

Singin' in the brain

Baby birds babble like human babies learning to talk



IMAGE / AARON ANDALMAN

Cathryn Delude
McGovern Institute

Young songbirds babble before they can mimic an adult's song, much like their human counterparts. Now, in work that offers insights into how birds—and perhaps people—learn new behaviors, MIT scientists have found that immature and adult bird-songs are driven by two separate brain pathways, rather than one pathway that slowly matures.

The work is reported in the May 2 issue of *Science*. “The babbling during song learning exemplifies

the ubiquitous exploratory behavior that we often call play but that is essential for trial-and-error learning,” comments Michale Fee, the senior author of the study and a neuroscientist in the McGovern Institute for Brain Research at MIT and associate professor in MIT's Department of Brain and Cognitive Sciences.

Early on, baby zebra finches produce a highly variable, babbling song. They practice incessantly until they can produce the stereotyped, never-changing song of adults. “This early variability is necessary for learning, so we wanted to determine whether it is produced by an immature adult motor pathway or by some other

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Early treatment of stomach infection may prevent cancer

Prompt treatment of a microbe that causes stomach ulcers and other ailments can reverse damage to the lining of the stomach and ultimately prevent one of the most lethal forms of cancer from developing there, MIT researchers have concluded.

In the May 1 issue of *Cancer Research*, a journal of the American Association for Cancer Research, the scientists say their study results should lay to rest any question about whether—and when—antibiotic treatment of *Helicobacter pylori* (*H. pylori*) can eliminate or reduce risk of developing gastric, or stomach, cancer.

The findings are important, the researchers say, because stomach cancer is the second-leading cause of cancer death worldwide and approximately half of the world's population is infected with *H. pylori*. Although *H. pylori* infection is now recognized as the major cause of both peptic ulcers and gastric cancer, and has been classified as a group I carcinogen by the World Health Organization, physicians are not sure whom to screen and treat with costly antibiotics, aside from first-degree relatives of gastric cancer patients and those with peptic ulcer disease.

Since it typically takes several decades for gastric cancer to develop in those who are susceptible—which is estimated to be up to 3 percent of infected people—researchers also do not know when to treat

►Please see STOMACH, PAGE 7



PHOTO / DONNA COVENEY

MIT Facilities gardener Kathy Coletti plants red azaleas by the Landau building near East Campus as spring begins to bloom on campus.

New emergency notification program for campus alerts

To improve MIT's ability to communicate rapidly with members of the community during an emergency, MIT emergency planners are asking students, faculty and staff to enter or update their emergency notification information at <http://web.mit.edu/mitalert>. This information will only be used to alert students, faculty and staff of a life-safety or public-health emergency.

The impetus to gather complete information for everyone on campus



follows the testing last August of a new emergency notification system designed to alert students, faculty and staff of an emergency via phone, text message and e-mail. The system—part of the comprehensive MIT Alert emergency communications program—dispatched phone calls and text messages to members of the

MIT community for whom we had information. As part of the test, a broadcast e-mail was also sent to the entire campus.

“Based on what was learned from the test, we are implementing changes and, in particular, working to collect more cell-phone data from students and staff to facilitate future testing and enhancements of the MIT Alert system,” said David Barber, Emergency and Business

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PEOPLE

Boyce named DME head

Mary Boyce will take the helm of the Department of Mechanical Engineering starting on July 1.



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RESEARCH

Debunking a job-testing myth

Pioneering study by David Autor shows that job testing increases productivity not at the expense of minority hiring.

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NEWS

China Forum lecture series begins

MIT will kick off new monthly lecture series on May 14 with a talk from Yingyi Qian, dean of the school of economics and management at Tsinghua University.

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Three of MIT's thinkers named to top 100 intellectuals list

Patrick Gillooly
News Office

Three of MIT's thinkers—Noam Chomsky, Esther Duflo and Neil Gershenfeld—have been named among 100 “global intellectuals” by Prospect Magazine.

The three are cited in the web-exclusive portion of the British monthly magazine's web site for their work on foreign policy, poverty and quantum computing.

Chomsky, a professor of linguistics, is cited as being “a groundbreaking linguist and a prominent critic of U.S. foreign policy” as well as the winner of the magazine's 2005 global intellectuals poll.

Duflo, the Abdul Latif Jameel Professor of Poverty Alleviation and Development



Noam Chomsky

Economics, was noted for her work on “health, poverty and credit issues in the developing world.”

Gershenfeld, director of the Center for Bits and Atoms at MIT and associate professor of media arts and sciences, “takes an interdisciplinary approach to quantum



Esther Duflo



Neil Gershenfeld

computing, nanotechnology and personal fabrication,” the magazine's citation notes.

Readers will now vote on their choice for “top global public intellectuals”—for the first time since Chomsky won the title in 2005—until May 15 at <http://www.prospect-magazine.co.uk/>

intellectuals/.

Prospect touts itself as a monthly that is “more readable than the Economist, more relevant than the Spectator, more romantic than the New Statesman,” according to its web site.

7 from MIT elected to the NAS

Seven MIT faculty members are among the 72 newly elected members and 18 foreign associates of the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research.

Election to the NAS—a private organization of scientists and engineers dedicated to advancing science and its use for the general welfare—is considered a top honor for those in the science and engineering fields. Established in 1863, the NAS acts as an official adviser to the federal government, upon request, in any matter of science or technology.

The new NAS members from MIT are:

- **Edward A. Boyle**, professor of ocean geochemistry, Department of Earth, Atmospheric and Planetary Sciences. Boyle's research focuses on trace metals and trace metal isotope ratios in the oceans, estuaries, rivers, and ice cores.
- **Stephen L. Buchwald**, Camille Dreyfus Professor of Chemistry, Department of Chemistry. Buchwald's research combines techniques of organic synthesis, physical organic chemistry and organometallic chemistry to devise catalytic processes of use to organic synthesis.
- **Edward F. DeLong**, professor of civil and environmental engineering and biological engineering, Department of Civil and Environmental Engineering. DeLong's research is currently focused on applying contemporary genomic technologies to dissect complex microbial assemblages.
- **Marc A. Kastner**, dean of the School of Science and Donner Professor of Science. Kastner's research interests include studying the motion of electrons in nanometer-size semiconductor structures and in transition-metal oxides.
- **Frank T. Leighton**, professor of applied mathematics, Department of Mathematics. Leighton is one of the world's preeminent authorities on algorithms for network applications. He holds numerous patents involving cryptography, digital-rights management and algorithms for network.
- **Timothy M. Swager**, head of the Department of Chemistry and John D. MacArthur Professor of Chemistry. Swager's research looks into supramolecular and materials chemistry with an emphasis on the synthesis and construction of functional assemblies.
- **Jack L. Wisdom**, professor of planetary sciences, Department of Earth, Atmospheric and Planetary Sciences. Wisdom's research includes long-term evolution of the orbits and spins of the planets and natural satellites, qualitative behavior of dynamical systems, chaotic behavior and dynamics of planetary rings.

Last week's election brings the total active number of NAS members to 2,041, with 397 active, nonvoting foreign associates.

Arts, sciences fellows named

Eight MIT faculty members are among the 212 new fellows recently elected to the American Academy of Arts & Sciences, one of the nation's oldest and most prestigious honorary societies and independent policy research centers.

“For 228 years, the Academy has served the public good by convening leading thinkers and doers from diverse perspectives to examine—and provide practical policy solutions to—the pressing issues of the day,” said Academy Chief Executive Officer and William T. Golden Chair Leslie Berlowitz. “I am confident that this distinguished class of new members will continue that tradition.”

The academy will welcome this year's new fellows at its annual induction ceremony in October at its Cambridge, Mass., headquarters.

The new MIT fellows are:

- **Tobias Colding**, professor of mathematics
- **Christopher Cummins**, professor of chemistry
- **Alan D. Grossman**, Praecis Professor of Biology
- **Timothy L. Grove**, professor of geology
- **Jonathan Gruber**, professor of economics
- **Klavs F. Jensen**, chemical engineering department head, Warren K. Lewis Professor of Chemical Engineering and professor of materials science and engineering
- **Marc A. Kastner**, Donner Professor of Science; dean, School of Science
- **Henry I. Smith**, professor of electrical engineering

The Clay Research Awards will be presented at 2 p.m. on May 12. This year's recipients are Claire Voisin of the Centre National de la Recherche Scientifique in France, and Cliff Taubes, chair of Harvard's mathematics department.

The conference will be held at Bartos Theatre in the MIT Media Lab (Building E15). For the schedule, visit <http://www.claymath.org>. Graduate and undergraduate students are encouraged to attend.



PHOTO / KAVEH MILANINIA

Dr. Ahmed Zewail receives a lifetime achievement award from MIT Arab Students Organization's President Iman Kandil '09 during the group's fifth annual Science and Technology Awards Banquet on Saturday, April 26.

MIT Arab students honor Nobel laureate, others

The MIT Arab Students Organization honored Nobel laureate Ahmed Zewail at its fifth annual Science and Technology Awards Banquet on Saturday, April 26.

Zewail, a professor at Caltech who won the Nobel Prize in chemistry in 1999, was presented with the organization's lifetime achievement award.

The organization presented several other awards at the ceremony, held at the Sheraton in Boston. Dina Katabi, MIT associate professor of electrical

engineering and computer science, was given a young professional award; Loai Naamani, an MIT doctoral student in civil and environmental engineering, was given a graduate student award; and Ibrahim Kanan, an MIT senior in mechanical engineering, was given an undergraduate student award.

“Every spring, the MIT Arab Students Organization celebrates exceptional Arabs and Arab-Americans who have made noteworthy contributions to science, technology and other areas of scholarship that will best serve the nation and the world in the 21st century,” said Iman Kandil, president of the MIT Arab Students Organization.

Clarification

In the April 30 edition of Tech Talk, the web site for more information on the new administrative officer program being run by human resources was mistakenly left out. Info can be obtained at <http://hrweb.mit.edu/aodevelopment/>.

The Department of Mathematics hosting Clay Research Conference May 12-13

MIT professor Thomas Mrowka and seven other speakers will present a variety of topics, ranging from quantum gravity and its connection with probability theory, to the solution of two recent conjectures, the Kodaira conjecture and the Weinstein conjecture.

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PHOTO / DONNA COVENEY

Mary Boyce, the newly appointed head of the Department of Mechanical Engineering



Boyce to head Department of Mechanical Engineering

Mary Boyce, the Gail E. Kendall Professor of Mechanical Engineering, has been named the next head of the Department of Mechanical Engineering effective July 1, School of Engineering Dean Subra Suresh announced last week.

Boyce, who received her bachelor's degree from the Virginia Polytechnic Institute and State University and her master's and doctoral degrees from MIT, is renowned for her research in the mechanics of polymers, networks and soft tissues and for her dedication to engineering education. The impact of her research has been recognized through the many awards she has received, which include election as a fellow of the American Academy of Arts and Sciences, the American Society of Mechanical Engineers (ASME) and the American Academy of Mechanics.

For her innovation in education she was named a MacVicar fellow and received the Joseph H. Keenan Award for Innovation in Undergraduate Education. She has served MIT and her professional field in numerous capacities, including chair of the Executive Committee for Applied Mechanics at ASME, membership on the U.S. National Committee on Theoretical and Applied Mechanics and the editorial board of the Journal of the Mechanics and Physics

of Solids.

Although a woman has served as associate department head in the Department of Computer Science and Electrical Engineering, Boyce will be the first woman department head in MIT's School of Engineering.

"I am confident we will all benefit from her energy, her insight and her dedication to engineering education and the engineering profession," Suresh said.

The dean thanked the faculty advisory committee, chaired by Roger Kamm, Germeshausen Professor of Mechanical and Biological Engineering. Other members of the panel included professors Gang Chen, Martin Culpepper, Carol Livermore, Tony Patera, Nick Patrikalakis, Ian Waitz and Kamal Youcef-Toumi.

Suresh also thanked Rohan Abeyaratne, Quentin Berg (1937) Professor in Mechanical Engineering, for his "extraordinary and dedicated service" as head of mechanical engineering since 2001, and as associate head, a position he held for four years before becoming department head.

"I hope and expect to have an opportunity in the near future to thank Rohan more formally and to elaborate on his contributions," Suresh said. "I look forward to a continued and close collaboration with him."

Two named associate directors at MIT Media Lab

Two long-term, prominent researchers at the MIT Media Lab, Hiroshi Ishii and Andrew Lippman, have been named associate directors at the lab, Director Frank Moss announced this week.

In announcing the appointments, Moss emphasized the key roles they will play in helping to realize new directions for the lab. "As the Media Lab explores creative ways for technology to have a lasting impact on people and society, we will also be looking for deeper collaboration with industry, to bring important innovations to the real world," Moss said.

Ishii is best known for creating the field of Tangible User Interfaces to realize seamless connections between humans, digital information and the physical world. A faculty member at the Media Lab since 1995, Ishii holds the Muriel R. Cooper Professorship of Media Arts and Sciences, heads the Tangible Media research group and co-directs the Things That Think

(TTT) consortium. His work focuses on inventing the future of digitally augmented objects and environments.

Before coming to the Media Lab, Ishii spent the majority of his career at NTT (Nippon Telegraph and Telephone Corporation), where his research team pioneered video-mediated remote collaboration media that created shared workspaces across distances.

A founding member of the Media Lab, Lippman has a more than 30-year history at MIT. He established and has directed the Digital Life consortium, which focuses on the confluence of technical invention and human understanding to create a networked world where communication becomes fully embedded in our daily lives. Lippman heads the lab's Viral Communications research group, which focuses on constructing infrastructure-free, scalable, collaborative systems that permit uncontrolled growth and use minimal power systems that move intelligence "from the trunk to the leaves." He also co-directs MIT's interdisciplinary Communications Futures program. While on sabbatical for the 2007-2008 academic year, Lippman is a visiting fellow at Nortel, one of the lab's corporate sponsors. He will assume his new duties upon his return to the lab in September.



LEFT: Hiroshi Ishii



RIGHT: Andrew Lippman

PHOTOS COURTESY OF THE MEDIA LAB

OBITUARIES

Theresa M. Roche, veteran of MIT Facilities

Theresa M. Roche, of Middleboro, Mass., an MIT Facilities employee for 15 years, died of complications from cancer on Monday, April 21, at Brigham and Women's Hospital.

Roche, who retired from MIT in 2007, worked the day shift in custodial services. Among the buildings she serviced was Building 68, where she was loved by members of the Department of Biology—who also held a farewell party for her upon her retirement. She would reach out to everyone with her laughter, smile and caring ways. Even during her illness, Roche maintained an upbeat and positive attitude and was an inspiration to all who knew her.

During her time with MIT Facilities, Theresa received several customer-service awards and was honored in 2006 with an Infinite Mile Award.

She was a devoted wife to her husband, Joe; mother to her two daughters, Donna and Carol; and grandmother to her seven grandchildren. She enjoyed traveling and shopping and keeping in touch with all of her friends. She will be sadly missed by all those who knew her. Donations in memory of Mrs. Roche may be made to Dana-Farber Cancer Institute, P.O. Box 55584, Boston, MA 02205-5584.



Theresa Roche

Get Tech Talk delivered electronically with RSS feed

Don't have time to stop by campus and pick up a hard copy of Tech Talk? Readers of Tech Talk can now get an electronic version of MIT's official newspaper delivered each week through a new RSS feed set up by the MIT News Office.

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Unraveling the heparin mystery
Team of researchers, led by MIT Professor Ram Sasikumar, explain how tainted heparin got past safety checks

Mapping Earth's water cycle
Entekhabi to lead science team for NASA satellite mission

Theresa Roche
Obituary

Study of universal day care paints mixed picture

Adults benefit, but children appear to suffer

Sarah H. Wright
News Office

Universal day care, the recurring dream of working parents everywhere, benefits adults economically but may burden young children with health and behavior problems, according to an MIT economist's study of a highly subsidized child-care program in Quebec.

Working with colleagues at two Canadian universities, MIT Professor Jonathan Gruber studied the impact of Quebec's child-care program over a decade, beginning with the provincial government's move in 1997 to subsidize universal day care for 4-year-olds and kindergarten for 5-year-olds. By 2000, the program included infants to 5-year-olds.

In their study, which has been issued as a working paper by the National Bureau of Economic Research, the researchers focused on changes in families' use of day care, the rate of mothers' return or entry into the work force and the effects of day care on children.

"The Quebec Family Policy was a major government innovation. Its 'five-dollar-a-day' plan has given us a rare experimental environment for analyzing the effects of publicly financed child care," says Gruber, professor of economics.

Their first finding falls in the "if you build it, they will come" category: The introduction of universal child-care subsidies led to a 14 percent increase in the proportion of 4-year-olds enrolled in government centers. Other age groups' use of the centers increased as well.

The researchers' second finding presented a puzzle economists relish. The number of married women (the study only used data on married women) participating in the labor force increased by almost 8 percent—a sizable increase but no match for the 14-percent increase in 4-year-olds in day care. So what accounts for the shortfall of workers or the big rush of kids?

"The new policy did more than enable some mothers to go to work. It also enabled all families—including those who use day care for lifestyle reasons—to replace informal arrangements with subsidized care. We found the number of moth-

ers who went to work was not enough to offset the costs of the child-care subsidies," says Gruber. Those costs are still borne by the government.

Other costs are borne by the children themselves, Gruber and his colleagues note in their summary of the effects of the Quebec child-care policy.

Their analysis of the well-being of children in day care, based on data from Canada's National Longitudinal Survey of Children and Youth (NLSCY), produced a dispiriting picture.

The researchers found consistent and robust evidence of negative effects of Quebec's policy on children, parenting and parenting outcomes, they write. Child outcomes include hyperactivity, inattention, aggressiveness and illness, and parental health and relations deteriorated, according to the study of NLSCY data.



IMAGE / STOCKXPRT

Gruber, widely known for his work on health-care reform, admits the study suggests that day care looks bad for children.

"But maybe that's the case for very young children. Maybe it reflects tough adjustment to day care for them. We can't let that

brush taint the whole picture," he says.

Gruber conducted the study, "Universal Childcare, Maternal Labor Supply and Family Well-Being," with Michael Baker of the University of Toronto and Kevin Milligan of the University of British Columbia.

We found the number of mothers who went to work was not enough to offset the costs of the child-care subsidies.

Economics Professor Jonathan Gruber



IMAGE / ISTOCK

MIT researchers find novel way to repair airway injuries

Technique could apply to different parts of human body

Anne Trafton
News Office

MIT tissue engineers have successfully healed airway injuries in rabbits using a technique they believe could apply to the trachea and other parts of the human body.

The work, published in the advance online issue of the Proceedings of the National Academy of Sciences the week of May 5, expands researchers' understanding of the control of tissue repair and could lead to new treatments for tracheal injuries, such as smoke inhalation and damage from long-term intubation.

The new technique heals airway injuries by placing new tracheal cells around the injury site. Two types of tracheal cells, embedded within a three-dimensional gelatin scaffold, take over the functions of the damaged tissue.

"We can begin to replicate the regulatory role cells play within tissues by creating engineered constructs with more than one cell type," said Elazer Edelman, the Thomas D. and Virginia W. Cabot Professor of Health Sciences and Technology and senior author of the paper.

Patents on the technique have been licensed to Pervasis, a company co-founded by Edelman, which develops cell-based therapies that induce repair and regeneration in a wide array of tissues.

The trachea and other respiratory tubes, like most tubes in the body, have an intricate, three-layer architecture. The inner layer, or epithelium, interacts with whatever is flowing through the tube—in the case of the trachea, air. The middle layer is composed of muscle that constricts or relaxes the tube, and the outer layer consists of connective tissue that supports microvessels and small nerves.

Most attempts at tissue regeneration seek to rebuild this complex architecture with structural precision.

However, the MIT researchers found that it is not necessary to recapture the ordered layering to heal injuries. Instead, they concentrated on restoring cellular health. When cells are intact and have

regained their biological function, they need only reside near the injured tissue to enhance overall repair.

Edelman and colleagues achieved this repair state by delivering a mixture of new healthy cells derived from the epithelial lining and the nourishing blood vessels. The combination of epithelial and endothelial cells take over the biochemical role lost with cell damage. The healthy cells release growth factors and other molecules necessary for healing tissue, and can modulate their delivery in response to physiological feedback control signals.

"Cells are not just an array of bricks surrounded by mortar, nor are they passive drug pumps. Cells are active elements that respond to the dynamic changes of their

environment with modulated secretion of critical factors. They don't need to be stacked in one specific fashion to function, but they do need to be healthy and near the injured tissue," said Edelman, who is also a professor at Harvard Medical School and cardiologist at Brigham and Women's Hospital.

To get the best results, both epithelial and endothelial cells must be replaced in the injured airway. "One cell type can't do it alone. With this complex disease, each regulatory cell offers something unique and together they optimize repair," Edelman said.

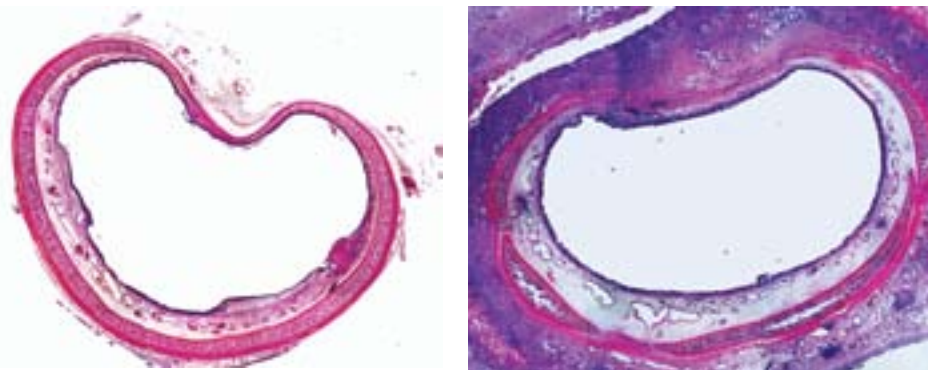
The cells must also be grown within a 3-D scaffold, otherwise, the two types of cells will stay segregated and will not work as effectively.

Because of the similarities between the trachea and other tubes in the body, such as those of the vascular, genitourinary and gastrointestinal systems, the researchers believe their approach could translate to other organs.

"We can apply this same approach to so many different parts of the body," said Brett Zani, a postdoctoral associate in the Harvard-MIT Division of Health Sciences and Technology and lead author of the paper.

Other authors are Koji Kojima and Charles Vacanti of the Laboratory of Tissue Engineering and Regenerative Medicine at Brigham and Women's Hospital.

The research was funded by the National Institutes of Health.



IMAGES / BRETT ZANI

LEFT: A cross-section of a rabbit trachea whose inner lining has been damaged. RIGHT: A cross-section of a rabbit trachea after being treated by adding engineered tracheal cells.

PHOTOS / DONNA COVENEY

MIT students work on a new kind of solar generator that employs low-cost materials. Here they mount the frame of the concentrator (which will be mounted with mirrors) on the base near Tang Hall on Memorial Drive.



Harnessing sunlight on the cheap

MIT student project aims to develop cost-efficient solar power

David Chandler
News Office

For a project that could be on the very cutting edge of renewable energy, this one is actually decidedly low tech—and that's the point.

A team of students, led by mechanical engineering graduate student Spencer Ahrens, has spent the last few months assembling a prototype for a concentrating solar power system they think could revolutionize the field. It's a 12-foot-square mirrored dish capable of concentrating sunlight by a factor of 1,000, built from simple, inexpensive industrial materials selected for price, durability and ease of assembly rather than for optimum performance.

Rather than aiming for a smooth parabolic surface that would bring the sunlight to a perfect focus, the dish is being made with 10-inch-wide by 12-foot-long strips of relatively low-cost, lightweight bathroom-type mirror glass. The frame is assembled from cheap aluminum tubing, with holes drilled in precise locations using a simple jig for alignment, so that the struts can be assembled into a framework that passively snaps into just the right parabolic curvature.

The control mechanism, which allows the dish to track the sun automatically across the sky, is also remarkably simple—photocells mounted on each side of the dish with opaque baffles, which cast a shadow on the cell when it drifts out of alignment, connect to a simple circuit that turns on small electric motors to push the dish back into the right position.

"The technical challenge here is to make it simple," Ahrens explains. The team is keeping careful track of all the costs for parts and the time spent on assembly, to provide a baseline for figuring out what

an eventual large-scale field of such dishes would cost. "We're using all commodity materials that are all in high production," he says.

That's in stark contrast to most attempts to build solar dish concentrating systems, which have tended to use expensive custom-made equipment to achieve high efficiency. A few large companies that have built such prototypes tend to "turn it into an ultimate high-tech, high-end project," says Jefferson Tester, HP Meissner Professor of Chemical Engineering, who has been advising the student-led group. "Then Spencer came along and said, 'We're going to fundamentally change this and make this an affordable technology for popular, widespread deployment.'"

Ahrens thinks that in mass production the dishes can be competitive in cost with other energy sources and could produce heat for space heating and electric power at the same time.

The prototype isn't quite finished yet, because of delays in getting the mirror glass shipped from the factory. And the details of assembly and operation could well present some unexpected stumbling blocks, as is so often the case with new designs, Tester says. Still, "they're smart kids, they know what they're doing," he says. "That's how you learn."

This is not the kind of thing you'd build for a single-home, backyard power system, however. Because the highly concentrated sunlight will be so powerful, the team is employing several precautions to safeguard against potential safety risks, and the prototype will not operate in public without

supervision.

Instead, the systems are designed to be deployed in large, utility-scale fields, fenced in to protect anyone from being in the wrong place. But because the beam comes to a focus about 12 feet from the surface, the danger is strictly localized—no risks for adjacent buildings or for planes flying overhead, Ahrens explains. When not attended, the dish will be covered "parked" pointing straight up, and will be mounted 7 feet above ground.

The students working on the project, because of their close proximity, will have to take precautions, wearing all-white clothing, to reflect the light, and welder-type goggles to protect their eyes.

Ahrens believes that such a design could quickly produce both hot water for space heating and electricity for the grid at prices that would be competitive today,

unlike conventional photovoltaic systems that are still far too pricey for baseload generation. "In the sunbelt, our dish would make about 10,000 peak watts of heat and 3,500 peak watts of electricity," he says. Deployed in large numbers, the systems could make a big difference: "One square meter of concentrator is worth about one barrel of oil per year," he says.

"It's designed for long life—we hope they will last more than 30 years with good maintenance—and for indigenous manufacturing in the developing world with minimal tooling," Ahrens says. "We want to get something up that will be kind of viral and be widely adopted around the world."

BIRDSONG: Research finds that young birds babble before singing

Continued from Page 1
circuit," Fee explains.

Past research has shown that the zebra finch has two distinct brain circuits dedicated to song, one for learning and another—known as the motor circuit—for producing the learned song. Damage to the first circuit while the bird is still learning prevents further learning, so the song remains immature. Yet in an adult that has already learned its song, disabling the learning circuit has no effect on song production.

Scientists assumed that the motor circuit is equally important in producing baby birds' babbling, but surprisingly, no one had done the experiments to find out. First author Dmitriy Aronov and co-author Aaron Andalman, both graduate students in Fee's lab, adapted existing techniques previously developed in the Fee lab so that they could temporarily disable parts of the brain and record from neurons in the singing bird.

The results were surprising.

When they disabled a part of the motor circuit known as HVC in these very young birds, the babies continued to sing, implying that some other brain region produces the babbling. The authors suspected that a key component of the learning circuit, called LMAN, has a previously unknown motor function. They confirmed this by showing that when LMAN was disabled in very young birds, they ceased babbling.

"This tells us that singing is driven by two different motor circuits at different stages of development," explains Aronov. "We've long known that these two pathways develop physiologically at different times, so there's an elegant parallel between our functional findings and what is already known about anatomy."

But what happens to LMAN in adulthood, after birds have learned their song? Contrary to the "use it or lose it" assumption, the authors found that LMAN retains its ability to drive babbling even in adulthood. Disrupting HVC in adults caused the birds to revert immediately to babbling, suggesting that LMAN can take over again if the more powerful signals from HVC are blocked.

Fee speculates that these results may apply more broadly to other forms of immature or exploratory behavior in humans as well as birds. "In birds, the exploratory phase ends when learning is complete," he says. "But we humans can always call upon our equivalent of LMAN, the prefrontal cortex, to be innovative and learn new things."

The NIH and graduate fellowships from the Hertz Foundation and the Friends of the McGovern Institute funded this study.

“
We want to get something up
that will be kind of viral and be
copied around the world.”

Spencer Ahrens
Mechanical engineering graduate student

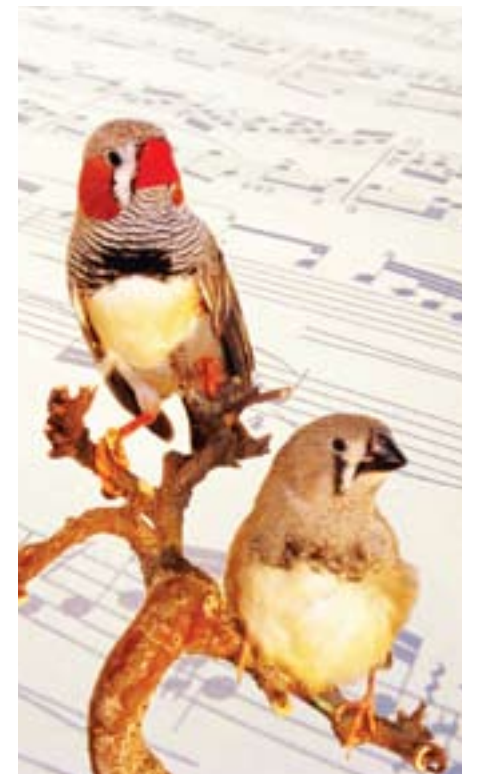


IMAGE / AARON ANDALMAN

Study debunks myth of job testing as race barrier

Sarah H. Wright
News Office

Conventional wisdom holds that the standardized tests some employers require of job applicants serve as a barrier to equal employment. But a pioneering study shows just the opposite: Screening increases employers' precision in matching applicants to jobs and can raise productivity for workers of all races—without hindering minority hiring.

"Job testing has the potential to raise productivity by improving the quality of matches between workers and firms. But because of the near-universal finding that minorities fare relatively poorly on standardized tests, there is a pervasive concern that better candidate selection comes at a cost of reduced opportunity for groups with lower average test scores," says David Autor, associate professor of economics at MIT who conducted the study with David Scarborough of Black Hills State University.

Their study, "Does Job Testing Harm Minority Workers? Evidence from Retail Establishments," was recently published in the *Quarterly Journal of Economics*. The paper is available at <http://econ-www.mit.edu/faculty/dautor/papers>.

Screening can raise productivity without compromising equal opportunity

As part of their research, Autor and Scarborough studied hiring and job longevity among primarily high school-educated workers who were paid hourly wages for customer-service jobs in the private sector. The researchers relied on data from a national retail firm whose 1,363 stores switched from informal, paper-based screening to computer-supported, test-based screening over the course of one year.

"Access to this data gave us the unique opportunity to evaluate the effects of job testing on minorities in a competitive business environment," Autor says.

Both paper- and test-based hiring methods used interviews, but the latter relies significantly on a personality test administered and scored by computer.

The retailer's 100-item personality test ranked attributes such as agreeableness, conscientiousness and extroversion that are associated with success—or productivity—in customer service.

"These tests basically predict how many

times you're willing to say, 'May I help you with that?' and 'Have a nice day!' before you run out of patience," Autor says.

An outside firm, Unicru, scored and analyzed the tests, highlighting problem areas and completing background checks and returned them to individual store managers. Qualified applicants were then interviewed.

Consistent with previous research, minority applicants performed significantly worse on the electronic employment test. But the researchers detected no change in the racial composition of hires once electronic screening was installed. Moreover, the authors found, productivity gains were equally large among minority and majority hires.

The findings are significant, according to Autor, because the outcomes do not support the accepted belief that minorities' relatively low scores on standardized tests mean that such tests harm the job prospects of minority workers.

"Initially, I was surprised. I expected the

increase in productivity that followed job testing would surely come at the expense of minority hiring," Autor says.

But the test of insightful research may be that very surprise, the moment when accepted beliefs dissolve in the face of new facts. The paradox that job testing did not harm minority workers is resolved quite simply, Autor notes.

Before the computer test, the retailer informally screened for the personality traits that are measured by the test. Job testing made this screening process more systematic and precise, but research showed it did not tip the scales for or against any particular group of applicants. Consequently, the productivity gains from testing came from improved selection within applicant groups (e.g., minorities, nonminorities), not from hiring fewer minorities.

Autor is quick to note that discrimination in employment exists and that bias—arising from prior information, interviews or beliefs about a particular group—can affect equality in hiring and efficiency in the workplace even with electronic testing.

For example, if job tests exacerbate an existing bias, testing just increases hiring of groups favored by the test. Then productivity stalls and neither employer nor workers profit.

Consequently, the productivity gains from testing came from improved selection among all applicant groups, not from hiring fewer minorities.

China Forum lecture series begins May 14

MIT will kick off a new monthly lecture series called the China Forum with a May 14 talk by Yingyi Qian, dean of the School of Economics and Management at Tsinghua University and professor of economics at UC Berkeley. Qian will speak about China's recent economic transformation.

The China Forum is part of a broader MIT effort to look at new ways of fostering ties with China. A new China strategy working group, headed by CSAIL Director and Professor Victor Zue and composed of faculty and staff with interests in and knowledge of greater China, is charged with identifying new initiatives and collaborations that MIT might launch with China in the coming years.

"MIT has a long history of involvement with China and has attracted top Chinese students to MIT since the beginning of the 20th century," commented Professor Philip S. Khoury, associate provost and head of strategic planning for international education and research. "We want to figure out what MIT's future engagement with China might look like, and what kinds of research and educational programs we might want to emphasize."

Qian was born in Beijing and holds degrees from Tsinghua University, Harvard, Yale and Columbia. He is a research fellow at the Centre for Economic Policy Research and the William Davidson Institute at the University of Michigan Business School, a fellow at the Chinese Economists Society (USA), and a nonresident senior research fellow at the Stanford Center for International Development. His main research areas include comparative economics, institutional economics, development economics, economics of transition and the Chinese economy.

The May 14 lecture is from 2 p.m. to 3 p.m. in The Stata Center, Room G449. Refreshments will be served starting at 1:45 p.m. For additional information, contact Vicky Palay in CSAIL, at palay@csail.mit.edu or by phone at 617-253-8924.

China Forum lectures will continue on a monthly basis, beginning in September 2008.



PHOTO / DONNA COVENEY

Good luck, Dean Benedict

The Chinese Dragon (freshmen Cathy Wu and Alice Li in disguise) made a surprise appearance on Killian Court for the Spring Picnic to celebrate Dean for Student Life Larry Benedict's upcoming retirement. Benedict got a personal 'thank you' from the dragon.

ALERT: Update your emergency information

Continued from Page 1

Continuity Planner in the Security and Emergency Management Office. "Our goal is to improve our ability to reach members of the community in an emergency in the quickest way possible."

Until very recently, university emergency management was thought of mostly in terms of mitigation of the potential for fires, laboratory accidents, emergencies in campus residence halls and crime on campus. But the universe of response requirements in a university setting has expanded rapidly in the last several years. MIT is actively upgrading its emergency management and response program as events around the country reveal more and more dimensions to protecting a campus community.

In recent years, MIT's Environment, Health and Safety Office (EHS), working closely with partner offices such as the MIT Police and Medical Departments, has been increasing its focus on issues related to the Institute's preparedness for extended outages and acute emergencies—from localized outages that affect a single floor or building (like the fire at One Broadway in December 2006)—to campus-wide disasters that might result from a hurricane, winter storm, major fire or a pandemic illness. The emergency structure consists of multiple layers connecting the

Institute leadership to individual laboratories and residence halls, and is at the heart of emergency planning, communication, response and recovery efforts.

For most localized incidents, the Emergency Response Team—the EHS Management System network—and Emergency Preparedness Coordinators are sufficient to mitigate the situation. For larger-scale emergencies—recall the campus-wide power outage in 2004 and the campus-wide water outage in 2005—response and resources across a broader section of campus must be marshaled. In these instances, an Emergency Operations Center, consisting of representatives from key MIT operational areas, is activated to muster the resources of MIT to oversee and resolve impacts of emergencies affecting multiple portions of campus.

Over the next year, all MIT departments and offices will be asked to draw up local emergency communications plans to ensure that the Emergency Operations Center and the Security and Emergency Management Office can communicate with departmental decision-makers, if needed, and that all units have methods for keeping in contact with their faculty, staff and students. By being fully prepared, we can ensure a safe and orderly campus response in any emergency and protect MIT's most important assets: its people and research.

In Sigma Xi lecture, Barsoum to focus on pyramids

Michel Barsoum PhD '85, distinguished professor at Drexel University, will deliver the 2008 Sigma Xi Lecture, entitled "The Mystery of the Great Egyptian Pyramids: The role of materials research in suggesting a partial solution," at 8:30 p.m., Wednesday, May 7, in the MIT Faculty Club, 50 Memorial Drive, Bldg. E26.

Barsoum earned his BSc degree in materials engineering from the American University in Cairo in 1977, and an MS from University of Missouri-Rolla in 1980 before getting his PhD in ceramics from the Department of Materials Science and Engineering at MIT. Barsoum's research into the highly controversial subject of pyramid building stems from his Egyptian heritage and his expertise in ceramic materials science, both of which he has applied to this highly visible research problem. He will discuss recent electron microscopical investigations strongly suggesting that ancient Egyptians had discovered a cement—based on dolomitic lime, diatomaceous silica and disaggregated limestone—that they may have used to cast in place some of the two-ton blocks used to assemble the great pyramids of the Giza plateau more than 4500 years ago. Such a discovery would have been the first monumental use of cementitious material on such a large scale and could have modern implications for low-cost, low-emissions production of building cements made from indigenous materials in our present world.

Sigma Xi, the national scientific research society, was founded in 1886 as an analogue to Phi Beta Kappa in the fields of science and engineering research. Its 100,000 members are affiliated with 500 chapters and clubs throughout the world. The MIT chapter is the organization's largest and annually elects new members from the undergraduate and graduate student bodies and the Institute's faculty and research staff. Each year, the chapter honors an outstanding academic researcher with MIT connections who has made important recent contributions to a scientific research field.

The annual lecture, which is open to the MIT community and the greater Boston area Sigma Xi membership, will be preceded by the Sigma Xi dinner for new initiates. Those wishing to attend the dinner at 6:30 p.m., immediately preceding the lecture, should contact Prof. Hobbs at 617-253-6835 or at hobbs@mit.edu.



MIT in the world

A dream come true

Donna Coveney
News Office

The inauguration this week of a new mosque in the Cambodian village of Tramung Chrum will represent a dream come true for residents of the Muslim enclave in the overwhelmingly Buddhist country.

That dream was brought to life by Alan Lightman, MIT physicist and writer who a decade or so ago, with his wife, Jeanne, made a pact to turn their energies toward humanitarian pursuits. Without a firm direction or funding, they formed the nonprofit Harpswell Foundation in 1999.

Within a few years, Lightman, Jeanne and their daughter, Elyse, would attend the opening of a school built in an impoverished village 50 miles from Phnom Penh, build and manage a women's dorm and leadership center in Phnom Penh and, finally, build the new mosque in Tramung Chrum.

Lightman has been entranced by science and the arts from an early age. Appointed professor of science and writing and senior lecturer in physics at MIT in 1989, he went on to head the Program in Writing and Humanistic Studies from 1991 to 1997 and helped found the Catalyst Collaborative, a collaboration between MIT and the Underground Railway Theatre of Boston in 2004. His novel, "Einstein's Dreams," published in 1993, was an international bestseller and has been translated into 30 languages.

Professor Lightman first heard of Tramung Chrum, a tiny Muslim village in Cambodia, in 2003 from the Rev. Fred Lipp. Lipp, who had been working to keep young girls in school in Cambodia with his own foundation, told Alan of a village whose only school had a roof of palm fronds. Lightman's imagination was kindled and in December of that year he and daughter Elyse accompanied Lipp to Cambodia.

What they found was a village of about 500 people—mostly Muslim Chams, one of Cambodia's ethnic minorities. With neither running water nor electricity, the local economy was based on subsistence farming and menial labor.

"We were overwhelmed with emotion," Lightman says softly, his eyes lighting at the memory. "These people had gone through tremendous suffering since



PHOTOS / ELYSE LIGHTMAN

Adjunct Professor of the Humanities in the Program in Writing Alan Lightman sits in the mosque built by his Harpswell Foundation with villagers, Muslim Chams (of the San Cham sect). The mosque (shown below) was completed in December 2007 and will be inaugurated this week in Tramung Chrum, Cambodia.

the mid-1970s and the genocide perpetrated by the Khmer Rouge, and in spite of that they had hope and resilience. "The best expression of that hope for the future," he says, "was when we arrived, mothers holding babies came up and asked for our help to build a school. They had nothing, lived in abject poverty, but wanted a school, a future. We were so moved."

Funded by donations from family and friends, the school was finished in the summer of 2005. Where a roof of palm fronds had been now stands a concrete-and-steel-girder school.

The impetus for his next project came from Veasna Chea, a native of Tramung Chrum who had made it through law school in Phnom Penh by living with three female classmates in the space on the mud floor beneath the school for four years. Male students could live in the Buddhist temples, but in the gritty capital, there were few, if any, safe places for women to stay, so few women

attended college.

Once again, he took on the challenge, found contractors and built the dormitory and leadership center.

But that was only the beginning. Lightman reckons, "One-third of my waking hours I spend on Cambodia daily." From sleeping security guards to the students' need for medical procedures, funds for upkeep, teachers, food and all life's issues, Lightman is the go-to guy. His daily electronic communications with the dorm represent the sole exception to Lightman's personal ban on using e-mail.

He is presently trying to raise a \$500,000 endowment to keep the dorm and all it offers up and running in the future.

As he busied himself managing the dorm and leadership center, the villagers of Tramung Chrum, thrilled with their school, asked him to build a mosque. To Lightman, health care seemed a more compelling need, but he understood that it had to be what the entire village wanted. So he asked the men and women of the village to choose five representatives each, and he met with the two groups separately. The men wanted a mosque, the women wanted health care.

A meeting was convened to give the 10 representatives the opportunity to address the whole village and then vote on which project to take forward. After a civil discussion, all the men and three women voted for the mosque. The reason? The mosque represented their spiritual health, which they considered more important than their physical health. Lightman recognized that the cultural value and tradition was different than his own and that the social fabric of the community depended on the mosque.

"They are so proud," he says, "so deeply happy with this mosque."



STOMACH: Early treatment of infection may help prevent cancer

Continued from Page 1

the infection for maximum benefit. Human studies that tested treatment in patients who had already developed tumors had mixed results, but one previous study showed that giving antibiotics before premalignant lesions develop was successful in preventing cancer, said the study's lead author, James G. Fox, a professor in the Department of Biological Engineering, director of MIT's Division of Comparative Medicine and member of the MIT Center for Environmental Health Sciences.

"We concluded that *H. pylori* eradication prevented gastric cancer to the greatest extent when antibiotics were given at an early point of infection, but that eradication therapy given at a later time point also delayed the development of severe lesions that can lead to cancer," Fox says.

The current study, which used a new mouse model of gastritis and stomach cancer, examined the effects of treating and eliminating *H. pylori* at different stages of progression from gastritis, an inflammation of the mucous membrane layer of the stomach, to the development of gastric cancer. To do this, Fox and colleagues from MIT and Columbia University developed transgenic "INS-GAS" mice that overexpressed gastrin, a hormone that controls secretion of gastric acid by the stomach's parietal cells. "If you lose these cells over time, they stop secreting

gastric acid, and this is, in and of itself, a risk factor for development of cancer, but gastric acid also helps protect against commensal bacterial colonization of the stomach," Fox says.

With increasing age, parietal cells in INS-GAS mice stopped producing gastric acid and underwent precancerous changes. By 20 months of age, the mice spontaneously developed invasive gastric cancer. Infection by *H. pylori* and progression to gastric cancer was accelerated in these mice, the researchers discovered.

They then treated the mice with antibiotics and looked for cellular changes. They found that, at every stage of advancing infection, mice that were treated with antibiotics had less-severe disease. Treating mice that were eight weeks post-infection reduced risk of developing cancer to the same level

seen in uninfected mice. But using antibiotics at 12 and 22 weeks post-infection did not reverse the damaging changes, such as inflammation and development of precancerous lesions, to the levels seen in uninfected mice.

"Our mouse model mimics the progressive process we know occurs in development of human gastric cancer," Fox says. "This shows early intervention provides the maximum benefit."

Of added benefit, Fox says, is the associated finding that antibiotic treatment also reduces the level of other bacterial species that have invaded the stomach. "Gastric acid is a barrier to bacteria and if there is no barrier, bacteria can move into the stomach from the lower bowel and colonize it, producing inflammation and progression to cancer," he says. "Findings in humans and mice now suggest that antibiotic treatment potentially changes gastric microbiota and may impact gastric carcinogenesis."

The first author of this paper is Chung-Wei Lee. Lee recently received his PhD under the supervision of Fox in the Department of Biological Engineering. Additional authors are Barry Rickman, Arlin B. Rogers and Zhongming Ge, all of the Division of Comparative Medicine, and Timothy C. Wang of Columbia University.

This work was funded by the National Institutes of Health.

Eradication therapy given at a later time point delayed the development of severe lesions that can lead to cancer.

James G. Fox
Biological engineering professor

CLASSIFIED ADS

Members of the MIT community may submit one ad each issue. Ads should be 30 words maximum; they will be edited. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.

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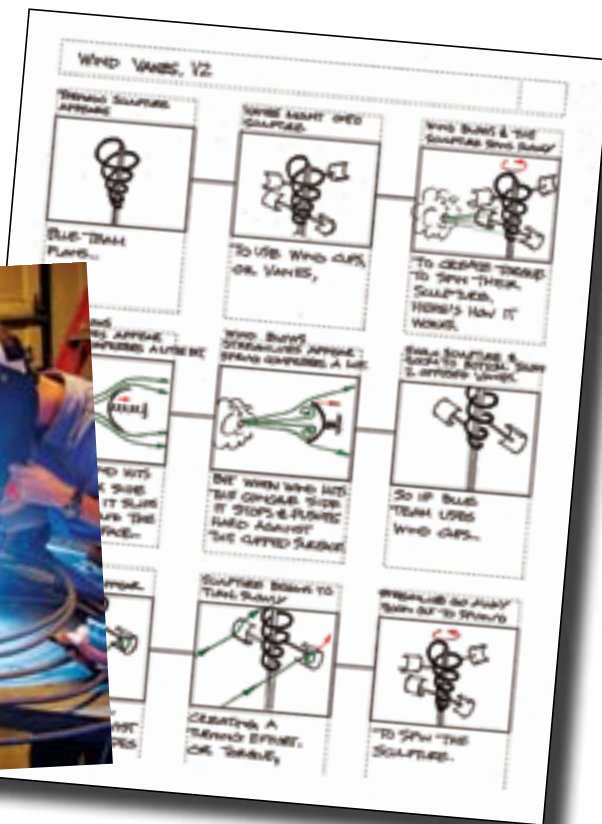
Gail's Beauty & Medicinal Soaps. May 15 & 16 at the Craft Fair, Lobby 10. E-mail gwood@compuserve.com.

WANTED

MIT faculty member looking for long-term room rental or studio in the Cambridge area (or anywhere within walking distance of red line stop) for \$400-500/mo or less. Room/studio will only be occupied two-three nights per week starting September 2008. Contact fharris@mit.edu.

Engineering an award-winning TV program

MIT faculty, students' perspective employed in PBS's 'Design Squad'



PHOTOS / MIKA TOMCZAK
 LEFT: Urban tornado installed on site at the museum. The tornado remained on exhibit for one year. CENTER: Blue team working on set, fabricating the sculpture. RIGHT: The storyboard for the Urban Tornado project.

Lois Slavin
 Engineering Systems Division

Several MIT faculty and students were recently delighted to learn that Design Squad, the PBS series created to attract boys and girls in their 'tweens and teens to consider engineering as a profession, was named a winner of the prestigious George Foster Peabody Award. From hosting the show to advising behind the scenes, members of the MIT community have played an important role in developing and implementing this popular series.

It began in 2002, with Associate Professor of Mechanical Engineering and Engineering Systems Daniel Frey, who served as the show's first adviser. In collaboration with series producers at WGBH-TV Boston, he created Design Squad's curriculum. Later, under Frey's guidance, MIT students (including Design Squad host Nate Ball '05, SM '07) participated in the show as part of the university's Undergraduate Research Opportunities Program. Frey, who holds a dual appointment with Mechanical Engineering and MIT's Engineering Systems Division, played a central role in developing the design challenges during the program's piloting phase and first season—he and the students conceptualized the challenges, tested their feasibility and formulated kits of materials.

Frey notes that the National Science Foundation Career Development Award he received during that time facilitated his thinking about experimentation, the development of a systems perspective through teamwork and the importance of engineering systems to the future of the engineering profession.

"Design Squad helps young people go beyond the stereotype of engineering being staid and analytic and demonstrates ways that it can be both creative and socially engaging. A hope is that it will encourage more young people to enter engineering," he explains.

David Wallace, Esther and Harold E. Edgerton Associate Professor of Mechanical Engineering and Engineering Systems, has been involved with creating the series' design challenges for two competing teams of aspiring teenage engineers. During filming he oversees engineering preparation for the challenges and is the technical adviser on set, mentoring the teams and helping with troubleshooting. During postproduction he reviews rough cuts of each episode for

content. He also helps to identify educational opportunities and crafts explanations of engineering concepts that are accurate and meaningful, yet still kid-friendly. He develops the animation storyboards and provides technical advice to the animation team.

Because he is passionate about design and education, holding an undergraduate degree in industrial design and undergraduate and advanced degrees in mechanical engineering, Wallace says he jumped at the opportunity to work on the series. "It is a chance to reach a wide audience and hopefully help to inspire the next generation of technical innovators," he says.

Other members of the MIT community involved in Design Squad include Pappalardo Professor Emeritus of Mechanical Engineering Woodie Flowers, MechEng graduate students Ben Powers, Helen Tsai and Mika Tomczak, and several UROP students. The oldest honor in electronic media, the Peabody Award recognizes distinguished achievement and meritorious public service by media organizations and professionals.

"What distinguishes WGBH's children's programming is that our format is curriculum-based, developed with leading educators from across the U.S. MIT's own Dave Wallace, Dan Frey and Woodie Flowers are perfect examples of this," says Maria Wolsky, Design Squad's executive producer.

Design Squad takes systems-based approach to attracting future engineers

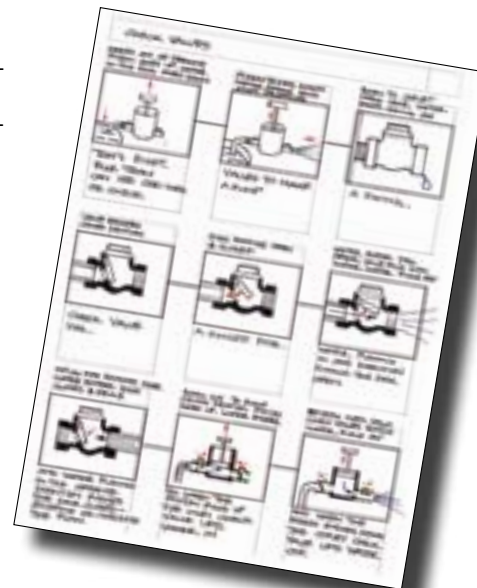
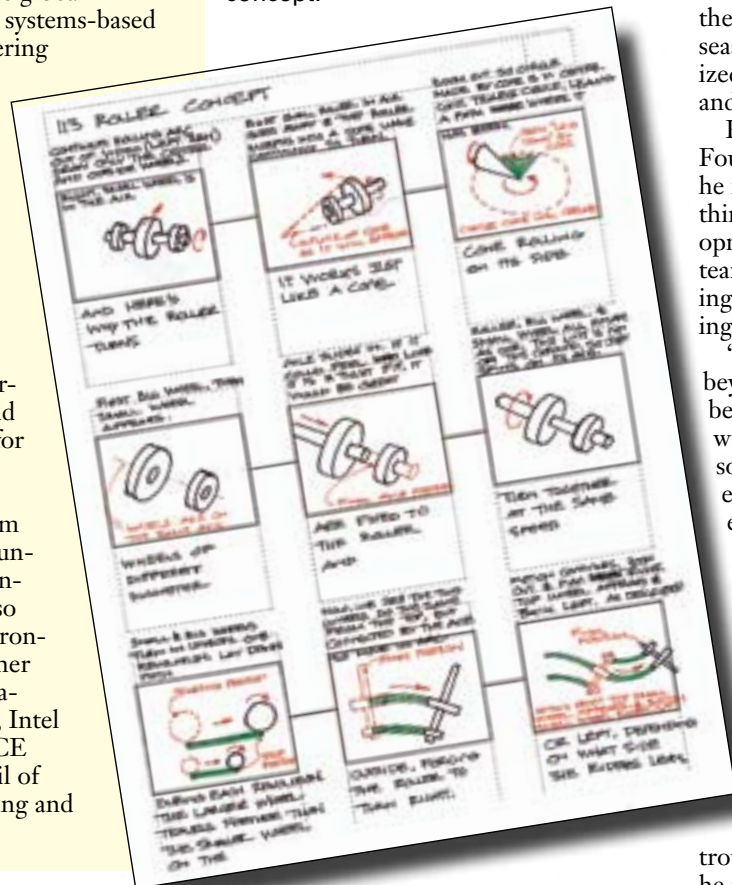
According to the National Science Foundation, the United States faces a daunting challenge: College-bound students' interest in engineering majors are decreasing and statistics show an even greater decline in interest among minority and female students.

Design Squad aims to help address this situation and attract a larger, more-diverse talent pool of future engineers who can create future technological innovations and help the United States remain competitive in the global marketplace. Its holistic, systems-based approach involves partnering with engineering societies, industry, universities, middle- and high-school teachers to produce not just the TV series, but also a web site, after-school program and public events across the country to demonstrate just how creative and exciting the engineering profession can be, and also to provide a model for teamwork.

Major funding for Design Squad comes from the National Science Foundation and the Intel Foundation. The project is also supported by Tyco Electronics, The Harold and Esther Edgerton Family Foundation, Noyce Foundation, Intel Corporation, IEEE, ASCE and the National Council of Examiners for Engineering and Surveying.



PHOTOS / MIKA TOMCZAK
 ABOVE: Members of red team rest their prototype 'summer sled' for L.L. Bean. BELOW: The storyboard for the 'summer sled' explains its 'roller concept'.



STORYBOARDS BY DAVID WALLACE
 ABOVE: An animation storyboard describes the function of a check valve and a team's idea for a simple hand pump.