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Wednesday – March 21, 2007

TechTalk
SERVING THE MIT COMMUNITY

Team maps huge math structure

Writing the character table for E_8 brought international happiness

David Vogan

Elizabeth Thomson
News Office

An international team of 18 mathematicians, including two from MIT, has mapped one of the largest and most complicated structures in mathematics. If written out on paper, the calculation describing this structure, known as E_8, would cover an area the size of Manhattan.

The work is important because it could lead to new discoveries in mathematics, physics and other fields. In addition, the innovative large-scale computing that was key to the work likely spells the future for how longstanding math problems will be solved in the 21st century.

MIT's David Vogan, a professor in the Department of Mathematics and member of the research team, presented the work Monday, March 19 to a standing-room-only crowd in Room 1-190. His talk, "The Character Table for E_8, or How We Wrote Down a 453,060 x 453,060 Matrix and Found Happiness," was peppered with jokes and laughter.

E_8, (pronounced "E eight") is an example of a Lie (pronounced "Lee") group. Lie groups were invented by the 19th-century Norwegian mathematician, Sophus Lie, to study symmetry. Underlying any symmetrical object, such as a sphere, is a Lie group. Balls, cylinders or cones are familiar examples of symmetric three-dimensional objects.

Mathematicians study symmetries in higher dimensions. E_8 has 248 dimensions.

"What's attractive about studying E_8 is that it's as complicated as symmetry can get. Mathematics can almost always offer another example that's harder than the one you're looking at now, but for Lie groups E_8 *is* the hardest one," Vogan said.

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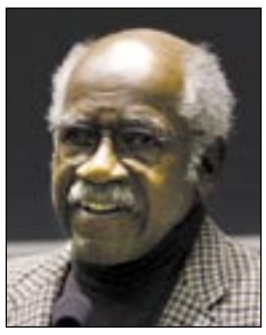
MIT conference portrays black architects' journey

Deborah Halber
News Office Correspondent

Architecture has one of the worst track records for attracting minority practitioners. Why that is true, and what can be done to change it, was the topic of a two-day conference at MIT, "Architecture Race Academe: The Black Architect's Journey."



Robert Coles

Mark Jarzombek

Janet Helms

Only 1.5 percent of registered architects in the American Institute of Architects (AIA) are black, a statistic only marginally higher than it was 40 years ago, according to keynote speaker Ted Landsmark, director of Boston Architectural College. Architecture is in danger of becoming a shrinking niche profession and not providing service to all the people of the world who need architects, he said.

Although MIT is not alone in graduating small numbers of black architects (most working architects receive their degrees at historically black colleges and universities), Mark Jarzombek, professor of architecture, said he hopes that 10 years from now, "MIT will no longer be seen as an example of the problem, but an example of the solution."

"The first step to change is to recognize our own failures publicly," Jarzombek said at the conference. "We have to see the problem as a broad cultural issue in the field for whom all of us should have laid claim." The goal of the conference, he said, is to explore how to bring the issue more into the mainstream of architectural discussions.

Adèle Naudé Santos, dean of the School of Architecture and Planning, said that MIT takes on issues—such as those raised

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PHOTO / **DONNA COVENEY**

March madness

If April is the cruelest month, March may be the most annoying: Balminess, followed by snow and ice storms, brought scenes like this to campus, along with pervasive mood swings.

Robotic brace aids stroke recovery

Worn on the arm, NeuroRobotic device is lightweight, portable

Deborah Halber
News Office Correspondent

At age 32, Maggie Fermental suffered a stroke that left her right side paralyzed. After a year and a half of conventional therapy with minimal results, she tried a new kind of robotic therapy developed by MIT engineers. A study to appear in the April 2007 issue of the American Journal of Physical Medicine & Rehabilitation shows that the device, which helped Fermental, also had positive results for five other severe stroke patients in a pilot clinical trial.

Fermental, a former surgical nurse, used the rehabilitation device 18 times over nine weeks. After 16 sessions, Fermental, now a stroke education nurse at Beth Israel Hospital, was able to fully bend and straighten her elbow on her own for the first time since the stroke. "It was incredible to be able to move my arm again on command," she said. "Cooking, dressing, shopping, turning on light switches, opening cabinets—it's easier now that I have two arms again."

The device—which sensed Fermental's electrical muscle activity and provided power assistance to facilitate her movements—also altered her brain.

Following a stroke, the destruction of brain cells leads to loss of motor function. With painstakingly repetitive exercise therapy, other neurons can take over some of the lost function. Devices such as the MIT-developed robotic brace can help people exploit their neural plasticity–the

See **BRACE**
Page 8

Julie Soriero is new dept. head and athletic director

Julie Soriero, director of athletics at Colorado College, has been named MIT's new department head and director of athletics, physical education and recreation, Dean Larry G. Benedict has announced. Soriero will join MIT as an associate professor on July 1, though she will likely visit campus this spring as part of preparing for her new role.

In making the announcement, Benedict said, "We are thrilled that Julie will be joining us as our new athletic director and department head. She brings a depth and breadth of experience balancing Division I and Division III programs, as well as values that are exceptionally aligned with those of MIT."

Julie Soriero

Soriero comes to MIT after having served at Colorado College for nine years, most recently as director of athletics. Prior to her appointment as director, she served Colorado College as the interim director of athletics concurrently with various other roles such as head women's basketball coach, director of events, senior women's administrator and senior associate athletic director. In addition, she previously has held leadership positions at Philadelphia University as head women's basketball coach and associate director of athletics and at the University of Pennsylvania as head women's basketball coach.

"Julie has an obvious love of athletics and is very student-focused," said Laura Capone, senior associate dean for student life and chair of the search committee. "Her enthusiasm is infectious and it was clear that she is one who constantly strives for excellence for herself and for students."

According to Benedict, Soriero brings to MIT experience leading a Division III institution with strong Division I and Division III programs, as well as comprehensive club and intramural programs. She comes with outstanding accomplishments in the areas of alumni relations and fundraising, while managing a large operating budget and organizing and defining the scope of a new building. Soriero also saw several of Colorado College's teams excel and be represented in NCAA tournaments, often in consecutive years.

Soriero began her career in athletics after receiving her S.B. degree in health and physical education from Pennsylvania State University and her Ed.M. degree in sports psychology from Temple University.

Soriero has received multiple honors and awards. She is currently serving on the board of the National Association of Collegiate Women Athletic Administrators and the executive board of the National Association of Collegiate Directors of Athletics. Among her other accomplishments, she was elected to the executive committee of the Association of Division III Independent Institutions, nominated for the "Sportswoman of Colorado" award, named one of Philadelphia's 40 Defining Women, recognized as the Women's Sports Foundation "All-American Coach," and named Coach of the Year multiple times.

Additional information, including Soriero's curriculum vitae, will be available online at web.mit.edu/dsl/fromthedean/announcement.html.

Review group addresses medical recommendations

The working group convened by President Susan Hockfield in December 2005 in response to the report of the Task Force on Medical Care for the MIT Community has completed its work, reviewing and successfully addressing all 41 of the report's recommendations, Theresa Stone, executive vice president and treasurer, has announced.

In a letter to the MIT community, Stone wrote, "On the basis of careful analysis, the Institute has dedicated resources for new personnel and programs while working to ensure that existing investments are used most effectively. In many cases, the implementation process has meant the introduction not only of new practices but also of new tools for assessment and ongoing improvement. The activities of the working group have also built a team that will continue to work collaboratively to advance these issues in the future."

Stone commented, "This initiative has strengthened both our medical services and our health insurance programs, while establishing a process and framework that will better enable MIT to manage these challenges in the future. Going forward, the Medical Department and Benefits will continue the creative partnership they have established to develop a comprehensive health, wellness, and disability strategy for our community."

Her letter highlighted some of the actions taken to address the report's recommendations.

"With respect to the Medical Department, major accomplishments to date have included increased clinical staffing, including both internists and nurses; improved access and services in mental health, dental, and wellness programs; and the development of new tools for quality assessment. We have also assessed and enhanced the financial management systems and processes that support our provision of medical care, so that our investments in clinical services can have the greatest long-term impact. The Center for Health Promotion and Wellness contin-

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Survey gives MIT a chance to talk back

Do you have suggestions for new ways to share information about your events, research or department news on campus? Which new technologies would you like MIT to consider using to share news and information? How do you get the latest MIT scoop that interests you?

This week, faculty, staff, students and alumni are being invited to participate in an online survey about MIT communications practices. You will have the opportunity to offer insights about topics of interest to you, along with preferred methods for sharing and receiving MIT news and information. Your participation in this research effort will influence the development of evolving methods of communication at MIT. The survey is being sponsored by Vice President of Institute Affairs Kirk Kolenbrander and MIT Alumni Association Vice President and CEO Elizabeth Garvin.

Please take a few minutes to complete the survey when you receive the e-mail invitation. If you have any questions, you may contact commsurvey@mit.edu.

Faculty will meet today

A regular meeting of the faculty will be held on Wednesday, March 21 at 3:30 p.m. in Room 32-123. Agenda items will include:

- Continued discussion on the report from the Task Force on the Undergraduate Educational Commons
- Proposal to disband the committee on faculty-administration
- Changes to Section 1.73.5 of "The Rules and Regulations of the Faculty"
- Report on the change of the Biological Engineering Division to the Department of Biological Engineering
- Resolution on the death of Professor Meyer
- Remarks from President Susan Hockfield
- Topics arising and questions for the president, provost and chancellor

No Tech Talk next week

There will be no Tech Talk on Wednesday, March 28. The next Tech Talk will be published on April 4. For ongoing MIT news updates, please go to the News Office web site, web.mit.edu/newsoffice/.

DIGITALK: WHERE IT'S AT

All about hardware

Information Services and Technology (IS&T) would like to invite members of the MIT community to a forum on the recommendation process for desktop and mobile computing hardware. The event will be held from 1:30 to 3 p.m. on Wednesday, April 4, in the Sala De Puerto Rico in the Student Center (W20).

IS&T's Hardware Core Team was chartered in 2006 to collect both vendor information and community input on best practices for purchasing new computers and peripherals. The team will share insights from its meetings with vendors at the April forum. If you have ideas for improving the computer purchasing process at the Institute, this is your forum.

The Hardware Core Team consists of representatives from the Computing Help Desk, the Computer Buying Advice Group, the Administrative Desktop Renewal Program and the four platform coordinators (Windows, Macintosh, Linux and mobile devices). If you have input for the team, send mail to hardware-core@mit.edu.

For IS&T's current hardware recommendations, see the Computing Buying Advice page at web.mit.edu/ist/services/hardware/presales.html.

SAP upgrade over Patriot's Day weekend

An SAP Production system upgrade that will bring MIT up to the most current release of SAP is scheduled for Patriot's Day weekend. The SAP Production environment will be unavailable beginning at 7 p.m. Friday, April 13, and will return to service at 6 a.m. on Tuesday, April 17.

SAP, ECAT and all SAPweb activity, including Employee Self Service (ESS), time sheet entry/approval, requisitioning, journal vouchers and credit card verification will be inaccessible during this maintenance period. The Data Warehouse will be available during the cutover weekend. The upgrade will not change SAPweb and ESS transactions; EHS SAPweb applications will have a new look but the same functionality. End-user training requirements are expected to be minimal.

IS&T will provide more specific information on system availability at web.mit.edu/sapbiz and through other communications. If you have questions about the upgrade, contact Kevin Lyons (klyons@mit.edu) or Sandy Pata (spata@mit.edu).

Engineering books online

Through the MIT Libraries' subscription to Books24x7, the MIT community has online access to hundreds of books on information technology and computer science. Now the MIT community can also access Books24x7's Engineering Pro Collection, a multidisciplinary reference resource. It offers hundreds of engineering books from myriad publishers, including MIT Press, IEEE, John Wiley & Sons, Cambridge University Press and McGraw-Hill.

To check out this online collection, go to the Books24x7 web site at library.books24x7.com.libproxy.mit.edu. Under "Browse Topics" on the right, select "Engineering Topics" from the drop-down menu, and choose from the list of categories. You can also view recently added books, the Top 10 books from last week, or do your own custom search. If you have feedback about this new service, you can reach the staff at Barker Engineering Library via the comments page at libraries.mit.edu/barker/ask-barker.html.

MIT Linux users: Stand and be counted!

To better understand the needs of the Linux community at MIT, IS&T has created the Linux "Stand and Be Counted" survey. If you're a Linux user and would like to cast your vote for the distributions, products and services that are important to you, visit web.mit.edu/surveys/linux between March 21 and March 30. The survey should take less than 10 minutes to fill out.

To find out more about current Linux offerings at MIT, go to web.mit.edu/ist/topics/linux.

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Two from MIT win Franklin Institute Awards

Two MIT professors have won 2007 Franklin Institute Awards, joining the august company of past winners including Albert Einstein, Thomas Edison and Orville Wright.

Professor Emeritus Klaus Biemann of the Department of Chemistry and Merton C. Flemings, the Toyota Professor of Materials Processing, Emeritus, are two of nine 2007 Franklin Institute Laureates. Winners are being honored "for their significant discoveries and achievements, which directly impact our daily lives or contribute to our present and future well-being."

Klaus Biemann

Biemann will receive the Benjamin Franklin Medal in chemistry "for pioneering the development of mass spectrometry, used to determine structure of complex molecules including sequencing of peptides and proteins, thus enabling the field of proteomics."

Flemings, who is also director of the Lemelson-MIT Program, will receive the Benjamin Franklin Medal in materials engineering "for contributions to understanding aspects of solidification of metallic alloys (and) the development of (the) semi-solid metalworking industry, which helps make sporting equipment, household appliances and cars strong and light."

Past Franklin winners include Albert Einstein, Thomas Edison and Orville Wright.

The new laureates will receive their awards April 26 at the end of a weeklong series of events and activities at the Franklin Institute open to middle school, high school and college students, as well as the general public.

These events include the Laureates' Laboratory, which will feature interactive demonstrations illustrating the specific concepts behind each laureate's work, and Meet the Scientists, a lively discussion and Q&A session geared toward students.

PHOTO / **DONNA COVENEY**

Architecture and planning dean Adele Santos, left; Ted Landsmark, director of Boston Architectural College, center, and Ho Yung Chang, architecture department head, welcomed participants to 'Architecture Race Academe: The Black Architect's Journey.'

Mentoring, inclusiveness draw aspiring architects to the field

Ruth Walker
News Office Correspondent

Wes Henderson got his first career counseling in elementary school, he told the audience at the Saturday, March 17 session of the two-day conference, "Architecture Race Academe: The Black Architect's Journey."

In the first-grade classroom of the segregated elementary school he attended, his teacher noticed the houses he was drawing and told him, "Oh, you should be an architect!"

"I hadn't really put a name to what I was doing, but she did that for me," Henderson said last weekend of that first-grade teacher.

He remembered the advice and ultimately heeded it.

He went on to earn two architecture degrees from MIT, in 1974 and 1976, and later a doctorate from UCLA.

After spending many years at universities in his home state of Texas, he now teaches architecture at Florida A&M University.

Henderson noted that the exchange with his first-grade teacher was but one example at the conference of how a specific bit of well-timed advice made a difference in the life of someone who would go on to become an architect.

The numbers in the room were small—just a few dozen on the gray, rainy Saturday morning after Friday's big snowstorm.

But then the numbers of blacks in architecture are small. In some categories—black professors who are full-time faculty at a top-tier institution—they can be counted literally on the fingers of one hand, according to numbers presented by Lawrence Sass, MIT assistant professor of architecture.

And because the numbers are so small, the discussions made clear, each black architect makes an individual journey. Many of the architects chose their path in response to specific pieces of advice they got from trusted mentors—counsel that probably took moments to impart but has been remembered ever since.

Sass, for instance, said that he had been advised to take the time to develop a personal portfolio of work—not always a top priority for debt-laden new graduates. "I get the feeling that most people…don't know how desperately important that is," as a preparation for academic appointments.

Some implicit recommendations for universities seeking to welcome more

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Visiting Iraqi journalist ranks culture over conflict

Stephanie Schorow
News Office Correspondent

Iraqi journalist Huda Ahmed never tells questioners whether she is a Sunni or Shia Muslim. Such a question, she believes, is not only inappropriate but underscores a dangerous lack of understanding of Iraqi history.

The American media is so focused on the Shia-Sunni split that "there is no need to talk about it," she said. "If you ask, you bring it into existence."

All she will say, and she says it proudly, is: "I am an Iraqi Muslim."

A journalist who was recognized for bravery while covering combat during the siege of Najaf in southern Iraq, Ahmed is currently at MIT's Center for International Studies as a recipient of the International Women's Media Foundation's Elizabeth Neuffer Fellowship. The nine-month fellowship to study human-rights journalism is sponsored in memory of the Boston Globe reporter who was killed while on assignment in Iraq in 2003.

Ahmed will take classes at MIT and Harvard, serve internships at WBUR with National Public Radio and possibly at two American daily newspapers, and participate in the Elizabeth Neuffer Forum on Human Rights and Journalism on March 29.

She will also write a study on the Iraq situation—focusing on family issues—which she hopes "will be studied by the American administration."

Ahmed, who is her 30s, does not go by her full name or have her photo taken, even in the relative safety of Cambridge. Her name has appeared on hit lists, and she is keenly aware of the dangers of journalism posed amid the chaos caused by warring insurgent groups. "Some of them don't announce why they kill such a politician or such an engineer or doctor or journalists," she said. "They just hit them and they go."

Yet she remains hopeful—because, she explained, Iraqis are hopeful people—that her homeland will gain some kind of normal life.

She does not believe, for example, that sectarian violence was inevitable after the fall of Saddam Hussein.

"Sunni and Shia used to live together. Sunni and Shia are both Muslims," she said. "They have differences but that doesn't mean they have to fight each other. We have intermarriage. We have mixed tribes, mixed families. Of course, there are fanatic families on both sides. Sunnis were favored by Saddam Hussein, but they were favored before that, even by the Ottomans. And even before that, the Shia were oppressed.

"But that didn't stop them from getting married to each other. They didn't say, 'Oh, he's Sunni and she's Shia,' and they couldn't marry each other. Nobody felt that way.

"Saddam was trying to have this gap—to build this seed. He worked so hard on that. Apparently he succeeded now."

American administrators in Iraq attempted to put more Shia in power after Saddam's fall, to redress inequities, but quotas and lists that identified leaders as Sunni or Shia just enhanced religious tension. When the Shia began to die in bombings, religious differences seemed irreconcilable, she said.

Ahmed, who was born and raised in Baghdad and graduated from the College of Languages of Baghdad University, became interested in journalism after the American invasion of 2003, when she started doing translation and other research work for the Washington Post. "We covered all the stories you could ever think of: hot spots, bombings, politics, culture," she said. She later worked for Knight-Ridder.

In the process, she got an education in American journalism and in what the American media will or will not cover. For example, she wishes the American press would focus on the lives of Iraqis and Iraqi culture as well as Iraqi politics and provide more in-depth stories that will help Americans understand the context of the current violence.

In her own research, Ahmed will delve into women's issues; she wants Americans to understand the nuances of Iraqi women's lives, such as why an Iraqi woman may choose to wear a veil or headscarf. Women started wearing scarves during the embargo of Saddam's era to mourn deaths from an unusual surge in cancer cases and other health problems and to show their faith. After 2003, many continued to wear a scarf to show commitment to the new post-Saddam politics; others wore scarves out of concern for security in the new religious atmosphere.

"But don't ever think that this woman, who wears a veil (scarf) because she was influenced by the Islamic party, that she is not strong, that she is not outspoken or that she cannot beat you and men in her speech," Ahmed said.

Iraqi women "are powerful, I tell you. And they are trying hard not to be left behind," she said. "They feel that this is their chance and even if it takes a long time, they have to do it."

The Elizabeth Neuffer Forum on Human Rights and Journalism will be held March 29 at the John F. Kennedy Presidential Library. For more information, go to www.iwmf.org/programs/neuffer.

Engineers create SpaceNet–the supply chain

Network of nodes could ensure deliveries to the moon

Deborah Halber
News Office Correspondent

If you think shipping freight from Cincinnati to El Paso is challenging, imagine trying to deliver an oxygen generation unit from the Earth to a remote location on the moon.

By 2020, NASA plans to establish a long-term human presence on the moon, potentially centered on an outpost to be built at the rim of the Shackleton crater near the lunar South Pole.

To make such a scenario possible, a reliable stream of consumables such as fuel, food and oxygen, spare parts and exploration equipment would have to make its way from the Earth to the moon as predictably as any Earth-based delivery system. Or more predictably: One missed shipment could have devastating consequences when you can't easily replenish essential supplies.

To figure out how to do that, MIT researchers Olivier L. de Weck, associate professor of aeronautics and astronautics and engineering systems, and David Simchi-Levi, professor of engineering systems and civil and environmental engineering, created SpaceNet, a software tool for modeling interplanetary supply chains. The latest version, SpaceNet 1.3, was released this month.

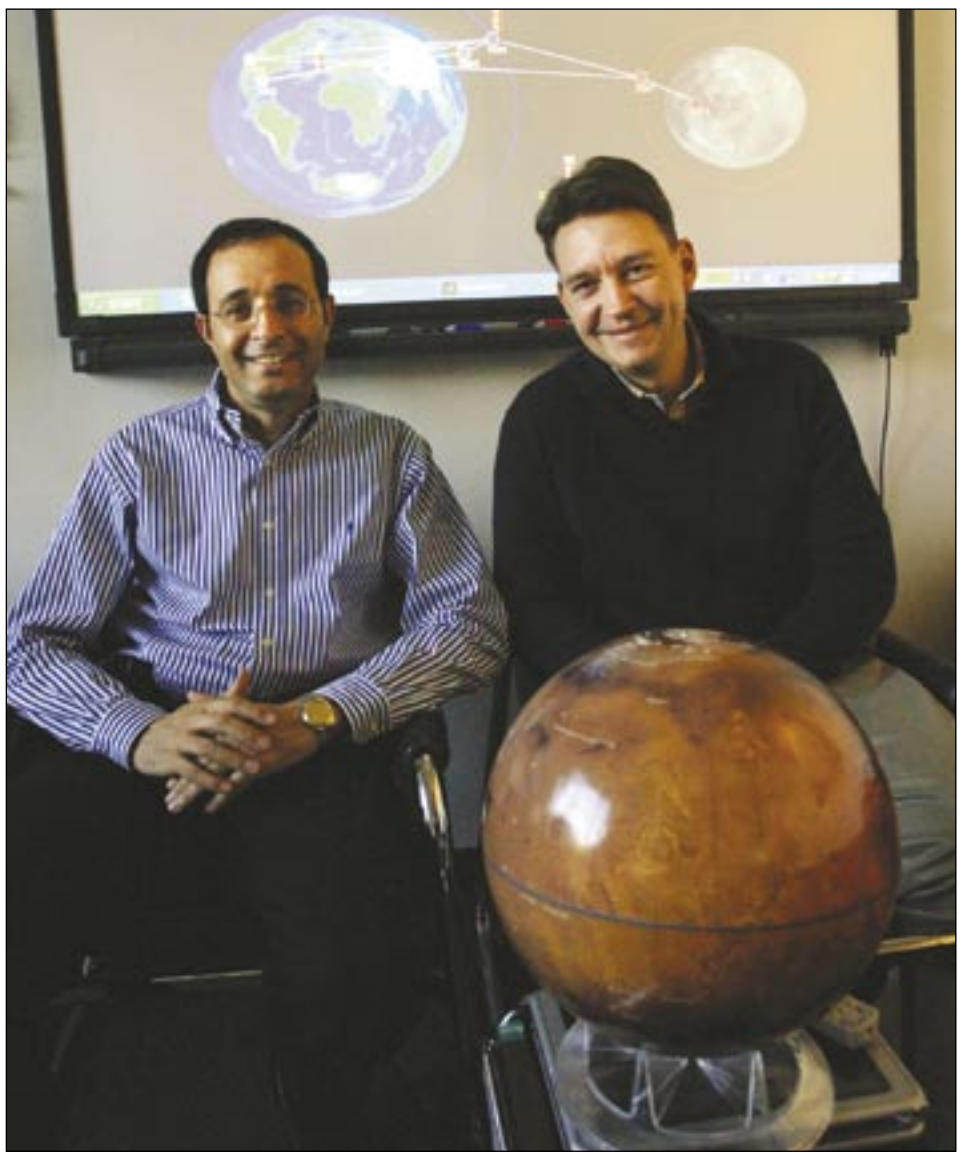


PHOTO / **DONNA COVENEY**

David Simchi-Levi, professor of engineering systems and civil and environmental engineering, left, and Olivier L. de Weck, associate professor of aeronautics and astronautics and engineering systems, developed software that helps figure out the logistics of shipping food, fuel, space exploration equipment and other supplies from Earth to other planets.

The system is based on a network of nodes on planetary surfaces, in stable orbits around the Earth, the moon or Mars, or at well-defined points in space where the gravitational force between the two bodies (in this case, the Earth and the moon) cancel each other out. These nodes act as a source, point of consumption or transfer point for space exploration logistics.

"Increasingly, there is a realization that crewed space missions such as the International Space Station or the buildup of a lunar outpost should not be treated as isolated missions, but rather as an integrated supply chain," said de Weck. The International Space Station already relies on periodic visits by the space shuttle and automated, unpiloted Russian Progress resupply vehicles.

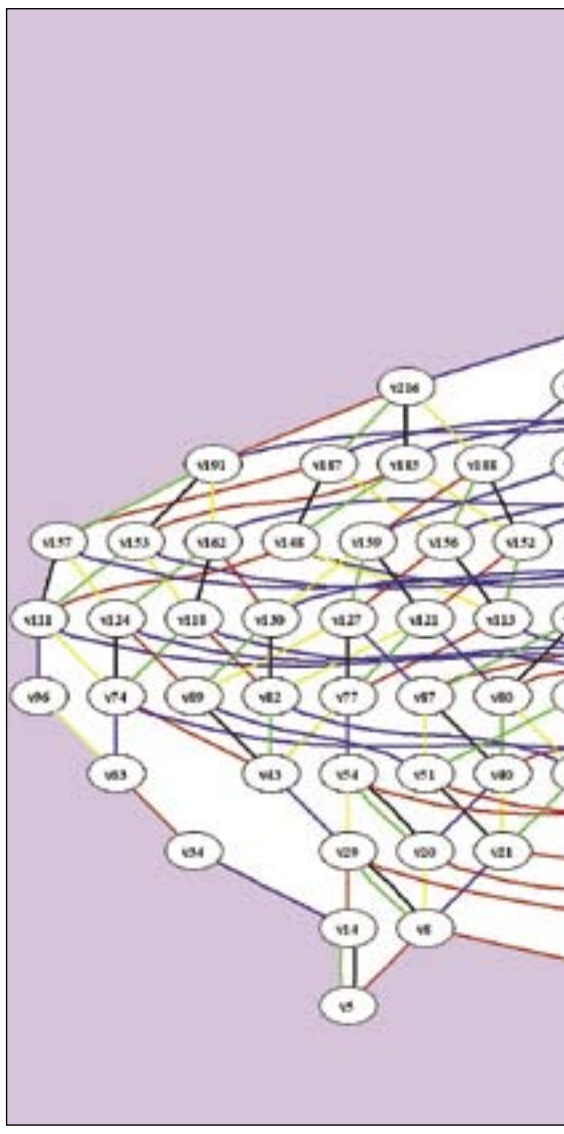
While "supply chain" usually refers to the flow of goods and materials in and out of manufacturing facilities, distribution centers and retail stores, de Weck said that a well-designed interplanetary supply chain would operate on much the same principles, with certain complicating factors. Transportation delays could be significant—as much as six to nine months in the case of Mars—and shipping capacity will be very limited. This will require mission planners to make difficult trade-offs between competing demands for different types of supplies.

A reliable supply chain will "improve exploration capability and the quality of scientific results from the missions while minimizing transportation costs and reducing risks" to crew members, de Weck said.

SpaceNet evaluates the capability of vehicles to carry pressurized and unpressurized cargo. It also simulates the flow of vehicles, crew and supply items through the trajectories of a space supply network, taking into account how much fuel and time are needed for single-sortie missions as well as multiyear campaigns in which an element or cargo shipment might have to be prepositioned by one set of vehicles or crew members while being used by another.

In addition to determining a logical route, SpaceNet also allows mission architects, planners, systems engineers and logisticians to focus on what will be

See **SPACENET** Page 6



This graphic describes a mathematical structure simi
connecting edges, are shorthand describing the geor

BIG MATH

Continued from Page 1

"E_8 was discovered over a century ago, in 1887, and until now, no one thought the structure could ever be understood," said Jeffrey Adams, project leader and a mathematics professor at the University of Maryland. "This groundbreaking achievement is significant both as an advance in basic knowledge, as well as a major advance in the use of large-scale computing to solve complicated mathematical problems."

The mapping of E_8 may well have unforeseen implications in mathematics and physics that won't be evident for years to come.

"There are lots of ways that E_8 appears in abstract mathematics, and it's going to

MIT bioengineers identify role of key protein in tumor growth

Anne Trafton
News Office

MIT researchers have identified how a missing protein causes tissue to become precancerous—a finding that could help doctors identify patients at high risk to develop tumors.

Most breast and prostate tumors are missing the protein, known as 14-3-3 sigma, but until now it has not been clear what role it plays in tumor growth. The MIT researchers report in the March 15 issue of Nature that when the protein is knocked down, dividing cells fail to separate fully and become precancerous.

"The cells try to divide and try to divide, and they just give up. They can't finish cytokinesis (the final stages of cell division)," said Michael Yaffe, associate professor of biology and biological engineering and leader of the research team. Failing to divide completely, the cells recombine into a single cell with two nuclei.

Such fused, or binucleate, cells have recently been shown to be precursors to cancer cells. They are often found in so-called "dysplastic" tissue, which consists of cells that are not fully normal but are not cancerous, said Yaffe.

Comparing tumors to weeds, Yaffe explained that those tissues act as fertile "soil" for tumor development. "Tumors grow in epithelial tissues that are already deranged for some reason, and something about that soil makes it better able to grow weeds," he said.

Loss of 14-3-3 sigma in dysplastic tissue could serve as a marker to help doctors predict whether tumors will develop. "Our hope is that it will be possible to monitor

Michael Yaffe

Phillip Sharp

14-3-3 expression in these 'benign' conditions, a subset of which may not be so benign," said Yaffe, who is also affiliated with MIT's Center for Cancer Research, the Broad Institute of MIT and Harvard, and Beth Israel Deaconess Medical Center.

The researchers were initially intrigued by the fact that 14-3-3 sigma is missing in normal tissue that surrounds tumors, which suggested that its function is lost very early in tumor development. Once the researchers started investigating the protein, they eventually unraveled a complex signaling pathway whose disruption leads to the failure of cell division.

They discovered that 14-3-3 sigma is most active during mitosis, when it helps control production of proteins necessary for division. Although 14-3-3 sigma interacts with many proteins, the research team focused on its relationship with a single protein, a translation factor known as eIF4B.

Translation factors are proteins that help determine the mix of proteins that a cell produces. Translation occurs when a messenger molecule known as mRNA carries information encoded by DNA to a cell organelle called the ribosome, which "translates" the mRNA sequence into a protein.

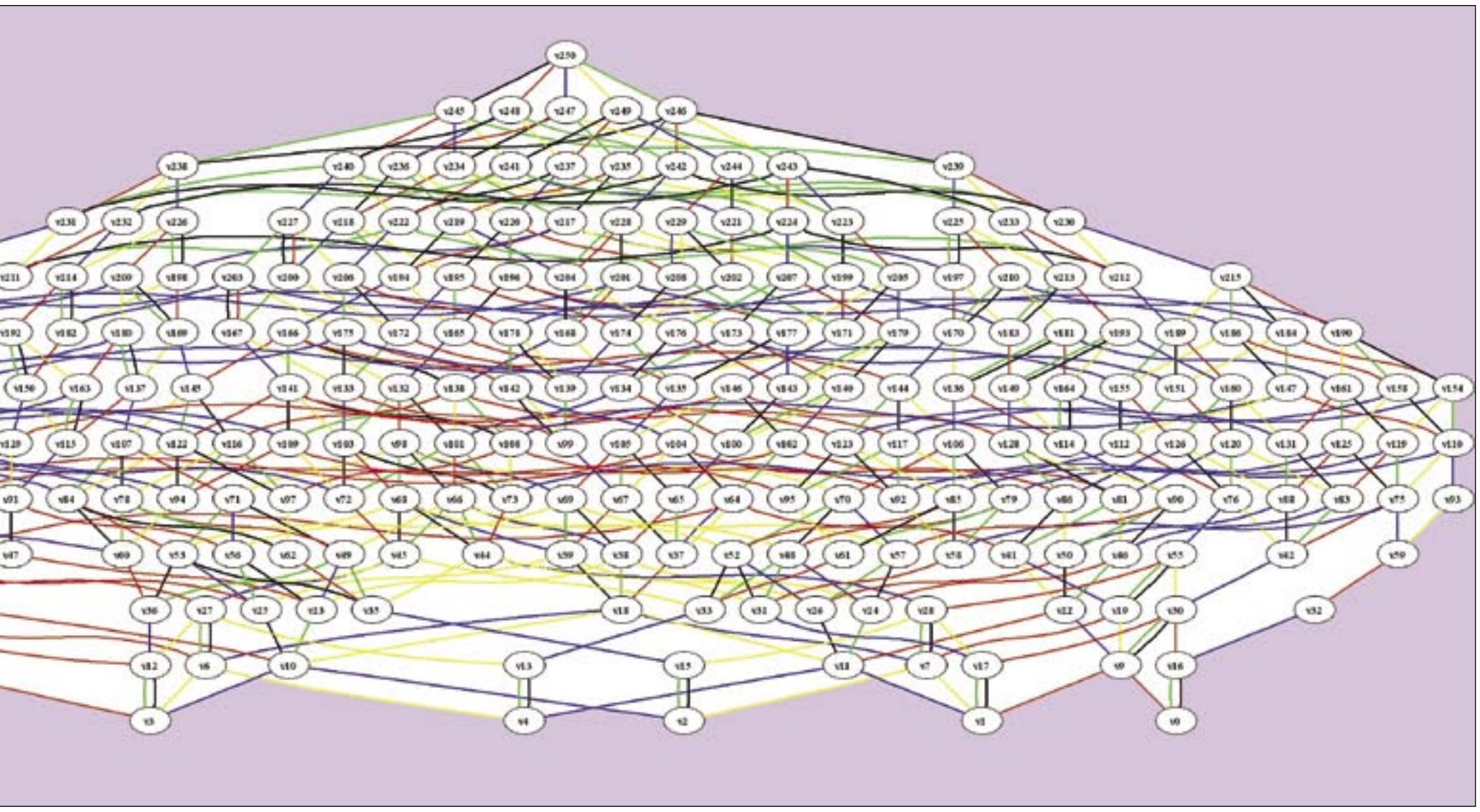
The translation factor eIF4B forms part of an enzyme that allows mRNA to unwind so the ribosome can read its sequence. When 14-3-3 sigma is knocked out, eIF4B is not produced, and mRNA for the protein p58 cannot be translated. p58 plays a critical role in the final splitting of one cell into two during mitosis, so when it is missing, the cells cannot fully divide.

When p58 function is restored, the cells resume normal division.

The work demonstrates the importance of studying translation factors and the cell signaling pathways that affect them, Yaffe said. Most research on gene regulation focuses on transcription factors, which control which DNA sequences are transcribed into mRNA, but now "we're at the beginning of understanding another wave of regulation," which takes place at the translation level, he said.

The lead author of the paper is former MIT postdoctoral fellow Erik Wilker. Other authors are Marcel van Vugt, a postdoctoral fellow at the Center for Cancer Research (CCR); Steven Artim of the CCR and MIT's Department of Biology; Paul Huang, a professor in the Harvard-MIT Division of Health Sciences and Technology and Department of Biological Engineering; Christian Petersen, a former MIT postdoctoral associate; Christian Reinhardt, a postdoctoral fellow in the CCR and biology; Yun Feng of the CCR and biology; MIT Institute Professor Phillip Sharp; Nahum Sonenberg of McGill University; and Forest White, an assistant professor of biological engineering.

The research was funded by the Anna Fuller Fund, the National Institutes of Health, the European Molecular Biology Organization, the David H. Koch Cancer Research Fund, and a Burroughs-Wellcome Career Development Award.



GRAPHIC COURTESY / **DAVID VOGAN, MIT**

lar to but much smaller than E_8. The corresponding picture for E_8 would take 800 9-by-12-inch pages to print at the resolution of this graphic. The connections in the graph, and the colors of the metry of the structure.

fun to try to find interpretations of our rk in some of those appearances," said gan. "The uniqueness of E_8 makes me pe that it should have a role to play in eoretical physics as well. So far the work that direction is pretty speculative, but l stay hopeful."

"This is an exciting breakthrough," said ter Sarnak, a professor of mathematics Princeton University and chair of the scitific board at the American Institute of athematics (AIM). "Understanding and assifying the representations of E_8 and e groups has been critical to understandg phenomena in many different areas of athematics and science, including algea, geometry, number theory, physics and chemistry. This project will be invaluable for future mathematicians and scientists," said Sarnak, who was not involved in the work.

The magnitude and nature of the E_8 calculation invite comparison with the Human Genome Project. The human genome, which contains all the genetic information of a cell, is less than a gigabyte in size. The result of the E_8 calculation, which contains all the information about E_8 and its representations, is 60 gigabytes. This is enough to store 45 days of continuous music in MP3 format.

The mapping of E_8 is also unusual because it involved a large team of mathematicians, who are typically known for their solitary style. "People will look back on this project as a significant landmark and because of this breakthrough, mathematics will now be viewed as a team sport," said Brian Conrey, executive director of AIM.

The E_8 calculation is part of an ambitious project sponsored by AIM and the National Science Foundation known as the Atlas of Lie Groups and Representations. The goal of the Atlas project is to determine the unitary representations—roughly speaking, symmetries of a quantum mechanical system—of all the Lie groups (E_8 is the largest of the exceptional Lie groups). This is one of the most important unsolved problems of mathematics. The E_8 calculation is a major step and suggests that the Atlas team is well on the way to solving this problem.

The Atlas team consists of 18 researchers from around the globe. The core group consists of Adams and Vogan, plus Dan Barbasch (Cornell), John Stembridge (University of Michigan), Peter Trapa (University of Utah) and Marc van Leeuwen (University of Poitiers). (Until his death in 2006, Fokko du Cloux, of University of Lyon, was also a member.) Additional team members include Dan Ciubotaru, the CLE Moore Instructor in MIT's Department of Mathematics, and Alfred Noel, a professor at the University of Massachusetts at Boston and an MIT visiting scholar.

For more information on E_8 visit aimath.org/E8/.

MIT biodiesel student group wins national Ecomagination Challenge

The Biodiesel@MIT team was 10 minutes into its PowerPoint presentation—a talk the group had given many times to drum up support for bringing a biodiesel processor to campus—when there was a loud knock on the Building 56 conference room door. MTV veejay Gardner Loulan burst in, mike in hand, with an oversized bunch of green balloons in tow.

"Hey, I hate to interrupt, but I'm here on behalf of GE and mtvU to tell you that you have won the Ecomagination Challenge!" he said. Then it was hugs, handshakes and high-fives all around.

That was how Biodiesel@MIT—a student-led initiative to turn used vegetable oil from campus dining facilities into biodiesel fuel for MIT diesel campus vehicles—found out they had won a national contest and $25,000 from GE and mtvU, MTV's 24-hour college network. The grant will go toward a biodiesel processor in a solar-powered filling station on the MIT campus.

The group was one of 10 finalists in the Ecomagination Challenge, which encouraged student involvement in campus greening and raising awareness for sustainability. Student groups from across the country submitted proposals for projects that would make their campuses more environmentally friendly.

Projects were judged on ecology, economics and creativity. Britta Barrett from GE corporate communications told the eight students in the room, who thought they were giving the presentation for MIT Energy Initiative education task force chair Angela Belcher, professor of biological engineering and materials science and engineering, and being videotaped for a new MIT task force web page on student energy-related initiatives, that their proposal was the best of the 10 finalists.

Matt Zedler, one of the biodiesel group's organizers and a senior mechanical engineering major from Richmond, Va., said that the carefully planned surprise announcement was, in fact, a surprise. "We weren't sure what was going on," he said, adding that he had been checking the challenge web site all morning for the March 15 announcement.

In addition to the $25,000 grant, MIT gets an mtvU Earth Day concert and festival headlined by Angels & Airwaves in April. All students are invited.

"MIT wants to 'walk the talk' on energy and the environment, and I believe that this project will pave the way for more student-led campus sustainability initiatives," said Joseph D. Roy-Mayhew, a junior chemical-biological engineering major who first looked into the feasibility of an on-campus biodiesel processor during a January 2006 IAP class sponsored by the Laboratory for Energy and the Environment. He further developed the idea with support from a Campus Sustainability UROP through the Environmental Programs Office.

PHOTO / **DONNA COVENEY**

Biodiesel@MIT first-year students Katie Rowe, left, and Katrina Ellison embrace while junior Joe Roy-Mayhew, left, and senior Matt Zedler high-five moments after learning their group had won a national 'green campus' challenge sponsored by GE and mtvU.

MIT a cappella group rules over rivals with Van Halen, Gorillaz

The MIT Logarhythms "took the a cappella cake" in a victory over a cappella groups from Harvard, Tufts and Brandeis at a sold-out concert, "All A Cappella LIVE at the Majestic." The Logs ruled thanks to audience votes.

The afternoon event was broadcast live on WERS radio from the Cutler Majestic Theater in Boston on Sunday, March 11.

The show featured live sets from four area a cappella acts—Brandeis Voicemale, Harvard Lowkeys, MIT Logarhythms and Tufts Beelzebubs—which gave vocals-only renditions of classic and contemporary pop hits, often with accompanying hand motions and dance moves.

The Logarhythms, an all-male 16-piece group wearing jeans, caps and colorful ties, performed their "extensive vocal harmonies with such attitude, humor and charisma that the audience and the judges were floored," wrote Jon Meyer for WERS.

"I have never heard Van Halen converted into a cappella. The feat frankly appears impossible. But the Logs defied expectations, bringing fist-pumping to their a cappella rendition of 'Jump' complete with the soloist's dead-on 'regular guy'-styled impression of David Lee Roth. They also performed Jet's 'Are You Gonna Be My Girl' as a duet, with choreography that ranged from hand movements to dance to slapstick to running around the entire theater searching for the song's titular 'Girl.' When the Logs closed with the Gorillaz' 'Feel Good Inc.,' it was the first standing ovation of the show," Meyer wrote.

The eight-piece, all-male Brandeis Voicemale opened its set with an energetic medley moving with ease from "Can't Stop Loving You" (Phil Collins) to "Here It Goes Again" (OK Go). The co-ed, 16-piece Harvard Lowkeys offered "California Dreamin'" (The Mamas and the Papas), Shawn Colvin's "Sunny Came Home" and Robyn's "Show Me Love."

The Tufts Beelzebubs closed the afternoon show with two vocal percussionists, multiple soloists and a strip tease; they got the day's second standing ovation.

PHOTO / **DANIEL BERSAK**

Architect and MIT alum Wes Henderson advocated mentoring to encourage and guide aspiring architects.

MIT Federal Credit Union announces annual award and scholarship programs

MIT Federal Credit Union Memorial Scholarship Program

The MIT Federal Credit Union has established a memorial scholarship to honor former MITFCU staff and volunteers who have contributed to the success of the credit union. Three $1,000 scholarships will be awarded annually. The scholarships will be presented to the recipients at the MITFCU annual business meeting on April 24.

2007 MIT Federal Credit Union People Helping People Award Program

The MIT Federal Credit Union People Helping People Award is an annual award presented to one member who has exemplified the meaning of "People Helping People" in the MIT community. The award recipient will receive $2,000 and will choose a charity from a pre-approved list to receive an additional $2,000 donation. The award will be presented at the MITFCU annual business meeting on April 24.

The application deadline is March 30.

To obtain eligibility requirements and applications for either program, visit www.mitfcu.org.

Anyone with questions should contact Maria Connelly at x3-3579 or mariac@mit.edu.

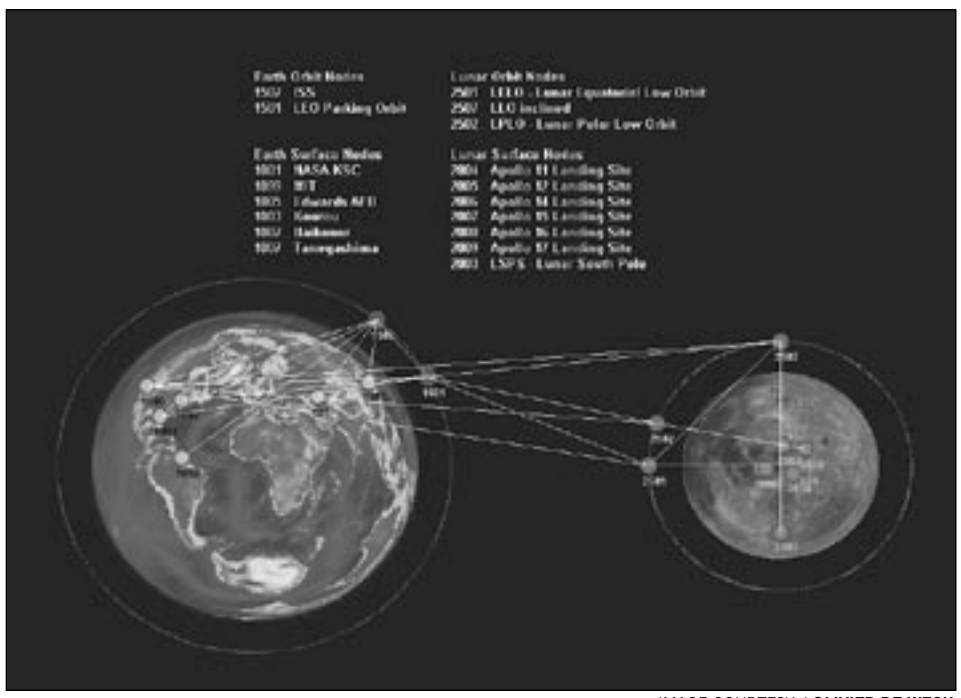


IMAGE COURTESY / **OLIVIER DE WECK**

The SpaceNet supply chain relies on a web of surface and landing nodes for interplanetary trucking. The model above includes the MIT campus as a launch site—or an in-joke among the researchers.

SPACENET

Continued from Page 4

needed to support crewed exploration missions.

Mars on Earth

To experience an environment as close as possible to harsh planetary conditions, MIT conducted an expedition to Devon Island in the Canadian arctic in 2005. The researchers established a semipermanent shelter at the existing NASA-sponsored Haughton-Mars Research Station (www.marsonearth.org) and compiled an inventory of materials at the base, including key items such as food, fuel, tools and scientific equipment, while carefully tracking inbound and outbound flights.

They also experimented with modern logistics technologies, such as radio frequency identification, that autonomously manage and track assets with the goal of creating a "smart exploration base" that could increase safety and save astronauts and explorers precious time.

SpaceNet 1.3 is written in MATLAB, a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis and numerical computation.

The SpaceNet development team includes MIT graduate students, postdoctoral associates and research staff led by de Weck and Simchi-Levi. They are aided by partners at Caltech's Jet Propulsion Laboratory, Payload Systems Inc., which provides science and engineering services for spaceflight applications, and NASA industry partner United Space Alliance.

For more information on SpaceNet 1.3, go to spacelogistics.mit.edu.

This work was funded by NASA.

ARCHITECTS CONFERENCE

Continued from Page 3

black architects-in-training:

- Make better use of black alumni as recruiters; follow up with alumni who have written letters of recommendation. This isn't always done, Henderson said.
- Pay attention to the visuals on campus: Even something as simple as display-case photos of racially mixed intramural sports teams can telegraph a message of inclusion.
- Ensure that black students have not only appropriate academic preparation but familiarity with the way things are done at a particular university.

Henderson credited Dolores Hayden, formerly of MIT and now of Yale, for facilitating his admission to UCLA. "She helped me see I needed to do more writing, go to more conferences."

He also credited Stanford Anderson, professor of architecture at MIT, as a mentor who wouldn't perhaps define himself as a mentor but who "maybe inadvertently" gave him some opportunities, including a field trip to Paris. "Did he take me?" Henderson asked rhetorically. "No, he took the whole class." But Henderson benefited along with everyone else. Mentors like these "let me see what an academic does," he said.

Not everyone, though, was convinced that structured mentoring is the best way to get more blacks into architecture. "It's not about who can take you by the hand and lead you through the system," as one participant put it. "It's about getting more people interested in architecture as a profession."

Janet E. Helms, Augustus Long Professor of counseling psychology and director of The Institute for the Study and Promotion of Race and Culture at Boston College, gave the morning's keynote address. Panels focused on teaching and practicing architecture; panelists included MIT alumnus Robert T. Coles (photos on page 1).

Continued from Page 1

by women scientists in 1999—and doesn't shy away from them. Increasing diversity on campus is one of MIT's major priorities, she said, and to ensure that the School of Architecture and Planning helps meet Institute-wide goals, the school has hired MIT alumna Robbin Nicole Chapman as manager of diversity recruitment.

"You're taking on an entire profession that has chosen to ignore these issues," Landsmark said, pointing out that there are only 29 licensed black architects in Massachusetts. Part of the problem is lack of awareness of the field, a lack of role models, a perception that architects don't make much money and a lack of ability to develop private practices because new business is tied to social connections not readily available to young minority practitioners, he said.

Catalysts for change, Landsmark said, might include sponsored programs to introduce 6- to 14-year-olds to design professionals, because most architects, regardless of race or gender, cite early exposure to someone in the field as a factor in choosing the field; recruiting design school faculty of color outside of traditional recruitment tracks; monitoring government and foundation diversity programs to see if they work; increasing the visibility of architects of color; and collecting better data on who enters the profession.

Conference speaker Ellen Weiss, Favrot Professor at the Tulane University School of Architecture, presented a biographical sketch of Robert R. Taylor, the first academically trained black American architect. Taylor, MIT's first black graduate, went on to teach at Tuskegee Institute in Alabama, where he designed most of the campus buildings. Taylor's primarily horizontal buildings have finely tuned proportions and classical porticos, many displaying Tuskegee's richly textured homemade bricks.

MEDICAL

Continued from Page 2

ues to advance its efforts to help members of the community to adopt and maintain healthy behaviors, attitudes and lifestyles," she noted.

The Institute has also increased the share of health insurance costs it bears "in order to slow the rate of premium increases for plan subscribers. We have also evaluated and negotiated favorable plans and/or pricing for medical care, dental care and prescriptions. Looking ahead, the analytical framework is in place to support even more effective use of the health insurance premiums paid by MIT and members of the community," Stone wrote.

A final report is available at the task force web site: mit.edu/task-force/medical/final/final-march-07.html. Further information will be available in coming issues of MIT Tech Talk and the Faculty Newsletter.

The members of the working group were Tricia Fay, director of benefits, Sherwin Greenblatt, then executive vice president and treasurer, Bill Kettyle, director of MIT Medical, Jim Morgan, controller, and Israel Ruiz, director of finance.

Stone also noted, "We remain deeply grateful to Professor Paul Joskow and his colleagues on the Medical Task Force for providing us with such a thoughtful and comprehensive assessment on which to build even stronger health care programs for the Institute's faculty, students and staff."

In Scheib's 'Desert,' love goes all wrong

Jay Scheib, assistant professor in music and theater arts, has created a new work, "This Place Is a Desert," a study of love gone wrong produced in collaboration with media artist Leah Gelpe.

"Desert" will be premiered at Boston's Institute of Contemporary Art (ICA) from March 22 to 25 as the new waterfront museum's inaugural theater production.

Conceived as a workshop with the Kretakor Ensemble in Budapest and developed at MIT, "This Place Is a Desert" unfolds in fragments: The action occurs through windows, reflected in mirrors, behind half-drawn curtains and projected live onto a wide screen looming above the stage.

Scheib, who's also directing MIT Dramashop's upcoming production of "Our Town," spoke to Lynn Heinemann of the Office of the Arts about his ICA "Desert" venture.

Q: How did you achieve the distinction of being the new ICA's first theatrical production?

A: David Henry, the curator at the ICA, has a real passion for cross-disciplinary performance works, especially those that use new and known technologies in live performance. I delayed the premiere of "This Place Is a Desert" so that it could happen here in Boston.

Q: Will you be using the ICA's incredible view of Boston in the show?

A: The play takes place on the waterfront, more or less. We have changed the text to incorporate the view.

Q: You've said that Italian modernist filmmaker Michelangelo Antonioni inspired you. How?

A: Antonioni used human life itself as a mode of artistic expression by observing and in some cases unleashing the social forces that surround and inform a character's actions. He fixates on those individuals for whom technological advancement provides a sense of profound anguish, helplessness and loss. These were Antonioni's heroes. And now they are mine.

Q: You call "Desert" a "motion portrait." What is that?

A: A motion portrait is a portrait that moves. The experience of the piece is live, but the dramaturgy is cinematic, hopping from one world to the next. What just happened informs what happens next—this is how we understand the piece as an audience. The piece accumulates in motion and in dialogue. And hence a motion portrait encompasses an intimate look at an impotent world, described in intimate motions, framed by intimate screens above the stage.

Q: Are all the videos used in the production shot live?

A: Nothing is pre-taped. We have a number of fixed cameras as well as a camera operator who moves with the actors. Leah (Gelpe) and I think in terms of four screens, four visual lines, much like a composer would think in terms of four instrumental lines.

"This Place Is a Desert" will be performed March 22 at 7:30 p.m., March 23 and 24 at 8 p.m. and March 25 at 2 p.m. at Boston's Institute of Contemporary Art (100 Northern Ave., Boston). Tickets cost $20; $15 for ICA members, students and seniors.

PHOTO COURTESY / **MIT SLOAN**

Melissa Mazmanian is researching how BlackBerry users balance the efficiency and lifestyle effects of their gadgets.

MIT Sloan study asks: Does BlackBerry equal 'CrackBerry' or career essential?

Sarah Foote and Michelle Choate
MIT Sloan School of Management

One might expect a doctoral student conducting research on BlackBerry usage to own one or more of the handheld devices. But Melissa Mazmanian, a fourth-year MIT Sloan doctoral student, doesn't own one, and she prefers it this way.

Mazmanian's study of how people use the BlackBerry in their everyday lives has already drawn attention in the Wall Street Journal and The Independent and on National Public Radio. Her research won an Academy of Management award in its division last summer.

When Mazmanian first began her research, which has been funded by the National Science Foundation, she decided it was best not to have preconceived notions, and thus she never purchased a BlackBerry.

"My goal is to try to figure out the personal and social challenges that go into negotiating norms. I've found that people struggle with when and where is it okay to use their BlackBerry," Mazmanian said.

"I'm lucky because people want to talk about their BlackBerry use. It's an easy project to describe and it hits enough of a nerve with people that they're eager to share. They light up when talking about how it affects their lives," she said, adding, "I've heard of people who wake up in the middle of the night to check their e-mail, others who set their alarms on the BlackBerry and check their messages first thing in the morning."

Mazmanian is working with several companies to conduct the research, including law firms, investment banks and an apparel manufacturer. (The companies participating in the study prefer to remain anonymous.) "Being from MIT is a great entrée, as far as people taking you seriously," she said. Mazmanian spent the month of January in southern California, studying the sales team of the apparel manufacturer, as the mobile nature of sales gave her additional opportunities to explore BlackBerrys in use.

What she has found to date is that BlackBerry use has a large impact on the workplace landscape, affecting expectations of work turnaround, employee availability, personal interactions and the increasingly rare notion of free time. Of course, like society in general, many of the people in the research study claim they have become "addicted" to using their BlackBerrys—thus the moniker "CrackBerry."

One group of professionals who had taken time during their annual partners' retreat to discuss their ever-increasing use of BlackBerrys found that even after the partners established shared guidelines they could not stop using their BlackBerrys during firm meetings, she said.

"It was fascinating; they just couldn't even keep to their own rules. What we tend to see is a gradual blurring of the lines between 'work time' and 'personal time' by device owners. Some people feel more productive when they use a BlackBerry. Others feel compelled to stay in the loop. Many also feel trapped by the social expectation to be constantly available," Mazmanian said.

Many of the people she has spoken with have become emotionally attached to the devices, she noted. One man she interviewed accidentally dropped his BlackBerry onto a train track and jumped down to get it without really thinking of the consequences. (He was fine.) Afterwards, she said, he was surprised by his own actions. But to many people, the device is that valuable.

Mazmanian acknowledged the negative stereotypes of electronic-device dependency. "There are a lot of good, helpful, rational reasons that people use BlackBerrys," she noted.

Working with MIT Sloan professors JoAnne Yates and Wanda Orlikowski, Mazmanian hopes to complete her research in time for her first baby, due in early June. She plans for two more years in the doctoral program.

Does Mazmanian regret not owning a BlackBerry? She said no. But she did miss an opportunity to be a guest speaker on "Talk of the Nation," a radio show on NPR, because she did not receive the e-mail invitation in time. She hopes, she said, to participate next time.

Mark Doty will read poems at MIT

The List Visual Arts Center will present a poetry reading by Mark Doty today, Wednesday, March 21, at 6:30 p.m. in the Stata Center, Room 32-144.

The author of seven books of poems, among them "School of the Arts," "Source," "Sweet Machine," "Atlantis" and "My Alexandria," Doty has also published three volumes of nonfiction prose—"Still Life with Oysters and Lemon," "Heaven's Coast" and "Firebird."

Doty has contributed an essay to the catalogue accompanying the current List Center exhibition, "Sensorium: Embodied Experience, Technology and Contemporary Art," on view through April 8. This reading is hosted by the List Center.

Doty's poems have appeared in many magazines, including the Atlantic Monthly, the London Review of Books, Ploughshares, Poetry and the New Yorker, and in "The Norton Anthology of Contemporary American Poetry."

Doty has received the National Book Critics Circle Award, the Los Angeles Times Book Prize, a Whiting Writers Award, two Lambda Literary Awards and the PEN/Martha Albrand Award for First Nonfiction. He is the only American poet to have received the T.S. Eliot Prize in the United Kingdom.

Doty lives in New York City and in Houston, Texas, where he is the John and Rebecca Moores Professor in the graduate program at the University of Houston.

For more information, call x3-4680 or visit web.mit.edu/lvac.

ICA presents Machover work

MIT Media Lab composer Tod Machover, known for his innovativeness as a musician and as a creator of new technology for musical instruments, will present an evening performance of work commissioned for the Grammy Award-winning Ying Quartet.

The concert at Boston's Institute for Contemporary Art will feature Machover's composition "…but not simpler…" on Friday, April 6, at 8 p.m. at the ICA's waterfront site.

Built around Machover's new string quartet commissioned by the Ying, the upcoming concert of continuous music brings together works from diverse periods and styles, from Bach to Beethoven, Cage to Carter, Byrd to the Beatles. The concert also includes original electronic interludes. The concert premiered last season in New York and was given a rave by the New York Times. April 6 is the event's Boston premiere.

Media arts and sciences graduate student Mike Fabio helped design the technology and sound infrastructure for the event.

For more information and to reserve tickets, please go to www.icaboston.org/programs/performance/subpage?keyword_id=28189.

Machover's work will also be featured this spring in other venues, including a concert piece on "Music, Mind and Health," to be presented at the Media Lab's "Human 2.0" symposium in Kresge on May 9 and the world premiere of "VinylCello," his new work for Hypercello and live DJ, to be performed by Matt Haimovitz, DJ Olive with Kent Nagano and the Berkeley Symphony Orchestra on May 11.

BRACE

Continued from **Page 1**

increasingly recognized ability of the brain to rewire itself in response to experience and training.

The robotic therapy device, which is awaiting FDA approval, was tested on stroke patients at MIT's Clinical Research Center and at Spaulding Rehabilitation Hospital in Boston. According to the researchers, the results show that "the ability of the device to provide a 'power assist' to…muscle groups may help close the feedback loop of brain intention and actual limb movement that is believed to be a key component of cerebral plasticity in motor recovery."

The study showed that the severely impaired patients' arm function improved, on average, 23 percent after using the brace, and the arm muscle tightness typical of stroke victims was significantly reduced.

Cost-effective rehabilitation

In the United States, there are 5.7 million stroke survivors and 700,000 new cases per year. Stroke is the single leading cause of disability in the United States. Many of the medical devices aimed at treating patients afflicted with neurological disorders have not fundamentally changed in decades, or require costly, high-risk brain implants.

The robotic therapy device was one of the first recipients of a grant from MIT's Deshpande Center for Technological Innovation. The center funds novel early-stage research and connects MIT's innovators with the resources needed to increase their commercial viability. The robotic therapy device received Deshpande grants in 2002 and 2003.

"We saw this as a novel technology with the potential to have a significant impact on the quality of life for people," said Charles Cooney, faculty director of the Deshpande Center and a professor in the Department of Chemical Engineering. "This study proves we were right."

The wearable, portable, lightweight robotic brace slides onto the arm. By sensing the patient's electrical muscle activity through electromyography (EMG)—which detects muscle cells' electrical activity when they contract—and sending that data to a motor, it allows stroke patients to control their affected limbs.

When used under the supervision of an occupational or physical therapist, the device can be used to help patients progress from basic motor training, such as lifting boxes or reaching for a light switch, to more complex tasks such as carrying a laundry basket or flipping a light on and off while holding an object with the unaffected limb.

According to the study researchers—Dr. Joel Stein, Kathryn Krebs and Richard Hughes, of Harvard Medical School and Spaulding Rehabilitation Hospital, and MIT graduates Kailas Narendran and John McBean—even people who have experienced a stroke years ago may be able to use the device to regain mobility.

"This brace will allow people who have suffered from neurological trauma to rebuild strength, rehabilitate and gain independence," said Woodie Flowers, Pappalardo Professor of Mechanical Engineering at MIT, who led the original research team that developed the device. "The joint brace is easily controlled by the user and appears to be cost-effective. It could afford self-driven therapy for a large patient population."

Relearning how to move

In 2002 and 2003, Flowers, along with then-students Narendran and McBean, developed a working prototype of the active joint brace. The first prototype system enabled paralyzed victims with certain kinds of spinal cord injuries to move their arms. In 2004, Narendran and McBean won the MIT $50K business plan competition and shortly afterward started the Boston-based company Myomo (an acronym for "my own motion") to develop a new class of medical technology they call NeuroRobotics.

"NeuroRobotics noninvasively helps people suffering from neurological trauma regain mobility by facilitating their ability to relearn how to control affected muscles and neurological pathways," Narendran said.

"Unlike other systems that stimulate or move the muscle for a patient, NeuroRobotics is embedded in lightweight wearable devices that actually adjust to a person's body and use the person's own electrical muscle activity signal to initiate and control movement," McBean said.

"Without the device, many of the individuals we tested were simply unable to complete the movement and thus had no practical way to improve their performance through practice," Stein said. "By allowing the user to complete an intended movement through its 'power assist' function, the device helps the user improve his or her performance through practice. Thus the device acts as a facilitator of the innate capability of the human brain to improve function through practice."

PHOTO COURTESY / **MYOMO, INC.**

Maggie Fermental, a stroke survivor and study participant, regained full motion at the elbow after 18 hours using the device and has maintained her progress to date.

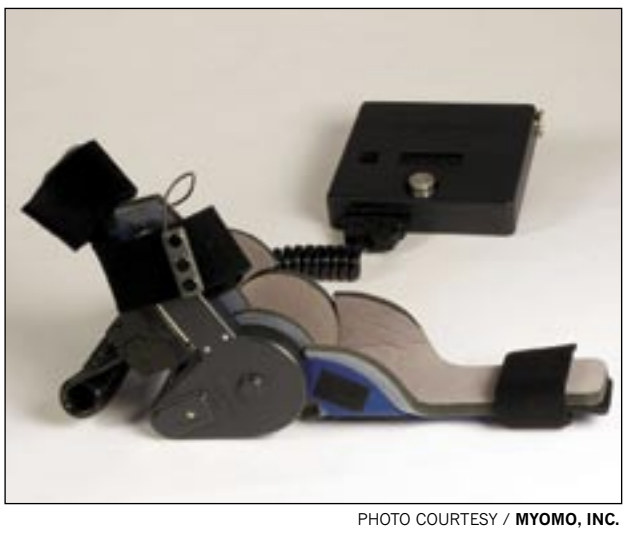


PHOTO COURTESY / **MYOMO, INC.**

The device is a lightweight elbow brace that employs an EMG sensor that sits on the surface of a user's bicep or tricep muscle, depending on desired motion. Proportional assistance is delivered through the portable control unit.

PHOTO COURTESY / **MYOMO, INC.**

The device facilitates tricep extension to assist with functional exercises, such as sit to stand.

PHOTO COURTESY / **MYOMO, INC.**

A stroke survivor who used the device has reported that he can now open the refrigerator door with his affected arm and use his unaffected arm to remove items.

PHOTO COURTESY / **MYOMO, INC.**

Subjects who have used the device report an improved ability to perform bilateral tasks, such as carrying a laundry basket.

PHOTO COURTESY / **MYOMO, INC.**

A study participant reported the ability, post trial, to be able to carry a glass with the unaffected limb, while flipping a light switch on or off with the affected limb.