change is a major issue for MIT.

Albrecht said that climate change issues are often framed as a false choice between economic interests and environmental ones, but that in fact each depends on the other, and improvements in energy technology provide great economic opportunities. He said that climate change issues are often framed as a false choice between economic interests and environmental ones, but that in fact each depends on the other, and improvements in energy technology provide great economic opportunities. He said that climate change issues are often framed as a false choice between economic interests and environmental ones, but that in fact each depends on the other, and improvements in energy technology provide great economic opportunities.

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Browner said that while renewable energy now accounts for about 1 percent of U.S. electricity production, “we hope we can double that in the next three to four years.” And the new energy bill would help to make that possible.

But such rapid growth in new technology presents a big challenge, Moniz said. To make a dent in climate change, “these technologies must go to very large scale very quickly,” he said. That means it’s essential to be working on a multiplicity of options, and it will be essential to bring about “better integration of the entrepreneurial community with the existing energy companies. We need to get a win-win package that is greater than the sum of the parts.”

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MIT engineers have built a fast, ultra-broadband, low-power radio chip, modeled on the human inner ear, that could enable wireless devices capable of receiving cell phone, Internet, radio and television signals.

Rahul Sarapeshkar, associate professor of electrical engineering and computer science, and his graduate student, Soumyajit Mandal, designed the chip to mimic the inner ear, or cochlea. The chip is faster than any human-designed radio-frequency spectrum analyzer and also operates at much lower power.

“The cochlea quickly gets the big picture of what’s going on in the sound spectrum,” said Sarapeshkar. “The more I started to look at the ear, the more I realized it’s like a super radio with 1,500 parallel channels.”

Sarapeshkar and his students describe their new chip, which they have dubbed the “radio frequency (RF) cochlea,” in a paper to be published in the June/July issue of the IEEE Journal of Solid-State Circuits. They have also filed for a patent to incorporate the RF cochlea in a universal or software radio architecture that is designed to efficiently transmit a broad spectrum of signals including cellular phone, wireless Internet, FM, and other signals.

**Q.** What is the RF cochlea?

**A.** The RF cochlea mimics the structure and function of the biological cochlea, which uses fluid mechanics, piezoelectrics and neural signal processing to convert sound waves into electrical signals that are sent to the brain.

As sound waves enter the cochlea, they create mechanical waves in the cochlear membrane and the fluid of the inner ear, activating hair cells (cells that cause electrical signals to be sent to the brain). The cochlea can perceive a 100-fold range of frequencies — in humans, from 100 to 10,000 Hz. Sarapeshkar used the same design principles in the RF cochlea to create a device that can perceive signals at million-fold higher frequencies, which includes radio signals for most commercial wireless applications.

“The device demonstrates what can happen when researchers take inspiration from fields outside their own,” said Sarapeshkar. “Somebody who works in radio would never think of this, and somebody who works in hearing would never think of it, but when you put the two together, each one provides insight into the other,” he says. For example, in addition to its use for radio applications, the work provides an analysis of why cochlear spectrum analysis is faster than any known spectrum-analysis algorithm. Thus, it sheds light on the mechanisms of hearing as well.

The RF cochlea, embedded on a silicon chip measuring 1.5 mm by 3 mm, works as an analog spectrum analyzer, detecting the composition of any electromagnetic waves within its perception range. Electromagnetic waves travel through electronic inductors and capacitors (analogous to the biological cochlea’s fluid and membrane). Electronic transistors play the role of the cochlea’s hair cells.

**Q.** What’s next for AGNES?

**A.** AgeLab’s Research Laboratory of Electronics, has also developed analog speech-synthesis chip inspired by the human vocal tract and a novel analysis-by-synthesis technique based on the vocal tract. The chip’s potential for robust speech recognition in noise and its potential for voice identification have several applications in portable devices and security applications.

The researchers have built circuits that can analyze heart rhythms for wireless heart monitoring, and are also working on projects inspired by signal processing in cells. In the past, his group has worked on hybrid analog-digital signal processors inspired by neurons in the brain.

Sarapeshkar says that engineers can learn a great deal from studying biological systems that have evolved over hundreds of millions of years to perform sensory and motor tasks very efficiently in noisy environments while using very little power.

“Humans have a long way to go before their architectures will successfully compete with those in nature, especially in situations where ultra-power-efficient or ultra-low-power operation are paramount,” he said. Nevertheless, “We can mine the intellectual resources of nature to create devices useful to humans, just as we have mined her physical resources in the past.”

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**Q.** How will aging differ in the future?

**A.** Studies indicate cognitive decline may begin by age 40 than you did at age 20. So aging is profoundly younger than people think. Aging is really about your life tomorrow. So how will aging differ in the future?

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**Q.** What’s next for AGNES?

**A.** The next stage is developing more quantitative performance metrics. It’s one thing to “feel their pain,” so to speak. It’s quite another to be able to start saying to industry, to government and to designers in general, "This is the metric you need to think about when you design your lives tomorrow — we think aging requires a new box of tools."
It’s a fine line
New method could lead to narrower chip patterns
David Chandler
News Office

Researchers at MIT have found a novel method for etching extremely narrow lines on a microchip, using a material that can be switched from transparent to opaque, and vice versa, just by exposing it to certain wavelengths of light.

Such materials are not new, but the researchers found a novel way of harnessing that property to create a mask with exceptionally fine lines of transparency. This mask can then be used to create a correspondingly fine line on the underlying material.

Producing such fine lines is crucial to many new technologies, from microchip manufacturing that is constantly seeking ways to cram more components onto a single chip, to a whole host of emerging fields based on nanoscale patterns. But these technologies have faced fundamental limits because they tend to rely on light to produce these patterns, and most techniques cannot produce patterns much smaller than the wavelengths of light itself. This method is a way of overcoming that limit.

The key is using interference patterns, in which different wavelengths of light sometimes reinforce each other and in other places cancel each other out. The researchers exposed the photochromic material — one that changes its color, and therefore its transparency, in response to light — to a pair of such patterns, each of a different wavelength, simultaneously. When the bright lines at one wavelength coincide with the dark lines at the other wavelength, extremely narrow lines of clear material are formed interspersed with the opaque material. This banded layer then serves as a mask through which the first wavelength illuminates a layer of material underneath, similarly to the way a photographic negative is used to make a print by shining light through it onto a sheet of photo paper underneath.

The research was carried out by research engineer Rajeesh Menon of the Research Laboratory of Electronics and graduate students Trisha Andrew in the Department of Chemistry and Hsin-Yu Tsai in the Department of Electrical Engineering and Computer Science, and was reported in a paper published in the April 10 issue of Science.

Remarkably, the new technique, in which the researchers call absorbance modulation, makes it possible to create lines that are only about one-tenth as wide as the wavelength of light used to create them. Part of the trick was to find a suitable photochromatic material whose clear and opaque parts would remain stable after the initial exposure to light.

Using this method, the team produced lines just 16 nanometers wide, and they say they could also place many such lines spaced a similar distance apart.

Such a technique “could have a significant impact on chip making,” Menon says, and could also help to enable new work in a variety of emerging fields that rely on nano-scale patterning, including nanophotonics, nanoelectronics, and nano-biological systems.

Already, a company has been formed to develop this technology, and Menon says he expects it to lead to commercial production within five years.

But that’s not the only potential application of the approach. Menon says his team is pursuing possible use of the same system for imaging systems, which could enable new kinds of microscopes for observing nanoscale resolution, with possible applications in biology and in materials science.

The work was partly funded by grants from LumArray Inc., where Menon is co-founder, the MIT Deshpande Center for Technological Innovation, and DARPA.

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More to the waterfall illusion than meets the eye
Motion illusions reveal new insights into perception: How you feel the world impacts how you see it
Cathryn Delude
McGovern Institute

In the classic waterfall illusion, if you stare at the downward motion of a waterfall for some period of time, stationary objects — such as rocks — appear to drift upward. MIT neuroscientists have found that this phenomenon, called motion aftereffect, occurs not only in our visual perception but also in our tactile perception, and that these senses actually influence one another. Put another way, how you feel the world can actually change how you see it — and vice versa.

In a paper published in the April 9 online issue of Current Biology, researchers found that people who were exposed to visual motion in a given direction perceived tactile motion in the opposite direction. Conversely, tactile motion in one direction gave rise to the illusion of visual motion in the opposite direction.

“Our discovery suggests that the sensory processing of visual and tactile motion use overlapping neural circuits,” explained Christopher Moore of the McGovern Institute for Brain Research at MIT and senior author of the paper. “The way something looks or feels can be influenced by a stimulus in the other sensory modality.”

Volunteers watched visual motion on a computer screen while placing their right index finger on a tactile stimulator directly behind the screen. The stimulator consisted of a centimeter-square array composed of 60 pins to deliver precisely controlled vibrations to the fingertips. This stimulator, the only one of its kind in the world, was developed by Qi Wang, now at the Georgia Institute of Technology, and Vincent Hayward, now at the Université Pierre et Marie Curie in France.

To test the effect of visual motion on the subjects’ perception of touch, the monitor displayed a pattern of horizontal stripes moving upward or downward for 10 seconds. After this visual pattern had disappeared, a single row of horizontal pins simultaneously vibrated the subjects’ fingertips. Although the pins delivered a static burst of vibration, all eight subjects perceived that the row of pins was sweeping either upward or downward, in the direction opposite to the movement of the preceding visual pattern.

To test the effect of tactile motion on visual perception, adjacent rows of pins vibrated in rapid succession, creating the sensation of a tactile object sweeping up or down the subjects’ fingertips. After 10 seconds of this stimulus, the monitor displayed a static pattern of horizontal stripes. Contrary to the prevailing assumption that vision always trumps touch, subjects perceived the stripes as moving in the opposite direction to the moving tactile stimulus.

Photos of the motion stimuli used in this study can be seen at: http://mcgovern.mit.edu

Aftereffects were once thought to reflect fatigue in the brain’s circuits,” said Konkle, “but now we know that pools of neurons are continuously coding motion information and recalibrating the brain to its sensory environment. Our neurons are not tired, they are constantly adapting to the world around us.”

Recent studies have found that a region of the visual cortex known as MT or V5 — long thought to play a major role in the perception of motion — may also process tactile motion. Moore’s team intends to explore this brain region in future studies to determine whether it contributes to these cross-modal motion aftereffects.

“Neuroscientists study perceptual illusions because they help reveal how the brain gives rise to conscious experience,” said Konkle. “We don’t experience the world through isolated senses, and our data support the emerging view that the brain is organized for cross talk among different sensory modalities.”

The research was supported by the McGovern Institute for Brain Research at MIT, the Mimsi Foundation, National Defense Science and Engineering Graduate Fellowship, Eric L. Adler Fellowship, Natural Sciences and Engineering Research Council of Canada, and McGill University.

Above right: This stimulator was used in a study to show that how humans feel the world can actually change how they see it — and vice versa. The device consists of a centimeter-square array composed of 60 pins to deliver precisely controlled vibrations to the fingertips.

PHOTO: JEREMY KOHL/NEURON/MCGOV.MIT.EDU/LUMARRAY
Cambridge Science Festival keeps on growing

Annual event, now in its 3rd year, begins April 25

Patrick Gillooly
News Office

The organizers of the rapidly growing Cambridge Science Festival — which will kick off its third year on April 25 — have ambitious plans for the future that include expanding the festival’s outreach beyond just nine days each spring.

“There is every sign that the festival has become an established part of the calendar in Cambridge,” says John Durant, director of the MIT Museum, which organizes the festival. “We’re now talking about tens of thousands of people engaging with science and technology through the festival.”

The festival, which aims to showcase and make accessible the wide range of scientific research going on across Cambridge, began in 2007, when approximately 15,000 people attended. In 2008, attendance ballooned to an estimated 28,000. That rapid growth has put a demand on physical space to house the festival’s 200-plus events, and a desire to shift the scope of the festival’s mission.

This year, for example, organizers have moved the popular Science Carnival — a free, all-ages event offering hands-on science experiments and live stage performances — from Cambridge City Hall to MIT’s more spacious Kresge Auditorium. The festival events, many of which are free, run daily from April 25 until May 3. For a complete list of events, visit http://cambridgesciencefestival.org.

There are so many wonderful things that are happening at MIT, and people sometimes have no clue,” she says, adding that the festival “showcases some globally significant and remarkable research that is going on here. The people in those labs want to show the world what they are doing.”

The festival’s success has even spawned imitators. Organizers of San Diego’s first citywide science festival, which took place several weeks ago, looked to MIT and the CSF for guidance in their planning, d’Arbeloff says. Some of the festival’s other highlights this year include:

• “The Brain Experience: Speaking of the Brain” (6:30 p.m., April 29, WGBH Yawkey Theater)
• “The Science of Baseball” (noon, May 1, Broad Institute)
• “The Brain Experience: Speaking of the Brain” (6-9 p.m., April 28, 43 Vassar St.)
• “‘The Science of Baseball’ (noon, May 1, Broad Institute)
• “NOVA: Meet the producers” (6:30 p.m., April 29, WGBH Yawkey Theater)
• “Third Annual Trivia Challenge!” (6-9 p.m., April 29, Stata Center)

Are you smarter than a fifth-grader?

The Science Trivia Challenge, a contest hosted by the MIT Club of Boston, is a staple of the annual Cambridge Science Festival. It’s a live team trivia quiz where contestants are challenged on their knowledge of science, technology and other subjects. This year, the event will be held from 6-9 p.m. on Wednesday, April 29, in the Stata Center.

The following are a series of questions from previous years in both the youth division (under 18) and the open division (any age).

YOUTH DIVISION #1

In 1994, two doctors in Perth, Australia, published their discovery that most stomach ulcers are caused not by stress but by a common spiral-shaped bacterium now known as Helicobacter pylori. This bacterium is able to survive in the human stomach because it releases enzymes that produce what?

(a) ammonia
(b) ethyl alcohol
(c) hydrochloric acid
(d) sodium chloride
(e) valine

YOUTH DIVISION #2

The new definition of a planet contains three criteria. For 5 points each, pick which two of the following are NOT part of the IAU’s final definition of a planet:

(a) has an orbit around the Sun
(b) is by far the largest object in its local population
(c) has enough self-gravity to assume a nearly-round shape
(d) has cleared the neighborhood around it
(e) does not produce energy by a nuclear fusion mechanism

OPEN DIVISION #1

One of the biggest controversies in the history of mathematics was over who “invented” the field of calculus. Ultimately, Isaac Newton and Gottfried Leibniz were co-credited with inventing it independently of one another, while each accused the other of plagiarizing their work. However, the word “calculus” to describe the field was coined by Leibniz, and modern calculus mainly uses Leibniz’ notations. What “f-word” did Newton use to describe his version of calculus?

(a) fascinations
(b) fissions
(c) ections
(d) fractions
(e) frations

Answers are at the bottom of the page.

“It’s awards season

The MIT News Office will publish the 2009 Institute Awards issue in print (MIT Tech Talk) and online on June 3 this year. The annual special section lists winners of annual awards, by department, along with photographs where available.

Complete information on how to submit awards is available at http://web.mit.edu/newsoffice/awards.html, but please note that the deadline is 3 p.m. on Friday, May 22, in order to be included in the awards issue. Do not submit Infinite Mile Awards or awards from outside organizations.

Any and all photographs are also welcomed and can be e-mailed to gilloy@mit.edu. Please send them as attachments, in .jpg format with a resolution of 300 dpi if possible. Please clearly identify the subjects and include the name of the photographer, as we cannot run them without that information.
Dialect Detectives

System that distinguishes among variants in spoken languages could enhance automated machine translation

Dorothy Ryan
Lincoln Laboratory

A law enforcement agency intercepts an international phone call alerting a suspected drug dealer to a new shipment. While the translator listening to the message is confident the caller’s Spanish carries a South American accent, he cannot pinpoint a more specific region for agents to put under surveillance. But technology under development by Pedro Torres-Carrasquillo and his colleagues at Lincoln Laboratory may lead to a dialect identification system that compensates for translational inaccuracy with multiple variants of a spoken language.

Language identification systems that can recognize as few as 29 written words from written text are already marketed, and systems that can identify a spoken language from a prescribed range of choices also exist. So far, however, no system that automatically discriminates one spoken dialect from another is available.

Lincoln Laboratory’s earlier work on dialect identification focused on building models that mapped the audio-frequency patterns of phonemes — the individual sounds of a spoken language. Torres-Carrasquillo, an electrical engineer specializing in speech processing in the laboratory’s Information Systems Technology Group, says his group has more recently moved from this phonetic-based approach to lower-level acoustic systems that use the basic spectral similarities of small pieces of spoken utterances. “We are not looking for the types of data linguists deal with — larger units such as phonemes and words,” he says. “We’re looking at the statistical distributions of basic frequency spectra of small pieces of sounds.”

The laboratory researchers are building a model that classifies the training data, finding markers that discriminate the frequency characteristics of the data. Previously, Torres-Carrasquillo says, the approach was to “get a lot of examples, and then build a model that looks like your examples.” But he is tackling the problem in a different way. “Our group’s idea is that we don’t need a model that looks like our data — we need a model that can classify our data,” he explains. “We take very small pieces — snip petticoat snippets — turn them into frequencies, add up all those contributions, and make a model that can tell them apart. We’re looking for patterns from just milliseconds of speech.”

The researchers are using pattern recognition and classification methods known as support vector machines (SVMs) and Gaussian Mixture Models (GMMs) that use models trained to emphasize the more distinctive tiny features seen in the frequency patterns of small pieces of the dialects in question. The trained GMMs have the edge in accuracy, but SVMs are “an order of magnitude faster than the GMM,” according to Torres-Carrasquillo. Even more effective than either SVMs or GMMs alone, he says, is combining the two techniques. In a test to discriminate general American English from Indian-accented English, for example, the error rate was 10 percent when GMM was used alone, 13 percent for SVM alone — and only 7 percent for a fusion of GMM and SVM.

“To be incorporated into an automatic machine translation system, a dialect identification system would have to be able to recognize a dialect without having to process lengthy strings of speech data. Torres-Carrasquillo’s goal is to be able to determine a speaker’s dialect by categorizing discrete, characteristic markers in the snippets, and then create a model without using large sets of training data. ‘We’d like to see a short-term spectrum characteristic that is a strong discriminator, is very pervasive in the dialect, and that could be reliably detected in a sample,’” he says. Finding this characteristic is a tall order. “You’re not going to have a single spectrum characteristic that gives away the identification,” Torres-Carrasquillo says. The linguistic differences between dialects of a language are often small; for example, vowel sounds in Cuban Spanish are slightly longer than those of Puerto Rican Spanish.

The subtle differences between the spectral pictures of dialects are difficult to detect, especially in the milliseconds of seconds of speech used in the laboratory experiments. “But as you look at the data” says Torres-Carrasquillo, “the differences start to pile up and you have a profile.” The laboratory’s work to classify dialect differences, Torres-Carrasquillo presented at a September 2008 speech communication and technology conference in Australia, may lead to the discovery of a strategy for any dialect problem — a global approach that could be exploited for various classes of dialects instead of a method that works only for specific dialects.

The Lincoln Laboratory research on dialect identification may contribute to approaches for language identification more generally, but Torres-Carrasquillo offers a caveat: “The differences one can exploit within two dialects are very specific — maybe too specific to be applicable to language ID.” Still, when a universal machine translation system arrives on the scene in some future decade, it may well depend on Lincoln Laboratory research to ensure that nuances of meaning conveyed in dialects are not lost in translation.
quality,” says Associate Provost and Ford International Professor of History Philip S. Khoury, who has known Harbison for nearly 30 years. “He is one of the world’s most distinguished and musically versatile composers, and he has always been completely devoted to teaching and, as he would say, learning from our remarkably talented students.”

An artist known for lucidity and logic in his compositions and performances, Harbison is equally adept at opera, choral and jazz. His Pulitzer Prize came in 1987 for his choral work “The Flight into Egypt,” with text from the Gospel of Matthew. Two years later, he was awarded a MacArthur “genius” grant for his work, and in 1995 he became an Institute Professor — the highest honor MIT can bestow on a member of the faculty.

Harbison, who is currently working on music inspired by Alice Munro’s short stories, says MIT students bring with them the right ingredients for studying, composing and performing music: high intelligence, logical thinking, interest in science and a curiosity about how things are made. In true MIT spirit, he tells students to break new ground and take risks.

“Go out and write things that your teacher won’t necessarily approve of,” he advises.

Music on the Mind

Whether it’s tinkering with music-editing software, performing in one of MIT’s eight professionally led music groups or making brain waves audible, music at MIT can mean many things.

In the Department of Brain and Cognitive Sciences, associate professor Pawan Sinha and graduate students are working on ways to create music and art from brainwaves. Intrigued with the possibility of understanding how mind extract meaning from sounds, Sinha has charted the electroencephalographic (EEG) response of brain neurons to tone sequences. Using a form of video gaming technology that picks up these brain signals and by associating them with specific sounds, Sinha eventually hopes to allow an individual to “perform” in an orchestra simply by thinking. Sinha is also designing a “Your Brain on Music” program in which a person would watch a shifting electronic projection of EEG signals that reflects his or her brain’s response to a piece of music. And, in what is perhaps his most ambitious project, Sinha hopes to design a “Brain Jukebox” that would let listeners hear music through the transformational lens of another person’s brain.

Sinha’s research is in line with MIT’s emphasis on interdisciplinary collaborations — and he is not alone in melding music with basic or applied research. Elaine Chew SM ’98, PhD ’00, an engineer and pianist who has composed piano works based on mathematical models, says her engineering and music studies at MIT were entwined. “There are deep connections between the way the human mind works when making music, and when it solves problems in the sciences,” she says. “Asking if my music studies help my engineering studies is analogous to asking a computational biologist if her biological studies help her statistical studies.”

Talented students, talented teachers

Chew’s passion for music is fairly typical of the average MIT student. More than 60 percent of incoming freshmen declare advanced proficiency in a musical instrument, and at least 1,400 MIT students enroll each year in a music or theater arts class. As part of the Emerson Program for Private Instruction, the Institute offers scholarships each year to some 50 of its most talented scholar-musicians to pursue private instruction on their instrument with local master teachers.

While only a few students pursue a full-time career in music, many graduates incorporate performance or composing into their professional and private lives. Such alumni include Eran Egozy ’95, MEIng ’99, and Alex Rigopoulus ’92, SM ’94, who founded the company that created “Guitar Hero.” This hugely popular video game emerged from the pair’s interest in providing a way for average people to express themselves musically through technology.

“Students are engaged in music and the arts in general at MIT as they are with all their other academic work with intensity, passion, commitment and rigor,” says Fred Harris, director of wind ensembles and lecturer in music. “Over and over I am told by students and alums that it’s the opportunity to explore, study, create and perform music that is among their most important, treasured and long-lasting experiences at MIT.”

Janet Sonenberg, professor of theater arts and head of the Music and Theater Arts Section, says much of the credit for MIT’s creative music spirit goes to Harbison, who made it possible to attract an “extraordinary” group of arts faculty to MIT. Harbison, in turn, praises MIT for seeking to hire faculty with new approaches instead of merely content to hand the baton to professors cut from the same template.

Such hires include Evan Ziporyn, the Kenan Sahin Distinguished Professor of Music. In 1993, Ziporyn founded the Gamelan Galak Tika, a Balinese music ensemble, not because it was logical for the Institute to have such a group but because he thought it would fit the Institute’s quirky, expansive nature. “The kind of person that is going to seek out a Gamelan is similar to the kind of person who is going to seek out a robot club to build robots,” he says. Teaching music at MIT was once thought to be about training the audiences of tomorrow, but today it’s about letting students have all manner of musical experiences, says Ziporyn. Among other things, he has taught a course in computer music composition, in which students write music with computer-processed sound. Many of these students write that course have little formal music training, but know far more about computers than he does, Ziporyn says.

“One of the things I always love about teaching a computer music course is I would have all students in there making pieces of really weird music,” Ziporyn says. “They ended up realizing, ‘I can write a piece of music. Maybe I’m not Mozart, but I can write a piece of music.’”

The Harbison celebration concert, which begins at 8 p.m., April 24 in Kresge Auditorium, is free and open to the public. For more information, please visit: http://web.mit.edu/arts/announcements/pro/2009/0422_Harbison.html

Some of MIT’s music ensembles include, clockwise from top left, Rambax MIT, MIT Chamber Music Society, MIT Festival Jazz Ensemble, Gamelan Galak Tika. Institute Professor John Harbison is shown in the top middle.

PHOTOS/HARVARD TAYLOR

MUSIC: Celebration of Harbison’s life showcases the importance of music at MIT

Continued from Page 1

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