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TechTalk
SERVING THE MIT COMMUNITY

MIT math model could aid natural gas production

Nancy Stauffer
Laboratory for Energy and the Environment

MIT engineers have developed a mathematical model that could help energy companies produce natural gas more efficiently and ensure a more reliable supply of this valuable fuel.

The researchers are now collaborating with experts at Shell to apply the model to a natural gas production system in Malaysia.

Natural gas consumption is expected to increase dramatically in the coming decades. However, in the short term, demand for this clean-burning fuel is highly volatile. Because natural gas is difficult to transport and store, energy companies tend to produce it only when they have buyers lined up and transportation capacity available, generally under long-term contracts. As a result, they miss opportunities for short-term sales, and the overall availability of natural gas is reduced.

Natural gas companies would like to operate their production networks more efficiently and flexibly. But operators can be overwhelmed by the sheer number of choices to be made and obligations to be met under supply contracts with customers and facility- and production-sharing agreements with other companies.

Paul I. Barton

According to Professor Paul I. Barton of the Department of Chemical Engineering, the only way for a company to optimize such a system—that is, to operate it so as to best meet all obligations, objectives and constraints—is to formulate it as a mathematical problem and solve it.

"If there were just one or two decisions to make, an engineer could do it," he said. "But when you've got 20 valves to set and 50 different constraints to satisfy, it's impossible for a person to see. Computer procedures can take all of that into account."

Barton and chemical engineering graduate student Ajay Selot have spent the past two years developing a mathematical model to help guide operators' decisions one to three months in advance. The model focuses on the "upstream supply chain," that is, the system from the natural gas reservoirs to bulk consumers such as power plants, utility companies and liquefied natural gas plants.

While other models have focused on optimizing individual subsystems, the new

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Chemist has new spin on electron behavior

Troy Van Voorhis likes to watch how things work. This natural curiosity led to his current research on the behavior of electrons and how they function in various molecular systems, including artificial photosynthesis. The theories and simulations he and his team create may help lead to improvements in devices such as electronics, solar cells and lighting.

PHOTO / **DONNA COVENEY**

Troy Van Voorhis, winner of the 2006 Packard Foundation Fellowship, studies electron behavior and artificial photosynthesis.

Now the MIT assistant professor of chemistry will have more opportunities to explore new simulations. Van Voorhis is one of 20 promising researchers recently awarded the 2006 David and Lucile Packard Foundation fellowship. He will receive an unrestricted research grant of $625,000 over five years.

"This frees me long term to develop methods to make reliable predictions about the transfer of electrons, which is the most basic chemical reaction," said Van Voorhis, 30. "It is dif-

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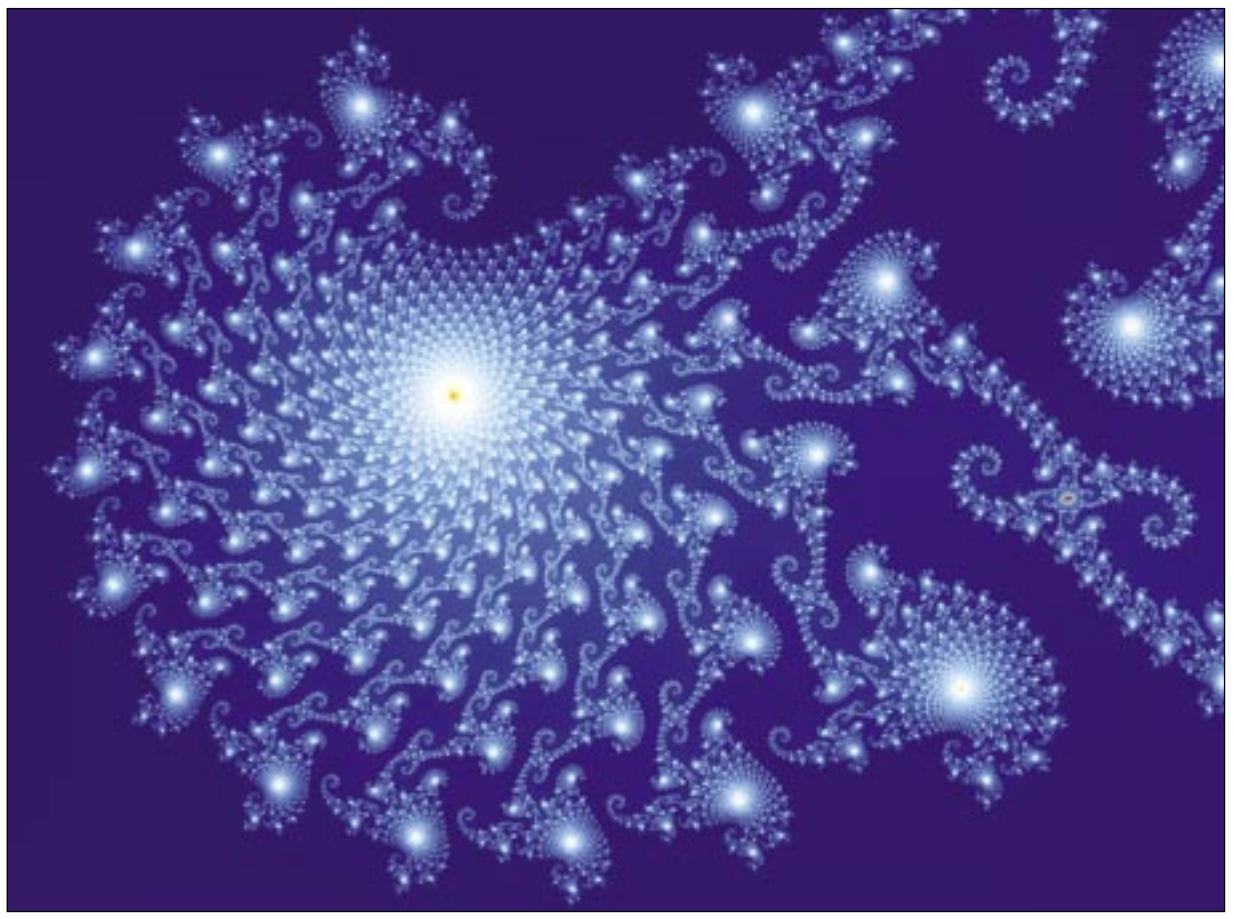

IMAGE / **WOLFGANG BEYER**

Fun with fractals

This fractal image is part of the Mandelbrot Set, named for the mathematician who first described it, Benoit Mandelbrot. Mandelbrot, known as the "father of fractal geometry," spoke at MIT on Nov. 8. Story on page 4.

Faculty discuss task force report, curriculum changes

Anne Trafton
News Office

Faculty discussion of the new curriculum changes proposed by the Task Force on the Undergraduate Educational Commons continued last week at the Nov. 15 faculty meeting.

About 200 faculty members attended the meeting, which was held in the Stata Center's Kirsch Auditorium. This was the faculty's second chance to discuss the proposed changes, which constitute the most dramatic changes to the MIT core curriculum in the past 50 years.

The recommendations, which include new requirements in science, mathematics and engineering as well as in the humanities, arts and social sciences, also promote an increased role for international educational experiences for undergraduates.

At the beginning of the meeting, President Susan Hockfield announced that the Dec. 20 faculty meeting has been cancelled but another meeting has been scheduled for Nov. 29 to continue discussing the proposed curriculum changes. At that meeting, the faculty will vote on a motion to delay any votes on the proposal until at least February, to give the faculty more time to talk about it.

Steven Lerman, professor of civil and environmental engineering and chair of the faculty, suggested that during the next few months, the faculty officers hold forums and gather comments from other faculty members on the proposed curriculum.

At last week's meeting, the floor was opened for faculty comment and three members of the task force—Dava Newman, Robert Redwine and Charles Stewart—answered questions and responded to comments from the faculty.

Shigeru Miyagawa, professor of foreign languages and literatures, praised the task force's commitment to encouraging international experiences. However, he pointed out that the new program may unintentionally make it more difficult for students to go abroad through the popular MISTI program.

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Julie Norris will serve as interim head, Office for Sponsored Programs

Julie T. Norris, who served for 10 years as director of MIT's Office of Sponsored Programs (OSP), has agreed to serve as OSP's interim director. Sherwin Greenblatt, executive vice president, and Claude R. Canizares, vice president for research and associate provost, announced in an e-mail to the MIT faculty and staff on Monday, Nov. 20.

Norris will assume her new position Dec. 2, following the departure of current OSP director Patrick W. Fitzgerald for a new position at Harvard University.

Norris is "widely recognized as one of the nation's leading experts in university research administration and is, of course, completely knowledgeable about MIT. We are extraordinarily grateful to her for returning to help us through this period of transition," they wrote. Since Norris' retirement in September 2004, she has served as a consultant to several universities, including MIT.

Norris will be "supported by the strong in-house management team, co-led by deputy director Patricia Greer and assistant director Colleen Leslie, and the very capable and dedicated OSP staff," said Greenblatt and Canizares. Leslie will continue to lead MIT's full implementation of the Grants.gov electronic proposal submission process. During this time, OSP will report directly to Canizares to "ensure close coupling to our research community," the e-mail stated.

Greenblatt and Canizares offered their "profound gratitude and very best wishes" to departing director Fitzgerald. A comprehensive and expedited national search for OSP's next director will be launched in the coming weeks. Any comments or suggestions regarding the search may be sent to vprassist@mit.edu.

No Tech Talk

Tech Talk will not be published on Wednesday, Nov. 29, due to the Thanksgiving holiday. The next issue will appear on Wednesday, Dec. 6. Check the News Office web site, web.mit.edu/newsoffice, for news updates.

NEWS YOU CAN USE

Thanksgiving airport shuttle available

The Parking and Transportation Office will once again provide shuttle service to Logan Airport for the Thanksgiving Break. Shuttles will be available today. Advance reservations are required. Please visit the Parking and Transportation Office web site, web.mit.edu/facilities/transportation/shuttles/airport.html, for details and shuttle availability. The shuttle fee is $7. All reservations will be processed via the web site and the shuttle fee will be billed to student bursar accounts or via employee payroll deductions.

Shuttles will depart from the Kresge parking lot at the scheduled time and will not wait for late arriving passengers. Normal trip time from MIT to Logan Airport is about half an hour, but please allow up to one hour for this trip. Traffic, construction and airport security delays should be expected.

Book sale

The MIT Libraries will hold a book sale on Thursday, Nov. 30, from 10 a.m. to 3 p.m. in the Bush Room (10-105). Books will be available in diverse areas including biology, chemistry, engineering, fiction, history, linguistics, math, physics, computer science, management, economics, political science and social science. Proceeds benefit the Libraries' Preservation Fund. The sale is open to the MIT community only. For more information, visit libraries.mit.edu/news.html.

Credit union

The MIT Federal Credit Union will be sponsoring an enhanced coffee break on Tuesday, Nov. 28. Please stop by to enjoy refreshments and talk to the MITFCU staff regarding the benefits of membership and the credit union's products and services. Join the MIT Federal Credit Union from 9:30 a.m. to 2 p.m. in E51, Ting Foyer. Enter into a drawing to win a $25 American Express gift check.

Furniture Exchange opens its house

The MIT Student Furniture Exchange is hosting two open house events, both with refreshments, on Saturday, Dec. 2, from 10 a.m. to 1 p.m., and on Tuesday, Dec. 5, from 10 a.m. to 4 p.m. Anyone affiliated with the Institute may browse among the bargains, including appliances, furniture and housewares. An MIT ID is required to make a purchase.

The Furniture Exchange, known as FX, is located in the rear of Building WW15 at 350 Brookline St. near Central Square in Cambridge. Parking is available.

Normal business hours are 10 a.m. to 4 p.m., Tuesday and Thursday, and 10 a.m. to 1 p.m. on the first Saturday of each month.

FX welcomes donations year round. FX accepts upholstered furniture, tables, bookcases and shelves, desks, beds and futons, dressers, cabinets and household goods of all kinds, including small appliances in good working order, cookware, dishes and glassware, lamps, bric-a-brac, rugs, children's items and used bikes. All donations must be in good condition.

Pick-ups of large donations can be arranged. For more information, call x3-4293 or visit web.mit.edu/womensleague/fx.

FX happily provides a tax donation letter.

All proceeds from FX sales are donated to the Women's League Scholarship Fund. Anyone interested in volunteering, even just a few hours a week, may contact FX manager Judy Halloran at x3-4293.

MBTA fare increases and T pass types

An MBTA fare increase will take effect on Jan. 1, 2007. In addition to the fare increases, there will be a change in T pass types. The Subway, Combo and Combo Plus pass types will be replaced by a new, reusable LinkPass card. The LinkPass (also called a "Charlie Card") will expand rider options by providing unlimited travel on the local bus and rapid transit network. Commuter Rail and Commuter Boat riders will continue to pick up a monthly T pass, called the Charlie "Ticket." Although the price of the T passes will go up, MIT staff who purchase their passes through the Parking and Transportation Office will continue to receive the same level of subsidy from the Institute. For more information, visit web.mit.edu/facilities/transportation.

OBITUARY

Stephen J. Madden Jr.

Stephen J. Madden Jr., a retired professor who taught in several MIT departments, died Oct. 7. He was 70.

Madden, a mathematician by training, worked at Draper Laboratory and taught in the Departments of Mathematics, Aeronautics and Astronautics, and Earth and Planetary Sciences.

Much of his research involved celestial navigation, flight, fluid mechanics and gravity. As part of the Apollo missions, he was responsible for determining the precise location of the moon throughout the mission, allowing the deployment and redocking of the lunar module to the mother ship.

Later, at Draper Laboratory, he performed early research on GPS systems. One of his last projects was for the LIGO (Laser Interferometer Gravitational-Wave Observatory) system, designed to detect gravity waves from distant supernovas, yielding clues to the fundamental structure of the universe.

Born in Newton, Mass., on June 8, 1936, Madden earned his B.S., M.S. and Ph.D. degrees in mathematics, all from MIT. He spent his entire 52-year professional career at MIT and its affiliated institutes.

Madden, who lived in Lexington and Provincetown, enjoyed fishing on the beaches of Cape Cod National Seashore and loved classical music, gardening and chemistry.

Madden is survived by his wife, Nancy Widmer Madden; a son, Dean Madden of Hanover, N.H.; a daughter, Elizabeth Madden Mirabile of Newton; two brothers, Robert H. Madden of Newton and John R. Madden of Duxbury; and five grandchildren.

A memorial service is planned for June 9, 2007 at the Auburndale Cove in Newton.

Donations may be made to the Stephen J. Madden Jr. Memorial Fund, c/o Office of Memorial Gifts, MIT, Room E19-439, 77 Massachusetts Ave., Cambridge, MA 02139.

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Wanted: Biologists who can speak 'math,' engineers fluent in genetics

Kathleen Cushman and Jennifer Donovan
Howard Hughes Medical Institute Bulletin

ILLUSTRATION / **DANIEL FAZAR, HHMI BULLETIN**

Biologists, computer scientists and engineers speak different languages: Mention "vector" to a molecular biologist and a plasmid (a circular piece of bacterial DNA used in gene cloning) comes to mind. Say "vector" to an engineer, and she thinks of a mathematical concept. Similarly with "expression": To a biologist, it means protein production from a gene; to an engineer, it's an equation.

This communications divide is becoming more of a problem now that research so often requires collaboration across disciplines. One-third of the engineers at MIT now work on biological problems, according to Graham C. Walker, MIT biology professor. Yet it can be challenging for biology and engineering students to understand each other.

The divide, deeper than mere semantics, can touch on basic cultural differences, he says. "Even among top-level scientists, our fundamental ways of conducting inquiry differ, depending on our interests and training."

Teaching introductory biology to MIT undergraduates, Walker experiences the disciplinary disconnect firsthand. "It's a constant challenge," he says, "to find ways to make biology comprehensible and relevant to students who think like engineers."

As a Howard Hughes Medical Institute (HHMI) professor—one of 20 research scientists nationwide who received $1 million each from HHMI to find innovative ways to stimulate undergraduates' interest in science—Walker is ever on the lookout for solutions to this problem. Last spring he invited Mary E. Lidstrom, a fellow HHMI professor, to MIT to discuss how she grapples with it at the University of Washington.

Lidstrom, who conducts an elective biology class for engineers, has found that biologists are motivated by the "what," while engineers are motivated by the "how." She told a room packed with MIT students and faculty that "engineering students tend to view biology as magic because they don't see us using differential equations. And often they don't even necessarily want to understand the 'what' of biology—they just want to use it.

"So we actually teach biology to engineers using a function-based approach, with the idea of nature as the designer and evolution as the design tool," Lidstrom says. "That's real engineering. And that's the way we feel biology should be taught."

To help her engineering students feel comfortable in this strange new territory, she says, "We talk about the functions of life, about information transfer, about adaptability. Engineers understand systems, and ecology is the perfect example of a system."

But while Lidstrom's approach may be useful for engineering students, says Julia Khodor, a graduate student who helps teach Walker's introductory biology course at MIT, it may be limited to engineering students. "Because our lectures need to reach all students, regardless of background," she says, "they are likely to remain mostly in the language of biology."

Lidstrom suggests another option—in effect, double majors. "The new research workforce will always need people firmly based in the core disciplines of biology and engineering," she says, "but it also needs translators who have the understanding and the tools to communicate about the other field."

Douglas A. Lauffenburger, a biological engineer who helped develop MIT's new major in that field, agrees. "The world of science keeps expanding," he says. "For a synthesis to be effective, we have to educate a third kind of person—a 'bilingual' one."

Reprinted with permission. A longer version of this article first appeared in the Dec. 2005 issue of the Howard Hughes Medical Institute Bulletin.

Scientists find genetic oddity protects sex cells

Antisense IME4 shows nature's yin-yang economy

David Cameron
Whitehead Institute

Researchers have found that a class of RNA molecules previously thought to have no function may in fact protect sex cells from self-destructing.

The findings from MIT, the Whitehead Institute for Biomedical Research and the Institute for Systems Biology in Seattle were reported in the Nov. 17 issue of the journal Cell.

Central to this discovery is the fundamental process of gene expression.

When a gene is ready to produce a protein, the two strands of DNA that comprise the gene unravel. The first strand produces a molecule called messenger RNA, which acts as the protein's template. Biologists call this first strand of DNA the "sense" or "coding" transcript.

Cintia Hongay

Even though the other strand doesn't contain a protein recipe, it may also, on occasion, produce an "antisense" RNA molecule, one whose sequence is complementary to that of the messenger, or sense, RNA. Antisense RNA has been detected for a number of genes but is largely considered a genetic oddity.

Using common baker's yeast, Cintia Hongay, a postdoctoral researcher in the lab of Whitehead member and MIT biology professor Gerald Fink, discovered that in the case of a gene called IME4, the antisense RNA blocks the sense RNA. In other words, the gene disables its own ability to make protein.

"This is the first case where a specific function in a higher cell for antisense RNA has been found," said Fink, senior author on the paper. "This points to an entirely new process of gene regulation that we've never seen before in eukaryotic cells."

There is a method to this sense/antisense madness, one that has a kind of yin and yang quality.

When conditions around yeast cells are good and rich in nutrients, the cells divide by mitosis—that is, the DNA duplicates so each daughter cell receives exactly the same number of chromosomes as the original cell. However, when the yeast cells are starving, IME4 switches on and activates a process called meiosis. Here, the cells divide into germ-cell spores that, like mammalian egg and sperm cells, have half the number of chromosomes. Yeast spores withstand this harsh environment far more ably than the larger cells from which they originate.

But in some cases, flipping the meiotic switch can be catastrophic. If a cell with only one copy of each chromosome (a haploid cell) is forced into meiosis, the progeny won't survive. Fortunately, such destructive meiotic division is avoided in haploid cells because they continually produce IME4 antisense RNA, blocking the production of sense RNA. Antisense IME4, then, safeguards against meiosis in cells that can't handle it.

"For years scientists have evaluated genomes by measuring the sense RNA, with antisense transcripts thought to have no meaning at all," says Fink. "Here we've found a process in which antisense RNA regulates sense RNA. This same process may occur in the sex cells of mammals. In fact, considering how widespread these antisense transcripts are, I wouldn't be surprised if these findings eventually lead us to discover an entirely new level of gene regulation."

Hongay is now searching the yeast genome for other genes that might be regulated by antisense RNA.

Additional authors of the paper are Paula L. Grisafi of Whitehead and Timothy Galitski of the Institute for Systems Biology in Seattle. This work was supported by the National Institutes of Health and a Ruth L. Kirschstein National Research Service Award postdoctoral fellowship.

FACULTY MEETING

Continued from Page 1

Miyagawa said that students need to take two years of foreign language before they can participate in the MISTI program, but the new curriculum requires students to take three foundational electives in the School of Humanities, Arts and Social Sciences over their first two years.

"This leaves very little time for other HASS courses, including foreign languages," he said.

Students who take a foreign language only during their junior and senior years will not be able to achieve fluency, as they can if they start earlier, he said.

Shigeru Miyagawa

"However unintended we believe this problem is, it's potentially dire," Miyagawa said.

Stewart, a professor of political science, said he agrees this could be a serious issue but he believes there are ways to work it out, including encouraging students who enter with Advanced Placement credit to use that flexibility to start studying a foreign language during their freshman year.

Steven Leeb, professor of electrical engineering and computer science, said he has concerns about the new "menu" structure of science requirements.

There will be either five or six areas of focus (e.g., chemical sciences, computation and engineering, life sciences, mathematics, physical sciences, and project-based experiences). Each student will choose one course from five of those areas, in addition to two semesters of calculus and one of physics.

Each focus area will have several different options. For example, electromagnetics (Course 8.02) and a new geophysics class have been put forward as possible equal selections from the physical sciences focus area.

Leeb said he fears the new structure will lead to grade inflation and a tension among classes for entertainment over content. He is especially concerned that, under this proposed menu structure, it is possible for freshmen to make choices that will make them unable to enter all majors at the beginning of their second year. "This proposal would break a fundamental compact that we have had with our incoming undergraduates for more than 50 years," he said.

Dava Newman

Robert Silbey, dean of science and chair of the curriculum task force, said he believes the menu system will be just as rigorous as the current Institute requirements. The faculty still need to work out what courses would be in each of the six "boxes."

"We were very careful that these are only suggestions, and it is up to the faculty to decide what is in the boxes," said Silbey. "If we do this right, we could have subjects in these boxes that would be spectacular and rigorous and MIT-quality."

Newman, a professor of aeronautics and astronautics and engineering systems, emphasized that the task force tried to focus on the "critical foundational elements" that students should learn. "There's so much we want all of our students to know—we can't do it all," she said.

Jeffrey Freidberg of the Department of Nuclear Science and Engineering said he believes many very smart U.S. undergraduates, including those from MIT, enter more technical graduate programs without sufficient math and science preparation to succeed on day one, and their preparation is substantially weaker than that of students from elite international universities.

"Shouldn't we have the possibility of a 'nerd track' in our GIRs, so to speak, where undergraduate students could take more math and science subjects, and aspire to be like Richard Feynmann rather than an industrial CEO, national lab director or manager in government?" he suggested.

Phillip Clay

Redwine, a professor of physics, responded that the task force had considered the possibility of de-emphasizing HASS courses, but the members strongly agreed not to do that.

Stewart pointed out that MIT's charter calls for it to "be in the world and provide leadership," summarizing the aspiration of MIT founder William Barton Rogers. Although it is now possible for students to create their own "nerd track," "We do have a particular mission, and part of it's reflected in the HASS requirements," he said.

David Trumper of the Department of Mechanical Engineering said he believes the proposal will "eviscerate" MIT's curriculum and tries to accomodate too many competing agendas. In particular, he is concerned that the plan puts international study on an equal footing with changes in the common math and science curriculum. "I want this to be the best damn science and engineering and biology education in the world, and I would sacrifice many things for that," he said.

David Mindell of the program in science, technology and society, a member of the task force, suggested that the faculty immediately adopt one of the recommendations, which is to eliminate the 90-unit penalty for double majors. That would be easy to implement and would have a huge impact on many students, he said.

Lerman ended the discussion portion of the meeting at 5 p.m. and encouraged those who still want to speak to come to the next meeting.

Fundraising campaign

Hockfield told the faculty that a new fundraising campaign, a focused "Campaign for Students," will be officially launched in December at the next meeting of the MIT Corporation. The five-year campaign, which will be led by Chancellor Phillip Clay, aims to raise at least $500 mil-

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‘Father of Fractals’ takes on the stock market

Katharine Stoel Gammon
News Office Correspondent

Benoit Mandelbrot is world famous for making mathematical sense of irregular shapes—clouds that are not round, mountains that are not cones, coastlines that are not smooth, and now, stock markets that are not as simple as previously thought.

Mandelbrot, known as the “father of fractal geometry,” spoke Nov. 8 to a crowd of more than 200 people in Room 10-250. His talk was the first in a series sponsored by the MIT Molecular Frontiers Club. Molecular Frontiers is a new international alliance of scientists, including several at MIT, intended to inspire young people to get involved in science. The title of Mandelbrot’s lecture was “The Mandelbrot Set and Fractals in Finance.”

Mandelbrot coined the term “fractals” in 1975 to describe shapes that appear similar at all levels of magnification and are also called “infinitely complex.” Examples of fractal-like structures in nature include snowflakes, rivers, broccoli flowers and systems of blood vessels.

“Fractals and chaos theory are particularly good at engaging young minds because of the images involved,” said Andreas Mershin, a postdoctoral associate at MIT’s Center for Biomedical Engineering, who introduced the 86-year-old Mandelbrot, who is the Sterling Professor of Mathematical Sciences, Emeritus at Yale University and lives in Scarsdale, N.Y.

Benoit Mandelbrot

Mandelbrot, who sometimes drifted into anecdotes about former colleagues and students, described the long process of his work. “I have been working on this subject all my life. My Ph.D. was finished in 1952, and I never realized until recently what I was actually doing. Only later did I realize that everything I was working on had the property of roughness.”

In the middle of World War II, Mandelbrot was a young man studying in the south of France. “The conditions were as grim as possible, and somehow I found I had this gift for seeing shapes in complicated structures instantly,” he said. After continuing his studies in Paris, Mandelbrot left France for Caltech in 1947 to study aeronautics.

He returned to France to get a Ph.D. in mathematical sciences from the University of Paris and then worked in the United States and Europe throughout the 1950s. In 1958, Mandelbrot settled with his wife, Aliette, in Yorktown, N.Y., where he joined the research staff at the IBM Thomas J. Watson Research Center. He went on to devote his academic life to seeing the truth in the roughness of geometrical shapes.

After working on the general properties of fractals, he moved on to examine more specific and complex examples, focusing on what came to be known as the Mandelbrot Set. An unusual type of fractal that comes from a simple equation, the Mandelbrot Set is popular outside of mathematics because of its aesthetic appeal and its complicated structure. No one has been able to prove the Mandelbrot Set is true, according to Mandelbrot. “But no one has been able to prove it’s not true, either,” he said, as large pictures of fractals filled the screen behind him.

Mandelbrot recently began to apply his knowledge of fractals to explain stock markets. “Markets, like oceans, have turbulence,” he said. “Some days the change in markets is very small, and some days it moves in a huge leap. Only fractals can explain this kind of random change.” He and a journalist, Richard Hudson, have co-written a book on the thorny subject to explain the complex gyrations of stock prices and exchange rates.

Molecular Frontiers, a new nonprofit based in Cambridge, is the brainchild of Swedish physical chemist Bengt Nord, former chair of the Nobel committee for chemistry.

Mandelbrot is an IBM Fellow Emeritus at the Thomas J. Watson Research Center and a Battelle Fellow at the Pacific Northwest National Laboratory.

Katharine Stoel Gammon is a student in MIT’s Graduate Program in Science Writing.

NATURAL GAS

Continued from Page 1

MIT model encompasses the whole system. “Ideally, operators would like to make decisions based on information from the entire system,” Selot said.

Based on fundamental physical principles, the researchers’ model describes gas flow, pressure and composition inside every pipeline in the network. Equations describe how the flow properties change as the gas passes through each facility along the way. The equations interact so the model can track flows and how they mix throughout the system.

To be useful in the real world, the model must also incorporate—in mathematical terms—the rules from all contracts and agreements. For example, what fraction of production must be shared with other companies?

Operational constraints must also be included. How rapidly can gas be withdrawn from a given well? Further, the company must define its goals, such as maximizing production, minimizing total costs or scheduling facilities in a particular way.

The final challenge is to “solve the model” so that it defines the specific operating choices that will best satisfy the stated obligations, constraints and goals. Standard optimization techniques cannot handle such a large and complex model. Selot is therefore refining and extending standard techniques to solve that problem.

He and Barton are now performing a case study of a natural gas production system in Malaysia operated by Sarawak Shell Berhad, Malaysia (SSB). They are working closely with field engineers at SSB and Shell International Exploration and Production, the Netherlands, to build a realistic representation of the Sarawak system—a challenge, as the system is the product of decades of evolution rather than coordinated planning. All of the system’s complexity must be reflected in the mathematical model if it is to be of practical value to the Sarawak planners.

This research was supported by Shell International Exploration and Production through MIT’s Laboratory for Energy and the Environment.

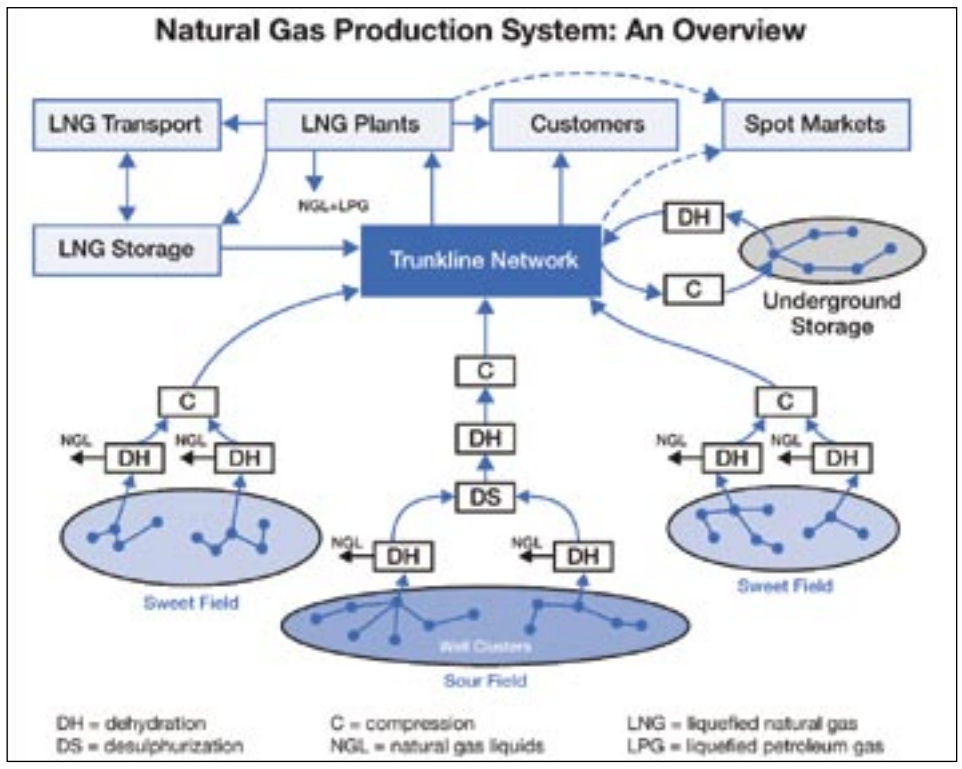
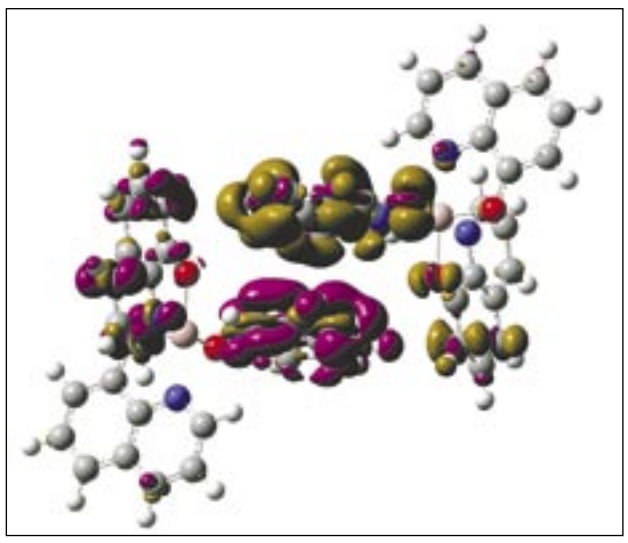


ILLUSTRATION / **AJAY SELOT**

A new MIT model simulates the flow of natural gas through production systems.



SIMULATION IMAGES COURTESY / **VAN VOORHIS LAB**

CHEMIST

Continued from Page 1

ficult to simulate the changes in electronic structure that accompany electron transfer, because a reaction pushes the electrons out of equilibrium, and current techniques for describing this are not adequate.”

Van Voorhis and his team are developing methods and computer software that can simulate what happens when a dot in a light-emitting diode (LED) of a computer display turns on. In the case of an optical LED, positive and negative charges are strongly attracted to one another and become trapped. The unusual rules of quantum physics dictate that the charges can only recombine to emit light if they are spinning in opposite directions. As a result, typically only 25 percent of the trapped charges produce light; the other 75 percent of the charges spin in the same direction and are essentially wasted.

Van Voorhis and his colleagues have developed a computer program that simulates how these coupled spinning charges are nudged to react and thus emit light. The simulations indicate that the emission will increase if some of the charges spinning in one direction can be turned into charges spinning in the opposite direction and then form stable pairs.

“This situation could be selectively created in optical LEDs to improve the efficiency of a device such as a display,” he said.

There are also potential applications of these visualization techniques to electronic devices, pharmaceuticals, energy and other fields, but they still are far off in the future.

Another big challenge being tackled by the Van Voorhis group is understanding and simulating the process of photosynthesis. In plant photosynthesis, light reacts with carbon dioxide and water to produce sugar and oxygen, which humans can later burn to produce energy. The knowledge of how to artificially mimic a process like photosynthesis could help scientists figure out a way to efficiently store solar energy in molecules that last for long periods.

The challenge is that the bonds being broken in any photosynthetic process are very strong. By breaking these strong bonds and forming weaker ones, molecules with higher energy are created. These molecules store the energy harvested from sunlight, and this energy is later released when the high-energy molecules are burned. However, current methods for artificial photosynthesis waste too much energy in breaking the strong bonds. Van Voorhis hopes to understand how to break bonds more efficiently so that a larger portion of the valuable energy is stored in the product molecules.

“We only have a partial knowledge of what is going on in photosynthesis,” Van Voorhis said. “If you don’t know exactly how something works, you don’t know how to improve it.”

To improve this state of affairs, his lab has been studying how electrons create and destroy chemical bonds. The new funding from the Packard Fellowship will allow him to move to the next step and start researching how to get light to turn into energy that won’t escape as heat.

In a device such as an optical display, positive (purple) and negative (gold) charges are attracted strongly to one another and become trapped (first picture, above left). Because of the unusual rules of quantum physics, the trapped charges can emit light (second picture) if they are spinning in opposite directions. Van Voorhis is creating simulations to show how to selectively create trapped charges in organic light-emitting diode displays to improve efficiency. Potential applications of these visualization techniques to electronic devices, pharmaceuticals, energy and other fields are still far off in the future.

Agile new plastics change shape with heat

Researchers at MIT and the Helmholtz Association of German Research Centers have invented a class of materials so remarkable for their agility in changing shape as they react to heat, they might be described as acrobatic plastics.

The new materials, known as "triple-shape materials," can assume three different shapes, each shape depending on how much heat is applied.

This landmark achievement comes from the laboratories of chemical engineer Robert Langer of MIT and polymer chemist Andreas Lendlein of the Helmholtz Institute in Teltow, Germany.

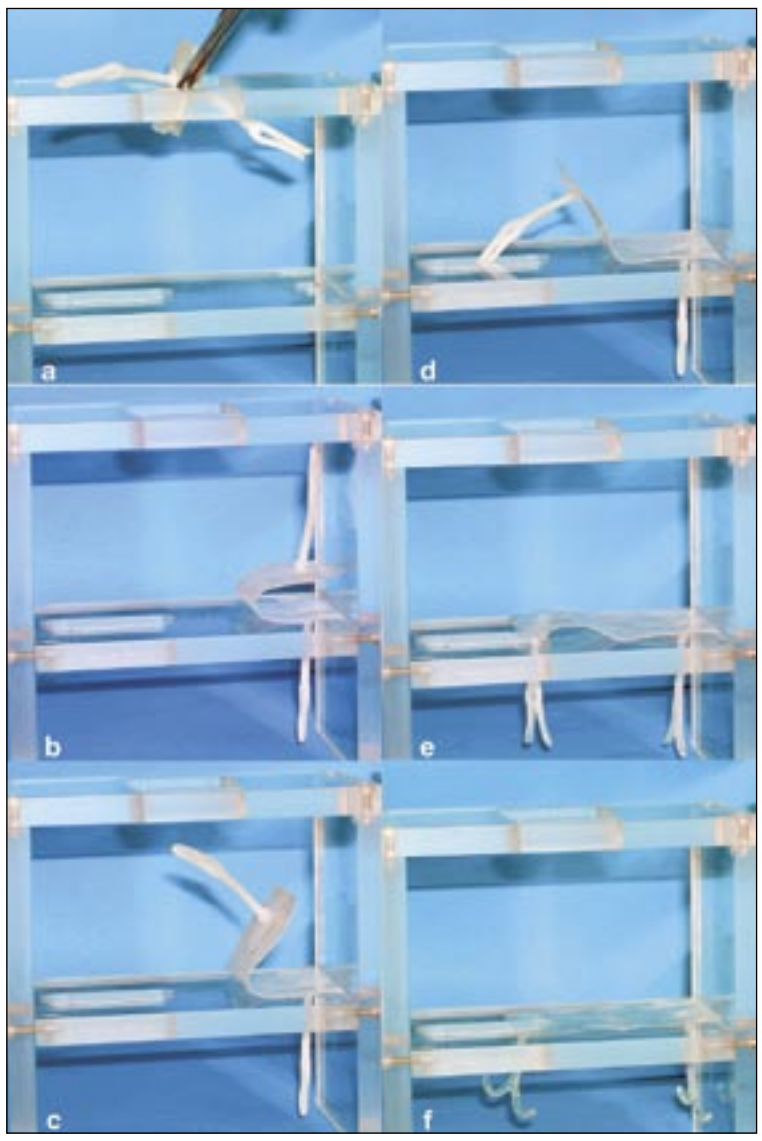
"Triple-shape materials can switch from shape A, then to shape B, and on to shape C," Lendlein explained. "Using two, rather than just one, shape-changes offers unique opportunities for applications such as 'intelligent' stents, or 'smart' fastener systems" for use in assembling commercial products, he said.

An "intelligent stent" made of the new class of plastics could assume three different shapes to facilitate medical procedures: It would assume a handy oval shape for insertion, then a fully inflated round shape for temporary use inside a blood vessel, duct or other cylindrical organ, and lastly, a compressed cylindrical shape for easy removal.

The triple-shape-shift from shape A to B to C could also have applications in industry. In factories, changeable plastic fasteners could be implanted in, or attached to, one part, then heated to extend an arm to another part. With further heating, the fastener would change shape yet again to lock itself in place. In effect, it would be an automated form of self-assembly.

Langer, an MIT Institute Professor, said, "It's like a new principle in materials, and it will be producing new opportunities. I imagine that if you had things you want to install and then remove," the ability to change their shapes at will could be useful. "It's the first time I've seen something that will go from shape A to shape B and then shape C."

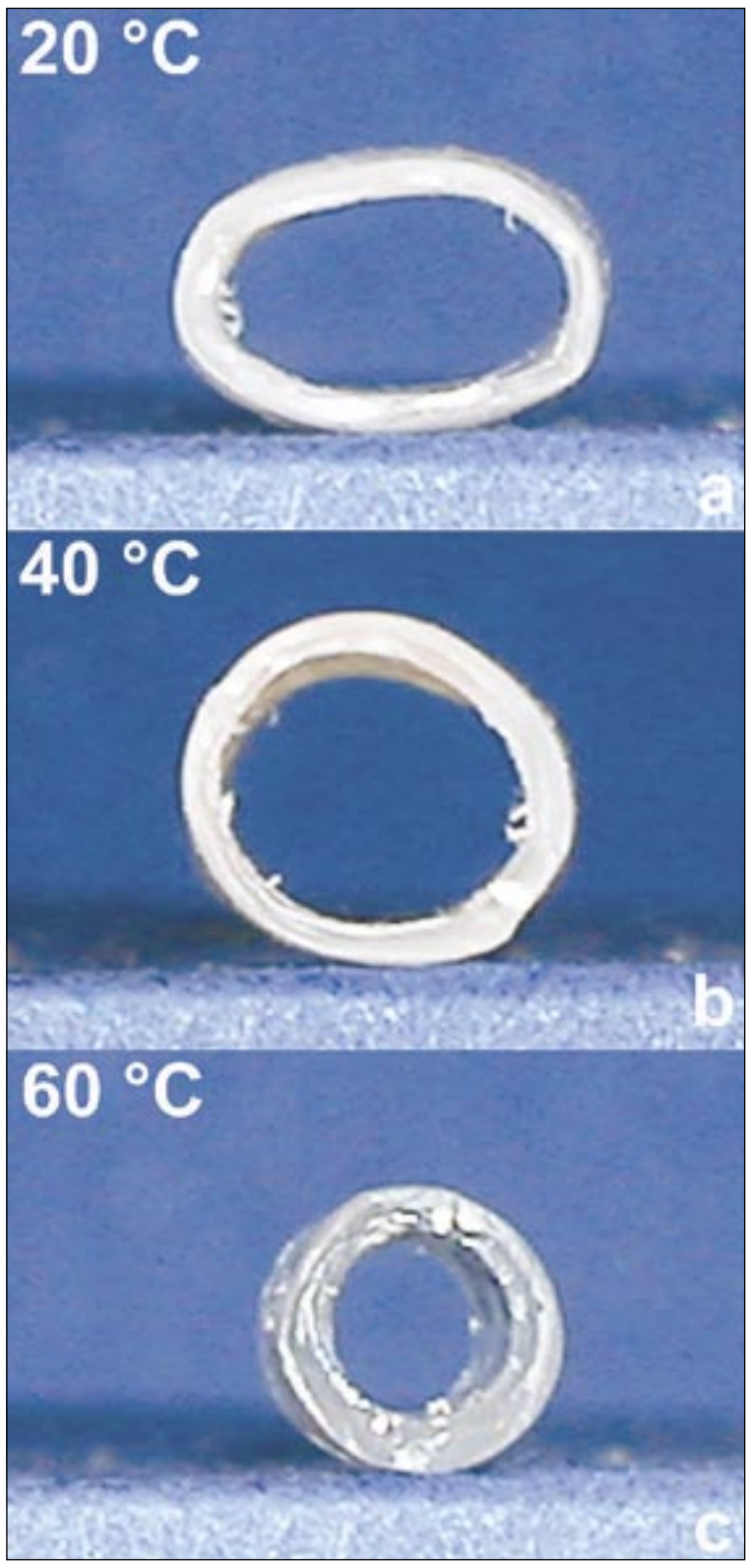
A paper on the work will appear in the Nov. 28 issue of the Proceedings of the National Academy of Sciences. Langer and Lendlein's coauthors are Ph.D. student Ingo Bellin and polymer chemist Steffen Kelch. Both work with Lendlein, who is leading the Center for Biomaterial Development in Teltow, near Berlin.



The series above illustrates the triple-shape effect of a fastener consisting of a plate with two anchors prepared from CL(50)EG: Starting at 20 degrees Celsius, the device, in an easily-handled form, is put into a scaffold, right, which might be difficult to access (a). Increasing the temperature to 40 degrees triggers unfolding and positioning into the cavity, left (figures b to d). Increasing the temperature to 60 degrees enables the anchors of the fastener to open and to couple the device into a well-defined position (e to f).

In earlier work, Lendlein and Langer invented a dual-shape class of materials, leading to what they call a "smart suture" that changes shape as needed for surgery (web.mit.edu/newsoffice/2002/langer-suture.html), and they introduced a plastic that changes shape when activated by light (web.mit.edu/newsoffice/2005/smart-plastics.html). In November 2005 they received the World Technology Network Award for these achievements.

Robert Langer



PHOTOS / **GKSS RESEARCH CENTER 2006**

The series above shows the triple-shape effect of a tube prepared from a polymer network, CL(50)EG. Starting at 20 degrees Celsius (a), the tube has an upright diameter of 4.5 mm; when heated to 40 degrees, it switches to a second programmed shape (b) with a diameter of 6.9 mm, and then to its permanent shape (c) with a diameter of 5.8 mm, when heated to 60 degrees. In both series, above and left, the material CL(50)EG used to produce the demonstration object is a two-phase polymer network consisting of 50 percent poly(ethylene glycol) (PEG) by weight and 50 percent poly(ε-caprolactone) (PCL) by weight.

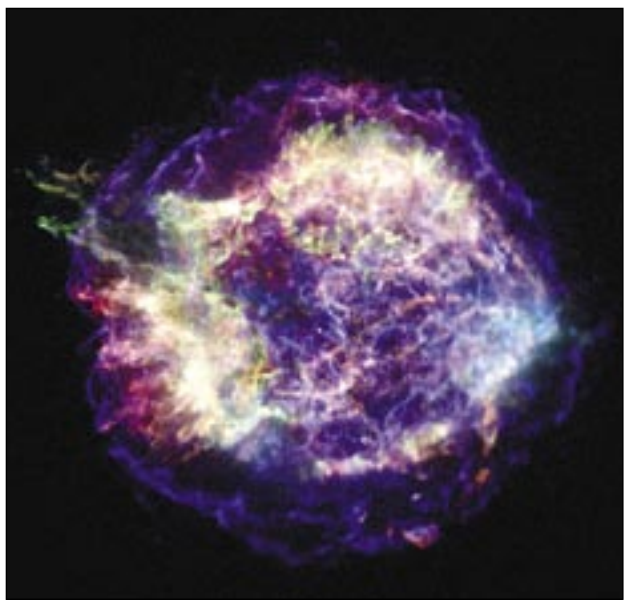


IMAGE COURTESY / **MIT AND UMASS-AMHERST**

A supernova remnant acts like a relativistic pinball machine by accelerating electrons to enormous energies. The blue, wispy arcs in this image of Cassiopeia A, the youngest supernova remnant in the Milky Way, show where the acceleration is taking place in an expanding shock wave generated by the explosion. The red and green regions show material from the destroyed star that has been heated to millions of degrees by the explosion.

Cosmic rays emerge from supernova remnants

MIT astronomers and a colleague have created an extraordinarily detailed image of the remains of an exploded star that provides new clues about the origins of cosmic rays, mysterious high-energy particles that bombard the Earth.

Using NASA's Chandra X-ray Observatory, the scientists mapped the rate of acceleration of cosmic ray electrons in a remnant of an exploded star, or supernova. The new map, the first of its kind, shows that the electrons are being accelerated at close to the theoretical maximum rate. This is compelling evidence that cosmic rays are created within supernova remnants.

The map was created from an image of Cassiopeia A, a 325-year-old supernova remnant. Blue, wispy arcs in the image trace the expanding outer shock wave where the acceleration takes place. The other colors in the image show debris from the explosion that has been heated to millions of degrees.

"Scientists have theorized since the 1960s that cosmic rays must be created in the tangle of magnetic fields at the shock (front), but here we can see this happening directly," said Michael Stage (Ph.D. 2003), who began the work as a postdoctoral associate at the MIT Kavli Institute for Astrophysics and Space and is now at the University of Massachusetts at Amherst.

"Explaining where cosmic rays come from helps us to understand other mysterious phenomena in the high-energy universe," such as the extragalactic jets thousands of light years in length produced by supermassive black holes, he said.

Scientists had previously developed a theory to explain how charged particles can be accelerated to extremely high energies—traveling at almost the speed of light—by bouncing back and forth across a shock wave many times.

"The electrons pick up speed each time they bounce across the shock front, like they're in a relativistic pinball machine," said team member Glenn Allen, a Kavli research scientist. "The magnetic fields are like the bumpers, and the shock is like a flipper."

In their analysis of the huge data set, the team was able to separate the X-rays coming from the accelerating electrons from those coming from the heated stellar debris.

"It's exciting to see regions where the glow produced by cosmic rays actually outshines the 10-million-degree gas heated by the supernova's shock waves," said John Houck, also a Kavli research scientist. "This helps us understand not only how cosmic rays are accelerated, but also how supernova remnants evolve."

The work was reported in the September issue of Nature Physics.

NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program for the agency's Science Mission Directorate. The Smithsonian Astrophysical Observatory controls science and flight operations from the Chandra X-ray Center in Cambridge, Mass.

New media, fan muscle will mold TV future

Stephanie Schorow
News Office Correspondent

How will we enjoy entertainment in the future? Via a high-definition plasma TV screen, computer, cellphone or iPod? Who will create entertainment? Will it be mega studios, independent producers or the whiz kid on his laptop—or a network of whiz kids? And who will watch the result when the audience is also the writer, critic and marketer?

Henry Jenkins

Experts—from network executives, academics and game designers to gadfly media artists—peered into the "Futures of Entertainment" at a two-day conference, Nov. 17-18, sponsored by the MIT comparative media studies program and the Convergence Culture Consortium. The future they sketched reached way beyond the buzzword of "interactivity" to a time when the line blurs between media producer and media consumer.

"We now live in a networked society where we're seeing the ability of communities to rapidly pool information," said Henry Jenkins, director of the comparative media studies program and conference organizer. "This new environment both creates community opportunities and creates activities for this community."

His examples? Characters on "Veronica Mars" have MySpace.com profiles. Fans plot the resistance movement of "The Matrix" trilogy. Fans decipher maps flashed during "Lost" or use Google's map technology to track the fictional journey of Jack Bauer in "24." Dialogue of the movie "Snakes on a Plane" is changed to fit Internet expectations.

"It is an age when we all want to participate and we want to see ourselves participate," Jenkins said.

The death of must-see TV

In a session on "Television Futures," panelists questioned whether the producers of "old media" were prepared for this brave new media world.

"We're stuck in spin cycle," confessed Andy Hunter, a planning director at GSD&M, an Austin, Texas-based communications agency.

Forrester vice president Josh Bernoff outlined four cautionary principles: Don't assume that nothing is going to change; don't assume everything will change; don't assume it's about the ideas, not the biz; and don't assume business drives everything.

But he was clear that "there will still be TV 10 years from now."

A point of some contention was the effect of digital video recorders such as TiVo on television advertising and whether advertisers were deserting TV for the Internet. Currently, the Internet lacks the "metrics" of measurement that will tell advertisers their money is well spent, Morgan noted.

But the metrics of such institutions as the Nielsen ratings are also dated. Networks should consider the popularity of shows globally and the degree of ardor shown by fans, said Mark Warshaw, a writer/producer who helped build the CW's "Smallville" into one of the most popular TV properties online.

The DVR's time-shifting capacity may spell the end of "appointment TV" or "must-see TV" scheduling. "You're not able to thread people through the night like you used to," Morgan said.

Major media "gatekeepers" will remain, but those gatekeepers have an eye on the upstarts. "A lot of TV executives look at the web like a farm team," said Warshaw.

Consumer-created entertainment media is not that different from quilting bees and barn raising, noted panelist Caterina Fake, developer of Flickr, an online photo sharing application, and now Yahoo! tech development director, during a session on "User-Generated Content."

Companies should solicit customer participation; game players, for example, can come up with solutions that elude even game designers. "You can't be more clever than the Internet," said Rob Tercek, executive vice president of MForma Group, a mobile entertainment publisher. But he warns that companies must be prepared for "emergent behavior" among consumers and there's no predicting what that will be.

> *You can't be more clever than the Internet.*
>
> **Rob Tercek**
> Executive Vice President, MForma Group

Take the creation of online community. When L'eggs tried to create a community of women for its pantyhose, the company did get a community—of eager males with a pantyhose fetish, Fake said. "You can never predict how an online community will evolve," she said.

From Wizard to Wiz to Wicked

A session on "Transmedia Properties" examined how narratives and characters flow across media platforms, opening new markets as well as expanding storytelling. It's not a new concept: Frank L. Baum's 1900 children's book "The Wizard of Oz" inspired the 1939 Judy Garland film, the 1975 musical and 1978 film "The Wiz," the 1995 novel "Wicked" and the 2003 Broadway musical of "Wicked."

"You have people building Troy on top of Troy on top of Troy," said Paul Levitz, president and publisher of DC Comics.

Creating transmedia property often means imagining a "world" as well as characters and a plot. Showing they "got" the concept, the creators of the hit TV series "Heroes" established a large web presence and online comic that expands the lives of the superhero characters, said Alex Chisholm, founder of (ICE)3 Studios, a media research and development consultancy. "They wanted it to be a universe," he said.

The growth of transmedia indicates "fan culture has become more mainstream," said Michael Lebowitz, CEO of Big Spaceship, a New York-based creative agency. Where once TV executives cancelled anything that made audiences scratch their heads, "complexity is now an accepted form of storytelling. It means we won—everyone in this room," Levitz said.

The conference also featured sessions on fan culture and virtual worlds. Bloggers' responses to the two-day event have been linked at www.convergenceculture.org.

Makan's '2' marks the moment when music and computing became one

Joanna Michalowski
Office of the Arts

"Almost every composer in my generation uses a computer," says Keeril Makan, who, like many of his peer group, seeks ways to incorporate digital media and cutting-edge technology into his music.

PHOTO COURTESY/ **OFFICE OF THE ARTS**

Keeril Makan, assistant professor of music, has seen the future of music, and it is linked to computing.

Makan, 35, is a sought-after contemporary composer who has received commissions from various ensembles and organizations all over the country and has participated in music festivals around the world. He joined the MIT community this fall as an assistant professor of music and teaches courses in music theory and composition.

One of his earlier pieces for violin and percussion, "2," will be performed next month in Boston as part of the Boston Modern Orchestra Project Club Concert series.

Makan, who takes his influences from American folk music, the European avant-garde, Indian classical music and minimalism, considers "2," written in 1998, to be the beginning of a long creative process. Most importantly, "2" marks the time when Makan began using a computer as a tool during composition.

"The computer served as a modeling environment," explained Makan. "I could hear what I was doing, and I could take ideas to a further extreme than I would have if I was just working on paper. I could force myself into positions that were purposely uncomfortable to explore something new about the way I was hearing continuity in music."

While Makan acknowledges that the computer was essential to the composition of the piece, it wasn't because of the way the computer sounded; it was more in the experience of time that the computer afforded him during the composition process.

A performer by nature (he played both the violin and oboe growing up), Makan isn't interested in purely electro-acoustic work. He's happier when he creates a "hybrid world where you can't tell where the acoustic ends or the electro-acoustic begins," he said.

And while Makan believes that the future of music will include technology, he noted that how technology is used will depend on the composer: Some composers only use their computers for notation, while others, like Makan, incorporate the use of the computer into the composition process, using it as an earphone.

Makan received his degrees in composition and religion at Oberlin College and Conservatory in Ohio and completed his Ph.D. in composition at the University of California at Berkeley; he began composing at a summer camp in a classroom environment.

"The teacher walked in and said, 'Composing is like painting; time is your frame and sound is your palette of color. Now go compose,'" recalled Makan with a laugh. "There was no instruction whatsoever." That teacher's philosophy, however, has been invaluable to Makan's confidence.

"If you have a connection to sound and you want to work with it, then you can find a way to do it. You can begin to compose," he says.

"2" will be performed on Tuesday, Dec. 5, with Gabriela Diaz on violin and Aaron Trant on percussion, at 7 p.m. at the Moonshine Room, Club Café. (209 Columbus Ave., Boston). Tickets cost $15. For more information, call (617) 363-0396.

FACULTY MEETING

Continued from Page 3

lion for four areas that impact students.

The four areas are:

- Undergraduate financial aid, which Hockfield said is now underendowed, resulting in the use this year of about $20 million in unrestricted funds
- Graduate financial aid, which currently does not provide a fully funded first year for all doctoral students
- Infrastructure for teaching, including classroom technology, lab renovation and resources to offer more project-based courses
- Student life.

The conclusion of the campaign will coincide with MIT's 150th anniversary, which occurs in 2011.

"I think it will provide a beneficial focus on the importance of MIT's living and learning communities for our undergraduate and graduate students," Hockfield said.

DIGITALK: WHERE IT'S AT

On the move: Mobile Partners User Group

The new MIT Mobile Partners User Group (MPUG) welcomes participants who are interested in software and services for various mobile devices/PDAs. Initially, the group will gather input from the community on what mobile options are desired. IS&T will work with MPUG to develop appropriate solutions that will meet most of the community's needs in this area. Currently, IS&T officially supports only mobile devices/PDAs running Palm OS; however, with input from MPUG, it is working to define a strategy for future mobile support.

MPUG meetings are held the third Friday of each month at 2 p.m. in the N42 Demo Center. The meeting schedule is posted on the Mobile Partners User Group page at web.mit.edu/mobilepartners. MPUG maintains a mailing list (mobilepartners@mit.edu) for discussions, meeting announcements and information of interest to mobile users. This list is for members of the MIT community only. To join or remove yourself from the list, go to mailman.mit.edu/mailman/listinfo/mobilepartners. If you have questions or suggestions, contact Andrew Yu, the IS&T mobile devices platform coordinator, at andrewyu@mit.edu.

NERCOMP discounts

MIT is an active participant in the Northeast Regional Computing Program, better known as NERCOMP. With 225 member institutions from nine northeastern states, NERCOMP's goal is to foster communication about the use of computers, networks, and information technology in academic settings. NERCOMP is known for its topical seminars and special-interest groups; training opportunities; licensing agreements with vendors; and an annual conference in March.

Members of the MIT community are eligible for significant discounts to NERCOMP events. To find out about upcoming workshops, go to www.nercomp.org/events/. To get on the NERCOMP mailing list, go to www.nercomp.org and then to the member login section on the upper right. Then click on "register here" to sign up.

The laws of simplicity

John Maeda, a graphic designer, visual artist and computer scientist at the MIT Media Lab, wants to keep things simple. Technology is meant to give us more flexibility and freedom, but devices crammed with menus and features often make users feel overwhelmed. In his new book, "The Laws of Simplicity" (MIT Press), Maeda outlines 10 laws and three keys for achieving simplicity in the design of technology products. He also proposes a few down-to-earth methods for making it happen: His acronym SHE, for example, stands for shrink, hide and embody.

To learn more about the book, visit the MIT Press catalog at mitpress.mit.edu. Maeda also maintains a blog at weblogs.media.mit.edu/SIMPLICITY/; he calls it his "scratch pad of thought regarding the theme of simplicity."

3DOWN

You can get timely information about the status of major communications and computing services at MIT via the 3DOWN Services Status page at 3down.mit.edu/. It's also a featured link on the IS&T home page at web.mit.edu/ist/.

The 3DOWN web page is one of the key ways that IS&T informs community members of planned outages, such as preventative maintenance service to the SAP production environment and telephone upgrades. 3DOWN is also the place to look for details about unplanned outages. To learn whether your problem is local or general, check the 3DOWN page before you call for help. Server and network problems—such as outages that affect entire MIT buildings and critical links—are announced here. After an extended outage has been addressed, IS&T posts an explanatory note on 3DOWN regarding its resolution.

If you have feedback about 3DOWN, send mail to 3down-admin@mit.edu.

Digitalk is compiled by Information Services and Technology.

Army linguist learns language of leadership as an MIT Sloan Fellow

Amy MacMillan
Leaders for Manufacturing Program

Lynne McCann served as chief of the Army's Foreign Language Proponency Office before she came to MIT Sloan, and the M.B.A. student (Sloan Fellow 2007) had seen a lot of the world. But, she recently said, she found a world within her classrooms and among her classmates—one that has already widened her perspective on the role to which she will return.

Thanks to the "diverse group of students here at MIT Sloan, I'm learning about their countries, cultures and working environments, while gaining experience working with a multinational group," she said.

Lynne McCann

While working at the Pentagon, it was McCann's responsibility to provide linguistic support to the military. Today, there are approximately 8,500 Army linguists needed for dangerous areas such as Iraq, Afghanistan, Bosnia and even in places such as Germany and Italy. Linguists are generally civilians, although some are former military members.

Learning the mother tongue

Under McCann's leadership, the first group of contract linguists was shipped to Iraq on Jan. 2, 2002, and some of them are still working there. When she left the Pentagon in June, there were approximately 7,500 linguists in Iraq, and the number was increasing by a rate of 100 to 200 a week, she said. The need for linguists has amplified as U.S. forces continue to stay in Iraq.

Currently, McCann says there's a dire need for Arabic speakers as well as Pashtu speakers, which are especially difficult to find. Pashtu is the native language of Afghanistan and the Taliban, and very few Americans speak it. The Department of Defense's Defense Language Institute, which originated during World War II, offers 90 different foreign language courses for military and civilian department personnel. Arabic training spans 63 weeks, and once completed, most novice Arabic speakers will still not be tremendously proficient, McCann says.

"We try to recruit people who have Arabic language skills. We train some. We have a multifaceted approach in trying to solve this problem," McCann says.

In her current role, McCann has been to Iraq twice and Afghanistan once to meet with the linguists who are deployed there. She is still in the Individual Ready Reserves as a chief warrant officer four and has never been deployed, but could be at any time.

McCann, a Florida native, never planned on having a military or government career. She has a background speaking Russian, which she learned in high school and college during the Cold War years. She joined the Army Reserves in 1984. She went through basic training and some additional language training and was hired as a Russian linguist. Her undergraduate degree is in humanities and fine arts from the University of Central Florida, in Orlando.

She worked at the American embassy in Moscow from 1989 to 1991 as a contractor. She was there during the August 1991 coup against Mikhail Gorbachev. "It gave my mother some gray hair," she said.

Called to serve

In 1996, McCann received a call from her reserve unit offering her a position at the Pentagon. Her son was 9 months old, so she called her nanny, and then her husband, before she accepted the six-month position in Washington. Before she knew it, six months had stretched into 10 years, and the family is now happily settled in Hamilton, Va. McCann's husband, Bob, works in the computer industry, and their son is now 11.

She was offered the opportunity to join the MIT Sloan Fellows program after she was awarded the 2004 Pace Award, in honor of former Secretary of the Army Frank Pace. When she's finished at MIT Sloan, she will return to work at the Pentagon but will be reassigned in order to use her newly acquired business and leadership skills.

In her free time, McCann has completed 23 marathons, one ultramarathon and one distance triathlon. She has run the Boston Marathon twice and intends to run it again in the spring. She is also an expert Irish stepdancer.

PHOTO / **THANED PRUTTIVARASIN**

Musical time travel

Tenor Sudeep Agarwala, graduate student in biology, rehearses with director William Cutter for the MIT Concert Choir's upcoming performance of 'Carmina Burana,' composed by Carl Orff in 1935 and based on 13th-century secular verses on the pleasures and perils of gluttony, lust and drink. Graduate students Elisabeth Hon, Stephan Jung and Agarwala will perform solo parts alongside seniors Daniel Cunningham and Joshua Li and sophomore Michael Johnson. The MIT Concert Choir performance of 'Carmina Burana' takes place on Saturday, Dec. 2 at 8 p.m. in Kresge Auditorium.

The Concert Choir will also perform Benjamin Britten's 'Sacred and Profane' (Eight Medieval Lyrics), Op. 91. Admission is $5 at the door.

Controversial architect Koolhaas discusses future of cities

Stephanie Schorow
News Office Correspondent

Necessity can be the mother of innovation even at an institute of technology: When a PowerPoint presentation by world-renowned Dutch architect Rem Koolhaas failed to work for his scheduled lecture on Nov. 14, staff of the Department of Architecture quickly switched gears on Koolhaas' behalf and transformed the event from a lecture into a "conversation" with faculty and students.

That suited many in the audience. There was a near-capacity turnout in Room 10-250 to hear Koolhaas, an influential yet controversial figure in the architecture world.

A Dutch graduate of the Architecture Association School in London, Koolhaas cofounded the Office for Metropolitan Architecture in 1975 and won the Pritzker Prize in 2000. Yet his style defies categorization; he was a writer and a social critic before he became a working architect, and his 1978 book, "Delirious New York," examines urban development. A professor at Harvard, he conducts the Project on the City, a research program investigating changing urban conditions.

"The architecture of Rem Koolhaas has been called Structuralist, post-Structuralist Humanist, post-Humanist, Neo-Modernist influenced by (Gilles) Deleuze or just plain old delusional," said Mark Jarzombek, professor of the history of architecture and director of the History, Theory and Criticism Program, in his introduction.

More recently, Koolhaas was mentioned, in a not particularly flattering way, in an article in the New Yorker magazine on the sprawling growth of the Nigerian city Lagos. Koolhaas has been studying conditions in Lagos for 11 years and has written articles and an upcoming book that see the African megacity as a harbinger of future urban development. The New Yorker article sniped at researchers who view Lagos as a "hip icon of the latest global trends."

Koolhaas' MIT lecture was intended to focus on Lagos. But shorn of his slides, he answered questions about his work there. In response to a question by Alexander d'Hooghe, assistant professor of architecture and urban design, Koolhaas detailed his approach.

To avoid "tourism," he matched Harvard students with local students for research. He sought evidence of inhabitants' resiliency, finding that, for example, the huge slowdowns of traffic on highway cloverleafs fostered the creation of markets catering to bus passengers. While at first sight, the extreme poverty seems to show that Lagos is a "city in crisis," Koolhaas sees "self-regulating chaos" at work. Yet, he noted ruefully, as a result "we are accused of being completely free of human feeling."

PHOTO / **DONNA COVENEY**

Rem Koolhaas, designer of the Seattle Public Library, among other works.

Koolhaas remains concerned with the forces of globalization, even though, he acknowledged, architecture is not an "ideal tool for politics." Globalization has entered a new stage, he said, as the United States has increasingly become "more detached" after Sept. 11.

There is, he said, a "noticeable lack of fear—which is perhaps the best word—of American power and American culture." This will create the chance for Russia and Europe to more fully define themselves.

Koolhaas said he was considering moving his business to Brussels as part of his commitment to the new European Union. Among Koolhaas' achievements is the design of a multicolored "barcode" symbol that unites the flags of European countries into a single image.

PHOTO / **CRAIG BAILEY**

Albert Chan (S.M. 1999, Ph.D. 2004) is pestered by Tom Bardwell and Margaret Ann Brady in a scene from Associate Professor Thomas DeFrantz's 'Queer Theory! A Musical Travesty.'

DeFrantz's 'Queer Theory' builds musical bridges

"Queer Theory! A Musical Travesty," written and directed by Thomas DeFrantz, associate professor of music and theater arts, will be performed Thursday, Nov. 30 through Saturday, Dec. 2 at 8 p.m., in Kresge Little Theater. An additional 2 p.m. matinee will be staged on Saturday, Dec. 2. Tickets are $10, $6 for students.

Set at an academic conference on addressing the relevance of queer studies, the satirical show incorporates dance, music and spoken words to portray the journey of five gay characters as they travel literally and metaphorically from the ivory tower of academia to a downtown drag bar. Along the way, according to DeFrantz, they learn the author's lesson: It is essential to bridge the gaps within the "really diverse queer community and figure out how to work together before we all fall apart."

"Queer Theory" was commissioned by Boston's Theater Offensive and will be presented by Slippage: Performance, Culture, Technology, a performance collective led by DeFrantz that explores connections between performance, formations of culture and interventions of technology.

DeFrantz earned his Ph.D. from the Department of Performance Studies at New York University in 1997 and joined the faculty of MIT that year. His area of expertise is the performed African American arts, and he has published essays on African American concert dance, social dance and theater.

DeFrantz is editor of "Dancin' Man Drums: Excavations in African American Dance." He serves as archivist for the Alvin Ailey American Dance Theater in New York, and he is the author of "Alvin Ailey's Embodiment of African American Culture," which won the 2004 de la Torre Bueno Prize for an Outstanding Dance Publication.

DeFrantz choreographed "Paul Robeson, All-American," a play for children by Ossie Davis, and he collaborated with Ballet Hispanico on "Border Crossings," an art-in-education program which tours nationwide. He has also choreographed and performed a "tap biography" of Thelonious Monk: "Monk's Mood: A Performance Meditation on the Life and Music of Thelonious Monk."

DeFrantz is a member of the Drama League of New York and the Dance Critics Association, and he serves on the editorial board of the Society of Dance History Scholars.

For more information, call x3-4720 or see web.mit.edu/slippage.

PHOTO / **DONNA COVENEY**

MIT conference honors artist at 70

Fellow artists, students and colleagues at MIT celebrated the life and creative career of Joan Jonas, professor of visual arts, with a day-long conference titled "Theatricality in Contemporary Art," held Oct. 23.

Jonas, 70, is a pioneer performance artist whose productions in the 1960s and 1970s were crucial to the development of video and conceptual art.

During the past decade, she has worked with composers to produce collaborative video-performance works, and she has performed and toured with The Wooster Group. Her most recent work continues to explore the relationship of new digital media to performance. Jonas is currently developing a performance for the Museum of Modern Art in Dublin where three of her installations will also be included.

In 2004, the Queens Museum of Art presented "Joan Jonas: Five Works," the first major exhibition of her work in a New York museum.

Author talks turkey on Thanksgiving dinner droop

It's the stuffing, stupid!

Sasha Brown
News Office

When it comes to the myth that Thanksgiving dinner makes us sleepy, Judith Wurtman takes the side of the big roast bird.

Wurtman, a researcher affiliated with MIT's Clinical Research Center, is co-author of a new book on the interaction between nutrition and brain chemistry. And she warns those about to settle in at the groaning board: The turkey is not responsible for drowsiness after the meal.

While it is true that tryptophan—an amino acid present in all protein—does make serotonin, which makes us relaxed, tryptophan from turkey alone is not what makes us tired, said Wurtman, whose PhD is in nutritional biochemistry.

Instead, it is the combination of the high-fat, high-carbohydrate food we eat as sides to the turkey—the sweet potatoes and marshmallows with brown sugar, the mashed potatoes, stuffing, gravy and sugar-filled cranberry sauce—that contribute to the exhaustion many people experience.

As Wurtman explains it, amino acids are found in all proteins, from cottage cheese to eggs. Among the amino acids that make up a protein, trytophan is the most limited, she said. Wurtman likened the process of amino acids journeying into the brain to hundreds of people trying to get through a subway turnstile. "Tryptophan stands little chance of getting through under normal circumstances," Wurtman said.

Add all the carbohydrates the typical American consumes during dinner, though, and the story changes, Wurtman said. Carbohydrates release insulin, which acts like a broom in the blood, chasing all but the tryptophan away. "Tryptophan ends up there rather alone," she said. Hence, it has a better chance of getting into the brain than it would have under normal circumstances.

PHOTO / **DONNA COVENEY**

Judith Wurtman, author of a new book on overeating, debunks the myth that turkey makes us drowsy.

Additionally, the other meal accoutrements—cheese puffs before dinner, wine throughout—add to that sleepy feeling, Wurtman said.

As for the "suburban" aspect of the myth, Wurtman notes, the post-turkey tiredness falls unequally on men and women.

"Who is in the living room munching on nuts and watching the ball game?" Wurtman asks with a laugh.

Joking aside, Thanksgiving does a powerful thing in our obese culture, Wurtman said, recalling a bulimic woman she once knew who called the holiday "national eating-disorder day."

"We all give ourselves permission to eat without control," Wurtman said. As someone who spends a lot of her work trying to help people lose weight, she is amazed by the holiday, which "does for supermarkets what Christmas does for retailers. It is all about excess. The whole thing is just a way of guilting people to shop."

For Wurtman's own Thanksgiving meal, health is the key. "It is not necessary to have excessive amounts of food," she said. Wurtman said she uses the opportunity to make different kinds of root vegetables—parsnips and turnips, for example—but that she does not drown them in butter. "To me, being healthy is important."

Wurtman's new book, "The Serotonin Power Diet: Use Your Brain's Natural Chemistry to Cut Cravings, Curb Emotional Overeating and Lose Weight," will be published Dec. 12.