

Student Advisory Committee makes recommendations

■ By Denise Brehm
News Office

Calling for a radical transformation of MIT culture, the Student Advisory Committee to the Presidential Task Force on Student Life and Learning is advocating the adoption of an educational triad that places equal emphasis on research, academics and community so that "the development of the whole student becomes the highest priority across all areas at MIT," according to its recently completed final report.

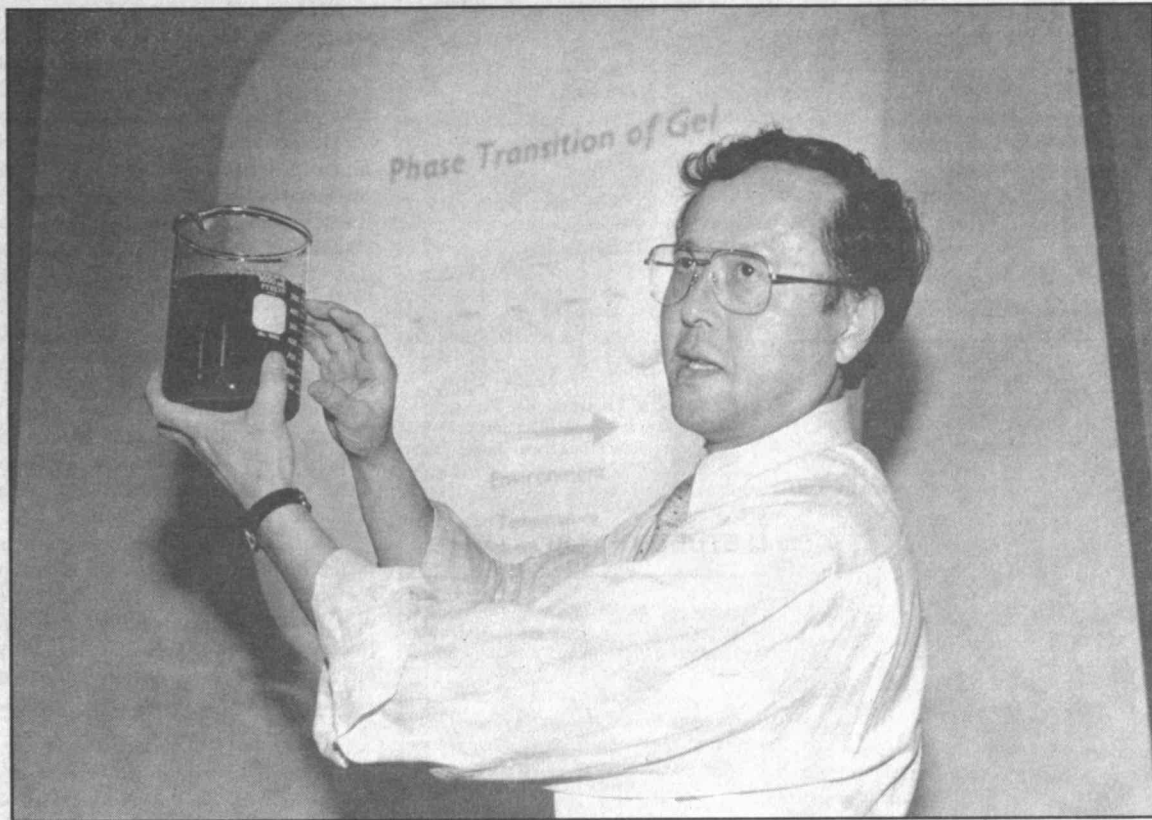
The Student Advisory Committee's report is the result of nearly two years of open forums, meetings with individuals and student groups, and work with the Task Force on Student Life and Learning, which was established

in September 1996 at the request of President Charles Vest. The Student Advisory Committee (SAC) was appointed shortly thereafter to advise the Task Force.

The SAC, which currently has about a dozen members (a total of 19 students have served since its inception), is in the process of holding meetings to discuss the recommendations in its report with individuals in the senior administration, including President Vest, Provost Joel Moses, the deans and the faculty chair. Committee members hope that the Task Force will adopt some of the recommendations in its own report to the president.

The SAC report calls for a far greater level of faculty and staff participation in the student community, with both

(continued on page 6)



Professor Toyochi Tanaka demonstrates how a gel can quickly swell and contract in response to different stimuli at a talk he gave during the ILF Research Directors Conference. Photo by Donna Coveney

Two teams win top prize in MIT \$50K contest

The MIT \$50K Entrepreneurship Competition judges—deadlocked over the high quality of student business plans—named two winners of the coveted \$30,000 top prize at the final awards ceremony last Thursday.

Volunteer Community Connection and Direct Hit—two Internet-

based ventures—each received \$30,000 after an anonymous donor fattened the fund with an additional \$20,000. The donation transformed the usual \$50,000 prize into \$70,000, marking the first time in the competition's history that two teams each received a grand prize. A third

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Event highlights variety of research

■ By Elizabeth A. Thomson
News Office

Some 500 research directors from companies around the world now understand first-hand the oft-used analogy that getting an education from MIT is like taking a drink from a firehose.

For two days last week at the Indus-

trial Liaison Program's 1998 Research Directors Conference, participants listened to research highlights from all five of MIT's schools and several laboratories. In addition, five concurrent sessions Wednesday afternoon presented 20 projects in more detail.

This year's conference marked the ILP's 50th anniversary. Karl F. Koster, acting director of the MIT Office of Corporate Relations, noted that when the ILP was formed in 1948, it had six

member companies. Now it has 200 from around the world.

SLOAN SCHOOL

One theme echoed by several speakers was the importance of research collaborations between MIT's schools. "This is one of MIT's real advantages," said Thomas J. Allen, deputy dean for the Sloan School of Management and the Howard W. Johnson Professor of

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Institute gears up for Commencement

■ By Robert J. Sales
News Office

The Commencement Committee, planning for a record crowd, has announced the full program for MIT's 132nd Commencement on Friday, June 5, at which President William J. Clinton will address some 2,250 seniors and graduate students and more than 9,000 relatives and guests.

Professor Joel Moses will be presiding at his final Commencement as provost and Alex d'Arbeloff at his first as chair of the MIT Corporation. Provost Moses will step down

on August 1 and return to research and teaching.

President Clinton, the first sitting president to speak at MIT, will deliver only two other Commencement speeches this year, at the Naval Academy on May 22 and Portland State University in Oregon on June 13.

Other speakers at this year's Commencement will include Geoffrey J. Coram, president of the Graduate Student Council, and Salman A. Khan, president of the Class of 1998. The invocation will be given by Swami Sarvagatunanda of the Ramakrishna Vedanta Society.

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Report on dangerous drinking to be discussed tomorrow

The co-chairs of the Working Group on Binge Drinking—Professor Phillip Sharp, head of the Department of Biology, and Dr. Mark Goldstein, chief of Pediatric and Student Health Services—will hold a community meeting Thursday at 1pm in the Student Center Mezzanine Lounge to discuss the report's recom-

mendations for continuing actions to curb dangerous drinking among MIT students. Copies of the report will be available at the meeting.

President Charles Vest and the Academic Council received and discussed the report with Dr. Sharp and Dr. Goldstein at the Academic Council meeting on Tuesday.

Expo explanation



Vinardeep Kaur, 13, of the Fitzgerald School explains her project, *The Eclipse*, to aeronautics and astronautics freshman Dana Forti at the sixth annual MIT/Cambridge Science Expo held in the Johnson Athletics Center last week. See story on page 5.

Photo by Donna Coveney

IN BRIEF

DICKSON FAREWELL

To honor Senior Vice President William Dickson, who is retiring after four decades at MIT, the Institute will host an all-MIT barbecue from 3-6pm on Friday, June 12 at the barbecue pits outside the Johnson Athletics Center. All are welcome.

AWARDS TODAY

The Awards Convocation will be held today at 3:30pm in Rm 10-250. A reception will follow the ceremony in the President's Courtyard (outside the Bush Room), or in the Bush Room itself in case of rain.

FACULTY MEETING

A regular faculty meeting will be held on Wednesday, May 20 at 3:15pm in Rm 10-250. Agenda items will include:

- Vote on the report of the Committee on Nominations, by Professor Hax
- Vote on the motion to implement a house-keeping change to Rules and Regulations of the Faculty, by Professor Bailyn
- Vote on the proposal to establish an MIT/WHOI Joint Masters of Engineering Program in Ocean Engineering, by Professor Vandiver

- Vote on the proposal to establish a Master's of Science in Comparative Media Studies, by Professor Jenkins

- Election of members of the Faculty Ex Officiis, by Professor Bailyn

- In recognition of retiring faculty members, by Professor Bailyn

- Report of the Killian Committee, by Professor Bras

- Report on the proposal to establish a Division of Bioengineering and Environmental Health, by Dean Brown

- Report on the move of the Division of Toxicology to the School of Engineering, by Professor Canizares

- Report of the ROTC Implementation Team, by Professor Clay

- Report from the Commencement Committee, by Professor Schlecht

NO TECH TALK

There will be no issue of MIT Tech Talk on May 27 because of the Memorial Day holiday. The deadline for submitting classified ads and announcements for the May 20 issue, which will cover the period from May 20-June 7, is Friday, May 15 at noon.

Middle East scholar Slyomovics named to new women's studies chair

Susan Slyomovics, a noted scholar of the Middle East, has joined the anthropology program in the School of Humanities and Social Science (SHSS) as the first holder of the Genevieve McMillan-Reba Stewart Chair in the Study of Women in the Developing World.

Dr. Slyomovics, previously a professor at Brown University, has published widely in gender studies, performance studies and anthropology. In addition to numerous articles and translations of Arabic poetry, she is the author of *The Merchant of Art: An Egyptian Hilali Oral Epic Poet in Performance* (University of California Press, 1988). Another book, *The Object of Memory: Arab and Jew Narrate the Palestinian Village* (University of Pennsylvania Press) will appear in June. She is presently editing a volume of essays entitled *Gender and Transformation in the Middle East* and is conducting research on the anthropology and literature of political prisoners in North Africa.

"I have a great opportunity to make

what I care about a part of the humanities and social science project at MIT," said Professor Slyomovics. "I look forward to teaching gender studies in the Middle East and North Africa and to bringing feminist scholars on the Middle East here to participate."

In 1998-99, she will teach courses in storytelling; photography and truth (with the Comparative Media Studies program); and the anthropology of the Middle East. She will spend part of this summer in the Middle East, including a return visit to the Palestinian village where she did her field work for *The Object of Memory*. Professor Slyomovics is sharing royalties from the book with the people she wrote about.

Originally from Montreal, Professor Slyomovics received the BA in philosophy from Barnard College in 1970, the MA in philosophy and Judaic studies from the Jewish Theological Seminary in 1977, and the PhD in Near Eastern studies and folklore from the University of California at Berkeley in 1985. She has also studied at Hebrew University in Jerusalem and the American University in Cairo. She is the recipient of numerous fellowships and awards including a Guggenheim Foundation Grant in 1995-96.

"Susan Slyomovics has an extraordinary scholarly range that spans North Africa and the Middle East and a sig-

nificant international reputation," said Philip S. Khoury, SHSS dean and a professor of Middle Eastern history. "She is a truly interdisciplinary humanist with deep interests in comparative literature, performance studies, anthropology and gender studies. She brings new distinction to women's studies and Middle Eastern studies at MIT."

The McMillan-Stewart chair is the first of its kind in the United States devoted to the study of women in the Middle East and North Africa. Women's issues are of special interest to Genevieve McMillan, a Cambridge intellectual, businesswoman, art patron, and philanthropist who established the chair. She named the chair in honor of her friend, Reba Stewart, a young American painter who died while practicing her art in Africa.

"Genevieve McMillan has a profound understanding of the problems facing women in the developing world and the importance of focusing rigorous scholarly attention on women in the Middle East and North Africa," Dean Khoury said. Her gift to MIT includes resources to establish a new lecture series on women in the developing world at the Graduate Consortium of Women's Studies at Radcliffe College, of which MIT is a founding member. That series is to begin under the direction of Professor Slyomovics.



Slyomovics

Press, 1988). Another book, *The Object of Memory: Arab and Jew Narrate the Palestinian Village* (University of Pennsylvania Press) will appear in June. She is presently editing a volume of essays entitled *Gender and Transformation in the Middle East* and is conducting research on the anthropology and literature of political prisoners in North Africa.

"I have a great opportunity to make

Dibner Institute appoints Fellows for 1998-99

The Dibner Institute for the History of Science and Technology has appointed thirteen resident, one visiting and seven postdoctoral Fellows for 1998-99. They come from several nations and pursue many different aspects of the history of science and technology.

The following are the names and planned research projects of the new Dibner Institute Resident Fellows:

Xiang Chen, Department of Philosophy, California Lutheran University. "Instruments as Material Paradigms: Experimental Apparatus in the Optical Revolution."

Kelly DeVries, associate professor, Department of History, Loyola College. "Devils from Hell: Gunpowder Weaponry During the Hundred Years War."

Moritz Epple, assistant professor for the history of mathematics and exact sciences, University of Mainz, Germany. His Dibner research will continue his work on the emergence of topology.

Training team seeks focus group participants

The Training Policies and Administration (TPA) team, an offshoot of the Human Resource Practices Development (HRPD) group, is seeking participants for focus groups to provide input on the first draft of its recommendations for staff training and development.

The focus groups will be held from noon-1pm on the following dates:

Tuesday, May 19—Support staff
Wednesday, May 20—Administrative staff, non-supervisory

Tuesday, May 26—Administrative staff, supervisory

Wednesday, May 27—Support staff

Locations will be announced. Anyone interested in participating should contact Samantha Conti at x3-7685 or <sconti@mit.edu> by Monday, May 18.

The TPA team thanks all staff who responded to their recent survey of staff training and development needs.

For further information, see the HRPD web site, which includes frequently asked questions, at <http://web.mit.edu/reeng/www/hrpd>



Juliet Floyd, associate professor of philosophy, Boston University. She plans to complete a book on the historical and philosophical significance of Ludwig Wittgenstein's discussions of mathematics and logic.

Alan Franklin, professor of physics, University of Colorado. "Death by a Thousand Cuts: Selectivity and the Production of Experimental Results."

Kostas Gavroglu, professor in the Department of History and Philosophy of Science, University of Athens. At the Dibner Institute he plans to work on two projects: the final stages of a book on the history of quantum chemistry, and research for a project entitled "The Sciences in the European Periphery During the Enlightenment."

Alexander Jones, professor in the Department of Classics and IHPST at the University of Toronto. At the Dibner Institute he will explore Ptolemy's Geography, the only book on cartography to have survived from classical antiquity.

Andrew Pickering, professor in the Department of Sociology at the University of Illinois at Urbana-Champaign. He will work on a book titled *History of Cybernetics*.

Nicolas Rasmussen, University of New South Wales, Australia. He will study American plant physiologists in the 1920s-1940s and their links to the biotechnology industry.

Leonard S. Reich, professor of science, technology and society and administrative science at Colby College. He will work on a book about transportation in American history titled *On Wheels, Wings and Waves*.

Katherine Rinne, associate fellow, Institute for Advanced Technology in the Humanities at the University of Virginia. She will continue to develop a CD-ROM prototype entitled "Aqua Urbis Romae: the Waters of the City of Rome," an interdisciplinary study of hydrology, topography and urban form that explores the city's 2,800-year water history.

Friedrich Steinle, research fellow, Max-Planck Institute for the History of Science, Berlin. He plans to continue work on a book titled *The Formative Period of Electromagnetism 1820-ca. 1833*.

Nicolas Wey-Gomez, assistant professor of Hispanic studies at MIT. "The Old Science in the New World: Scholastic Science and Moral Philosophy in the Spanish Colonial Americas."

Appointed as a Dibner Institute Visiting Fellow is **Lis Brack-Bernsen**.

She has taught at the Universities of Copenhagen and Aarhus in Denmark and is the author of articles on the history of ancient astronomy. While at the Dibner Institute, she will work on interpreting Babylonian lunar text TU 11.

The Dibner Institute has made the following postdoctoral fellowship appointments:

Arne Hessenbruch, a visiting lecturer at the University of Pennsylvania. His project is a book, *Reception of the Theory of Radioactive Disintegration*.

Christophe Lecuyer recently completed his dissertation at Stanford University. His Dibner project is "From the Lab to the Fab: Physics Research, Manufacturing Practice, and Ion Implantation at High Voltage Engineering Corporation and Fairchild Semiconductor, 1962-1978."

Reviel Netz, research fellow and affiliated lecturer, Cambridge University. He expects to write a brief volume, *An Introduction to Cognitive History*.

Richard Sorrenson, assistant professor at Indiana University. He will continue work on his manuscript, *Visible Technicians: The Pursuit of Natural Philosophy by Mathematical and Optical Instrument Makers in 18th-Century England*.

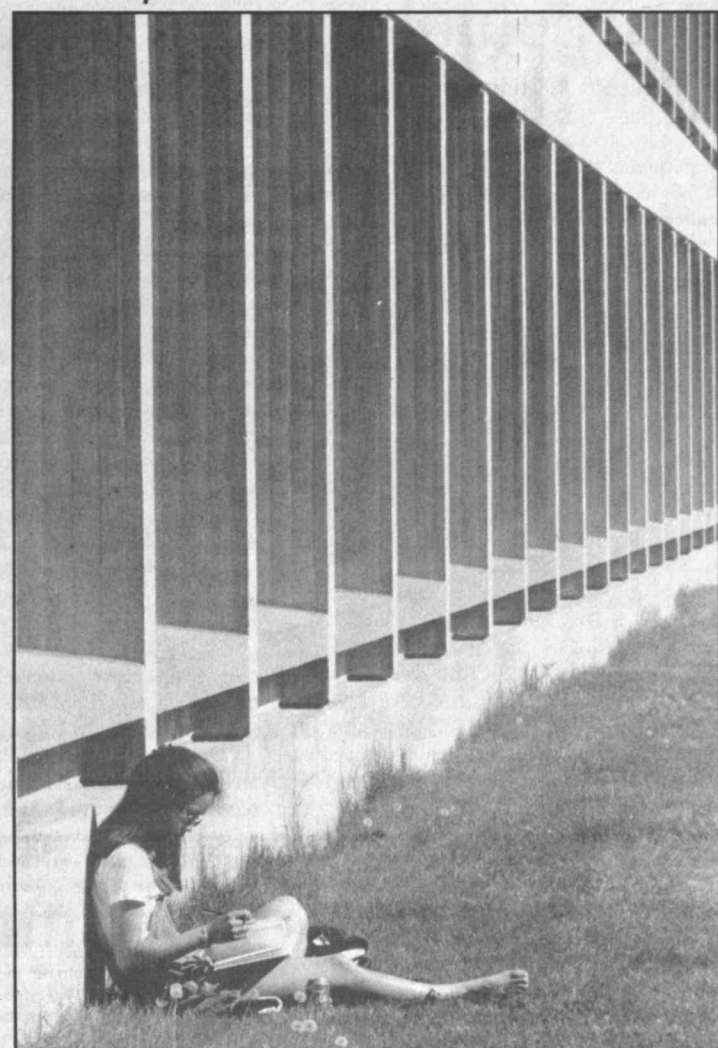
Klaus Stauber completed his dissertation at Cambridge University. He will analyze the debate between two leading astrophotometrists, G. Müller in Potsdam and E. Pickering at Harvard College Observatory.

John Michael Steele will investigate the lunar and planetary records contained in the "Astronomical Diaries" kept by Babylonian astronomers from mid-eighth century BC to the beginning of the Christian era. He also plans to study East Asian, European and Babylonian records of meteors.

Benno van Dalen, Alexander von Humboldt Foundation Fellow, Institut für Geschichte der Naturwissenschaften, Frankfurt, Germany. He will work on a manuscript tentatively titled *The Activities of Muslim Astronomers in China During the Mongolian Yuan Dynasty (1260-1368)*.

The Dibner Institute has also reappointed Noah Efron, Tal Golan, David McGee and James Voelkel to a second year as postdoctoral fellows and announced that fellowship awards have been made to 11 PhD candidates enrolled in programs at three Dibner Institute consortium-member institutions: host institution MIT, Boston University and Harvard University.

Line up



Architectural graduate student Eunice Lin catches some rays as the camera catches an interesting convergence of lines.

Photo by Donna Coveney

1998-99 Knight Science Journalism Fellows named

Newspaper, magazine and film journalists from the United States, Europe and Asia have been selected as Knight Science Journalism Fellows for 1998-99 at MIT. The journalists come from California, Arizona, Wisconsin, New Jersey and Washington, DC, as well as from Germany and India. They arrive at the Institute September 1.

The Fellows will spend nine months at the Institute in group and individual study of recent developments in technology and science, under the leadership of Boyce Rensberger, who succeeds Victor McElheny as director of the Knight Fellowships on July 1. The program is part of the Program on Science, Technology, and Society in the School of Humanities and Social Science. Principal sponsor of the program is the John S. and James L. Knight Foundation of Miami.

The new group, the 16th since the program's founding, brings the total of Fellows to 162 from the United States and 15 foreign countries—73 women and 89 men. Of the total, 46 have been citizens of other nations. An additional four have been US citizens working abroad. The largest group of Knight Fellows has come from newspapers.

The new Fellows are:

Kevin Coughlin, technology reporter for The Star-Ledger in Newark, NJ, a Newhouse newspaper. He supplements his coverage of electronic technologies with cable television reports.

Kerry Fehr-Snyder, 34, technology reporter for The Arizona Republic in Phoenix, a Pulliam newspaper. She recently covered the Iridium communications satellite project and writes a weekly column called "Digital Desert."

Venkatesh Hariharan, 29, freelance electronics reporter, Bombay, India. A former executive editor of Express Computer, he contributes to Upside magazine in California.

Andrew Lawler, 36, science policy reporter for Science magazine in Washington, DC, the weekly journal of the American Association for the Advancement of Science. He covers the White House, Congress and federal agencies.

Robin Lloyd, 35, science writer for the Pasadena Star-News, California. Holder of a PhD in sociology from the University of California at Santa Barbara, she frequently covers science news at California Institute of Technology and the Jet Propulsion Laboratory.

Daniel Pendick, 35, freelance writer, Milwaukee, WI. He is a former associate editor and currently a contributing editor to Earth magazine, and a frequent contributor to the New Scientist.

Bruce Shechter, 43, freelance writer, Altadena, CA. Holder of a 1978 PhD in physics from MIT, he recently completed a biography of the mathematician Paul Erdos, entitled *My Brain is Open*.

Claudia Wassmann, 38, television science journalist, Sueddeutscher Rundfunk, residing in Heidelberg, Germany. Holder of a doctorate in medicine from Heinrich Heine University in Duesseldorf, she recently completed a documentary on schizophrenia.

Choosing the Fellows was a selection committee consisting of Mr. Rensberger, Mr. McElheny, Professor of Biology Nancy Hopkins, 1986-87 Knight Fellow Robert Buder, and 1991-92 Knight Fellow Shawna Vogel.

Mr. Rensberger is a former reporter for the Detroit Free Press and The New York Times, head writer for the 3-2-1 Contact! program of Children's Television Workshop, senior editor of Science 80 magazine, science editor of The Washington Post and first editor of Horizon, the paper's monthly learning section on science, mathematics and history. He is co-director of the Science Writing Fellowships at the Marine Biological Laboratory in Woods Hole and author of *Life Itself*, published in 1997 by Oxford University Press.

Mr. McElheny, a former reporter at The Charlotte Observer, Science magazine, The Boston Globe and The New York Times, is retiring to devote full time to writing. *Insisting on the Impossible*, his biography of Edwin Land, inventor of instant photography, will be published this fall by Perseus Books.

Students compete to design a perpetual-motion machine

■ By Elizabeth A. Thomson
News Office

A perpetual motion machine, or one that moves forever with no source of energy from the outside, is considered impossible by organizations including the American and British patent offices (the latter will not accept patent applications on this subject; the US requires a working model).

So what could be a better problem for MIT undergraduates to tackle?

Two students have won honorable mentions in MIT's first Perpetual Motion Competition. Carl C. Dietrich, a junior in aeronautics and astronautics, and David A. Shear, a sophomore in mechanical engineering, each received \$250 for their written proposals describing machines they believe fit the criteria. They will receive their prizes at a reception May 14.

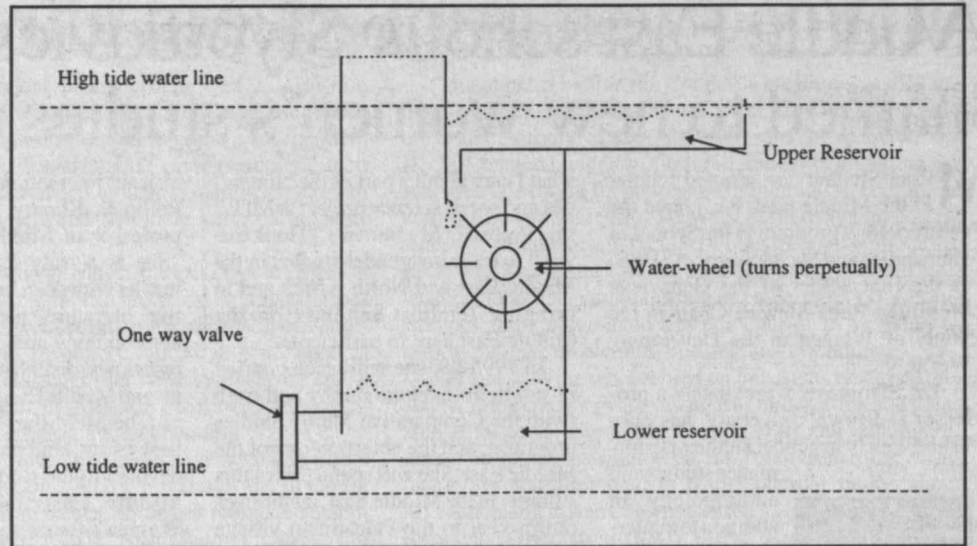
Six undergraduates entered the competition. None succeeded in winning the \$500 first prize by stumping the judges—students in a class taught by Dr. Yuri B. Chernyak within the Concourse Program directed by Professor Robert M. Rose. However, the entries from Mr. Dietrich and Mr. Shear were so well done that the judges agreed they merited some acknowledgment and split the money between them.

Mr. Dietrich submitted his entry, which presented three machine designs, "on the premise that this design competition is not some form of elaborate April Fool's Day joke." (The deadline for entries was April 1.) He went on to describe a water wheel that turns perpetually based on tidal motion, a second water wheel that employs solar energy to do the same, and a generator flying in space that uses "the flux of ions emanating from the sun" to move about.

Mr. Shear described a continuously spinning top that works via magnets inside the top and under the concave dish the top spins in. Although the judges eventually debunked this submission, too, "the model kept us busy for some time," they wrote in a letter to Mr. Shear.

Why are two MIT instructors "espousing such a major crackpot idea?" said Dr. Chernyak, a NASA senior fellow at MIT. Answer: it's a great teaching vehicle. "There's some very serious physics behind the humor," he said. "You have to understand the physics of the world to understand why a perpetual motion machine will or won't work... The ability to find errors in some fine presentations is a vitally important feature of a scientist."

Dr. Chernyak teaches Problems in Electricity and Magnetism, a Concourse Program enrichment course for students in their second term of



In Carl Dietrich's design for a perpetual motion machine (one of three he submitted), the upper reservoir fills at high tide and the water slowly empties into the lower reservoir, continuously turning a water wheel. Once the tide falls below the level of the lower reservoir, the water drains back into the ocean through a one-way valve. Diagram courtesy Carl Dietrich

physics. "The problems presented are meant to stretch their minds, and give them a better intuitive feel for physics," said Professor Rose, of the Department of Materials Science and Engineering.

In past semesters, some of those problems led to the students' unintentionally inventing their own perpetual motion machines, some of which seemed to create energy where there was none

before. The appearance of such seemingly simple solutions to global energy and environmental problems led to spirited arguments, analysis, and, according to Professor Rose, "a much deeper understanding of freshman physics... Then it occurred to us that we should extend this challenge to the MIT community at large," and so the Perpetual Motion Competition was born.

Haystack workshop introduces new VLBI system, Mark IV

■ By Deborah Halber
News Office

More than 100 engineers from 18 countries took part in a workshop at the MIT Haystack Observatory in Westford from May 10-13 for operators of the global network of VLBI (very long baseline interferometer) stations.

The workshop provided technical training in all operational aspects of VLBI, including hands-on sessions, lectures, demonstrations and seminars. Included in the presentations was an introduction to Haystack's latest and most sensitive VLBI system, the Mark IV, which is expected to be up and running at observatories around the world by late next year.

The workshop—popularly known as the chiefs' meeting because it offers technical training to staff members who are, or hope to become, one of the

chief operators at their station—is sponsored by NASA and by the European VLBI Network. The workshop was organized by the Haystack Observatory geodetic VLBI staff and the NASA Goddard Space Flight Center VLBI group.

"We are now completing the next generation of VLBI equipment, called Mark IV, which is being deployed worldwide. This is an opportunity to train engineers at various radiotelescope stations in the operations, the new equipment and procedures in general," said Joseph E. Salah, director of Haystack.

VLBI uses simultaneously operating radio telescopes around the world to monitor radio signals from distant sources, typically quasars in galaxies billions of light years away. The data are sampled and time-tagged according to atomic clocks operating at each site, and recorded on magnetic tapes.

The tapes are shipped to a VLBI correlator, such

as the Mark III at Haystack, and processed with custom-designed hardware and controlling software that matches the pattern of radio waves from the distant radio sources. The hardware compensates for the different positions of the telescopes on the surface of the Earth and for the Doppler shift of the radio waves due to the Earth's rotation.

From this processing, the difference in time of arrival at the stations of the signals from the quasars is determined to a precision of a few picoseconds (light travels one millimeter in three picoseconds). Measuring these time differences from at least three sources makes it possible to calculate the distances between the receiving telescopes to a typical precision of better than one centimeter.

These distances are used to determine many geophysical properties, such as the velocities of the plates covering the Earth's surface and the changes in the Earth's rotation rate caused by El Niño. The

correlator data are also of astrophysical interest because they can be used to make extremely high-resolution images of the extragalactic objects that are the source of the radio emission.

"The Mark IV VLBI system is an evolutionary improvement over the Mark III," said Arthur Niell, senior research scientist at Haystack. "With the Mark IV, the tapes from up to 32 telescopes can be fully correlated at one time, while the Mark III is limited to only four stations."

"The Mark IV also will allow correlation at much higher rates—up to 2 billion samples per second per station, compared to 250 million for the Mark III—providing a much more sensitive system and higher accuracy."

The Mark IV prototype is ready, and the complete correlator should be active by late 1999. Most recording-equipment upgrades at the telescopes should be completed by then, Dr. Niell said.

Institute Calendar

* Open to public
** Open to MIT community only

(For arts-related listings, see page 7)

Tech Talk Calendar and Student Notices are on-line at <<http://web.mit.edu/newsoffice/tt/listings>>.

Next deadline for listings: Noon Friday, May 15. Covers events from Wednesday, May 20 through Sunday, June 7. Listings for the Institute Calendar and Student Notices should be submitted using the web form at <<http://web.mit.edu/newsoffice/tt/calform>>. Questions can be e-mailed to <ttcalendar@mit.edu> or call x3-2704. Early submissions encouraged.

May 13-24

■ SPECIAL INTEREST

The Awards Convocation will be held May 13 (today) at 3:30pm in Rm 10-250. A reception will follow the ceremony in the President's Courtyard (outside the Bush Room), or in the Bush Room itself in case of rain. All members of the MIT Community are invited.

■ SEMINARS & LECTURES

WEDNESDAY, MAY 13

But Is It Socialization? International Institutional Effects on Chinese Arms Control Policy*—Alasatair Iain Johnston, Harvard Univ. Sponsored by Security Studies Program. Noon-1:30pm, Rm E38-615. Bag lunch, refreshments provided. More info: x3-0133, <llvine@mit.edu>.

Bioinformatics in Gene and Drug Recovery*—Dr. David Searls, Smith Kline Beecham. Problems and Methods in Bioinformatics Seminar, sponsored by Metabolic Engineering Lab & Lab for Intelligent Systems Process Eng. 4pm, Rm 56-114. More info: x3-4583 or <gregstep@mit.edu>.

Fluid Inclusion Constraints on the Mechanics of Low-angle Normal Faulting and Foot-wall Exhumation*—Prof. Jane Selverstone, Univ of New Mexico. Sponsored by Department of Earth, Atmospheric, and Planetary Sciences. 4pm, Rm 54-915. Refreshments at 3:30pm, Ida Green Lounge. More info: x3-3382 or <http://www-caps.mit.edu/dept_sem.html>.

THURSDAY, MAY 14

Digital Lights, Cameras, Materials...*—Patrick Hanrahan, Stanford Univ. Sponsored by MIT Lab for Computer Science. 3:30pm, Rm 34-101. Refreshments at 3:15pm. More info: x3-0145, <bbarry@hq.lcs.mit.edu> or <http://www.lcs.mit.edu/web_project/dls97.html>.

Closed Crack Detection using a Novel Fiber Optic Sensing Technique*—Niel Elvin, Dept. of Civil and Environmental Engineering. Sponsored by Engineering & Environmental Mechanics Group. 4pm, Rm 1-350. More info: x3-7186, <obuyuk@mit.edu>.

Modeling Crystal Plasticity: Is There Life Beyond Finite Elements?—Vasily Bulatov, ME Dept. Sponsored by Div. of Mechanics & Materials, ME Dept. 4-5pm, Rm 5-234. Refreshments prior to talk. More info: x3-9379, <l_m@mit.edu> or <<http://lohtse.mit.edu/~maha/seminar.html>>.

Benzo[a]pyrene-Mediated Induction of CYP1A1 by a Unique Protein with Two Functions*—Prof. Edward Bresnick, UMass. Medical Center. The Robert S. Harris Lecture, sponsored by the Division of Toxicology. 4:15 pm, Rm 6-120. Refreshments at 4pm. More info: x3-6792 <toxop@mit.edu>.

FRIDAY, MAY 15

US & International Science & Technology Policy: A Symposium in Honor of Eugene B. Skolnikoff**. Sponsored by the Department of Political Science. 9:00am-5:30pm, Killian Hall, Rm 14W-111. More info: <pekreutz@mit.edu>.

Computation of Unsteady Nonlinear Flows in Cascades Using a Harmonic-Balance Technique*—Prof. Kenneth C. Hall, Duke Univ. FDRL Seminar, Dept. of Aeronautics & Astronautics. Noon, Rm 33-206. More info: <jeans@mit.edu> or <<http://raphael/seminars.html>>.

Startups and Letdowns: Reflections of a Professor in Venture Land**—Raymond F. Baddour, Lamont duPont Professor of Chemical Engineering, Emeritus, MIT. Warren K. Lewis Lectureship in Chemical Engineering. 3pm, Rm 66-110, Gilliland Auditorium. More info: x8-7031 <arline@mit.edu> or <<http://web.mit.edu/cheme/www/Titlepage.html>>.

Key Issues for the Applications of High Temperature Superconductors*—Prof. David C. Larbalestier, Univ. of Wisconsin. Sponsored by Plasma Science and Fusion Center. 4pm, Rm NW17-218. More info: <rivenberg@psfc.mit.edu> or <<http://www.psc.mit.edu/cgi/calendars/psfc>>.

What Can the Marine Os Isotope Record Tell Us About the Geologic History of Chemical Weathering?—Dr. Greg Ravizza, WHOI. Sponsored by Earth, Atmospheric, and Planetary Sciences. 4-5pm, Rm 54-915. Refreshments at 3:30pm, Ida Green Lounge. More info: x3-3382, <bevkt@mit.edu>, <http://www-caps.mit.edu/dept_sem.html>.

TUESDAY, MAY 19

Using Polymer Science to Influence Cell Biology*—Molly S. Shoichet, Univ. of Toronto. Sponsored by Department of Materials Science and Engineering as part of the Perspectives in Biomedical Materials Science and Engineering Series 3pm, Rm 8-314 (John Chipman Room). More info: x8-0537 or <burbkett@mit.edu>.

WEDNESDAY, MAY 20

Global Silica Dynamics in an Ocean General Circulation Model*—Anand Gnanesikan, Princeton Univ. Physical Oceanography Sack Lunch Seminar. 12:10-1pm, Rm 54-915. More info: <<http://puddle.mit.edu/~ganacho/sack.html>>.

THURSDAY, MAY 21

Eddy-Induced Variability in Mode Water Formation*—Wilco Hazeleger, KNMI, The Netherlands. Physical Oceanography Sack Lunch Seminar. 12:10-1pm, Rm 54-1615. More info: <<http://puddle.mit.edu/~ganacho/sack.html>>.

Dynamics in Driven Granular Media: How Sand Melts and Flows*—Narayanan Menon, U. Mass. Amherst. Sponsored by Div. of Mechanics & Materials, ME Dept. 4-5 pm, Rm 5-234. Refreshments prior to talk. More info: x3-9379, <l_m@mit.edu> or <<http://lohtse.mit.edu/~maha/seminar.html>>.

FRIDAY, MAY 22

Aurora: An Infrastructure for Dynamic Work Sessions*—Prof. Christos N. Nikolaou, Computer Science Dept., Univ. of Crete, Greece. MIT Design Laboratory Seminar. 11am-noon, Rm 5-314. More info: x3-8372 <gunst@mit.edu>.

Ripples, Twisters and Avalanches in Plasma Phase Space*—Prof. B. Breizmann, U. of Texas at Austin. Sponsored by Plasma Science and Fusion Center Seminar Series. 4 pm, Rm NW17-218. More info: x3-8101 <rivenberg@psfc.mit.edu>.

■ COMMUNITY CALENDAR

Hi-Tech Swapfest, Sunday May 17. Sponsored by Sponsered by WIMX, the MIT Electronics Research Society, WIXM/R and the Harvard Wireless Club. 9am-2pm, Albany & Main St. Buy, sell, swap electronics, computers, radio parts, etc. Buyers \$4 (\$1 off with MIT ID), sellers \$10/space. More info: x8-3754.

Wives Group**—May 13: Trip to Mount Auburn Cemetery. Meet at MIT Coop in Kendall Square at 2:45pm. May 20: Wives Group Barbecue at the Barbecue pits between Johnson Athletics Center (W34) and Briggs Field House (W23) from 3-6pm. Spouses and children welcome. Bring chairs and a dish to share. Info: Jennifer x3-1614.

MIT Women's League**—Informal Needlework Group: May 20. 10:30am-1:30pm, Rm 10-340 (Emma Rogers Room).

MIT Community Summer Softball: Empire Sign-up, Wednesday, May 13, 5:30pm, Student Center, 3rd Floor, PDR1; Empire Clinic, Thursday, May 21, 5:30pm, Rm 1-190. More Info: Mark Throop 508-877-9263 or Maryann Smela x3-6207. New Teams and Umps welcome!

■ MITAC

The MIT Activities Office (MITAC) serves the cultural and recreational needs of the MIT community (including MIT's retirement community). Two locations: (1) Room 20A-023, 9:30am-3:30pm, Wednesday-Friday (2) Room LLA-218, x6130, Lincoln Lab, 1:15-4pm, Thursday and Friday only. More info: x3-7990 or <julieh@mit.edu>. MITAC accepts only cash or a personal check made payable to MIT. MIT IDs must be presented.

Six Flags Adventure Theme Park (NJ)**—Early bird one day, two park passes good thru June 14, 1998. Tickets: \$22 (reg. \$40).

Tanglewood and the Boston Symphony (Tanglewood, Lenox)**—Sun., Aug. 9 thru Mon., Aug. 10. Tickets: \$219 pp double occupancy. Purchase by 6/16.

Nova Scotia Weekend Getaway (Canada)**—Fri., Oct. 9 thru Sun., Oct. 11. Tickets: \$199 pp double occupancy. Purchase by 8/21.

Trapp Family Lodge Weekend (Stowe, VT)**—Sun., Nov. 8 thru Wed., Nov. 11. Tickets: \$215 pp double for two nights (Sun. and Mon. evening) and \$315 pp double for three nights (Sun., Mon., and Tues. evening).

Museum Passes**—Children's Museum, \$4 (reg \$6-7). Museum of Science, \$4 (reg \$5.50-\$7.50). NE Aquarium, \$5.50 (reg. \$5.50 and \$11).

Discount Movie Tickets**—Sony Theatres \$5. Showcase Cinemas \$5.50. General Cinemas: adults \$5.50, children \$3.25. Kendall Square Cinema \$6.50.

AUV seeks clues to global climate change in Labrador Sea

■ By Andrea Cohen
MIT Sea Grant

Most New Englanders booking a winter cruise opt for tropical destinations like the Caribbean. But this February, Jim Bellingham and his traveling companions headed north instead, to the icy, gale-whipped reaches of the Labrador Sea.

The principal research engineer with MIT Sea Grant's Autonomous Underwater Vehicles (AUV) Laboratory chose the Labrador Sea precisely for its violent seasonal offering—and the clues they offer toward a clearer understanding of global climate change.

Along with regions in Antarctica and the Mediterranean, the Labrador Sea is the site of deep ocean convection, or the mixing of near-surface water into the ocean's depths. During the summer months, a warm cap of water (5°C or 6°C) forms on the surface. In winter, cold Arctic winds chill that relatively salty surface water, making it heavier and causing it to mix with warmer waters below. As winter progresses, that mixed layer of water extends deeper toward the ocean floor.

This vertical mixing of the Labrador Sea—a critical part of the thermohaline cycle—delivers cold water to the deep ocean as part of a larger circulation process transferring heat from warm tropical climes northward. As such, the currents are known to play a critical role in regulating climate throughout the world. In fact, many scientists believe that changes in the

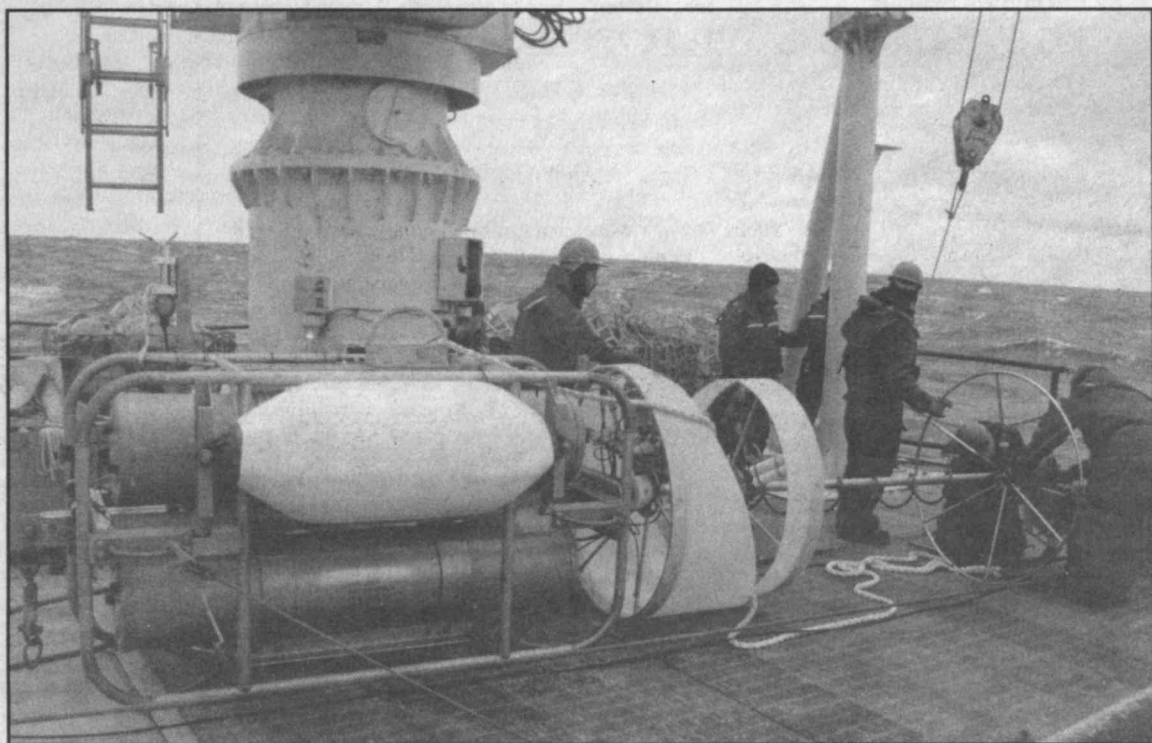
thermohaline cycle caused a little historical weather event a few years back known as the Ice Age.

Unfortunately, observing the processes by which deep waters are formed is difficult. As a result, many questions remain unanswered about this phenomenon—which, in turn, leaves gaps in models that predict global climate events.

Up until recently, researchers had to rely on traditional oceanographic tools that generally allowed them to study various processes with vertical measurements. In that method, Dr. Bellingham said, "you lower something down and then you pick it up. What you get is a sense of how things change as a function of depth."

However, what researchers don't get is a sense of horizontal variability. Through a five-year project called the Autonomous Ocean Sampling Network (AOSN), researchers from MIT Sea Grant are using durable, low-cost, easily maneuverable AUVs to navigate and collect data about deep ocean convection over large areas and under harsh conditions. Supported by MIT Sea Grant with major funding from the Office of Naval Research, AOSN is a collaborative effort involving scientists from the Woods Hole Oceanographic Institution (WHOI), the University of Washington, and Chapel Hill, NC-based Electronic Data Consultants (EDC).

In the latest portion of this project, Dr. Bellingham and colleagues left Woods Hole in late January aboard the research vessel *R/V Knorr*—the same



Crew members and researchers aboard the *R/V Knorr* in the Labrador Sea deploy the mooring system for the *Odyssey IIB*.
Photo courtesy MIT Sea Grant

ship that discovered the *Titanic* off of the Grand Banks in 1985. Working between major winter storms and 30-foot seas, the researchers successfully deployed their elaborate mooring system, complete with a docking station where the AUV could recharge itself and download data.

The goal of the mission was to leave the AUV and the mooring at sea to collect data while the researchers returned home. From the warmth of their offices, researchers would communicate with the vehicle via a two-way satellite link. The idea, said Dr. Bellingham, is that scientists will be able to "configure surveys responding to specific convection episodes, allowing a real-time reactive presence in a remote, hostile environment."

From hurricanes to deep-ocean convection, most of the ocean's high-energy events are episodic in nature. With several AUVs roving an area and sending data back to shore, scientists would be poised to respond to such events. One application might be to monitor an open-ocean aquaculture site for cold currents of water that can stream in and kill fish. A network of AUVs could also provide information useful for fisheries management, for military purposes, and for studying pollution transport.

During their time at sea, the research team ran numerous successful missions with its latest version of MIT Sea Grant's AUV, *Odyssey IIB*. "We were measuring simple things such as temperature and salinity, but doing a very accurate job of it," Dr. Bellingham said.

The WHOI team members included

Hanumant Singh, Dana Yoerger and Martin Bowen, who worked on the AUV's docking system; Keith von der Heydt, who concentrated on satellite and radio communications; John Kemp, an expert in putting complex moorings into place; and Mark Johnson, who focused on acoustic communications. Mike Feezor (EDC), Albert Bradley (WHOI) and James Bales (MIT Sea Grant) worked on battery charging and power and data transfer; Robert Grieve (MIT Sea Grant) handled vehicle operations; and Brad Moran (MIT Sea Grant) handled vehicle software.

MISSION LANDMARKS

The team chalked up a number of firsts, especially in the realm of communications. Position and scientific measurements were transmitted acoustically by the AUV to the dock, which recorded the data and relayed them by radio to the ship, where scientists monitored the mission's progress. Back on shore, satellite transmissions from the mooring in the Labrador Sea appeared as e-mail on colleagues' computers. Satellites relayed e-mail from scientists back to the mooring.

During the mission, the AUV demonstrated the first successful homing on a deep (500-meter) dock. In addition, vehicle measurements of the spatial variability and dynamics of the mixed layer highlighted a much more active process than is imaged from shipboard sensors.

From an operational perspective, the growing maturity of the systems was evident as well, with more than 20 vehicle missions run from the *Knorr* in winds up to 35 knots. Despite this

progress, the system was not ready to be left behind in the Labrador Sea unattended. As a result, the researchers decided to pull up the mooring and bring the AUV home with them—a tough decision, says Bellingham, because it was "one of the first times I wanted to come back with fewer vehicles."

Back from the Labrador Sea, the team continues to work on docking. With growing confidence in their techniques, they plan more scientific operations with AUVs for the future, including joint operations with the Harvard-led Littoral Ocean Observation and Predictions System Project in Massachusetts Bay. Even as these systems are perfected, the team is creating systems for the next generation of vehicles. A Bellingham-led project for monitoring the Arctic Ocean with long-range AUVs is being kicked off this month at MIT.

Bellingham noted that there is "no one silver bullet for making measurements in the ocean." Instead, he described a developing arsenal that includes many AUVs with different energy, payload, propulsion and endurance systems. What the various systems share is the ability to operate for extended periods without a person nearby.

"Our need for getting data from the ocean is rising exponentially for all kinds of monitoring reasons, while the dollars that are going into those systems are plummeting," he said. As a result, the wave of the future will, by necessity, include more and more of these types of economical and robust systems.

Don't recycle broken glass

Broken glass and any materials other than cans, plastic and glass bottles must not be placed in recycling containers marked for that purpose, said recycling coordinator Jennifer Combs.

Her warning was issued after an employee of Jet-a-Way, the company that picks up the recycling material from campus, required six stitches for a cut he received from a broken microscope slide which was placed in a recycling container.

Both the cut itself and the question of whether anything dangerous was on the slide were of concern. "The Biosafety Office had to track

down the slides and send them out for testing," Ms. Combs said. "An incident like this can have some serious physical, emotional and legal consequences."

Sharp objects including broken glass, window panes, mirrors, slides and laboratory materials should not be dropped into recycling containers, Ms. Combs emphasized. They are intended only for glass bottles, metal cans and #1 and #2 plastic (a number is stamped inside a recycling logo on the bottom of plastic containers).

Anyone with questions about recycling may contact Ms. Combs, at <recycling@mit.edu> or x3-7671.

Shuttle driver spots lone toddler on late-night stroll

■ By Denise Brehm
News Office

He doesn't usually stop for passengers on Magazine Street, but when Safe Ride driver Jim McNeely spotted the stocking-footed toddler walking alone in the dark, he pulled the van over without hesitating.

"I saw this little kid walking along the sidewalk. All he had on was a little shirt, socks and a diaper. His body language, his facial expression—everything said to me that he was in trouble," said Mr. McNeely, a retired social worker and guidance counselor who drives one of MIT's shuttle vans. "When I pulled up next to him, it scared him. He went up the stairs of a house and started pulling on the door."

It was 3:45am and Mr. McNeely was making his last trip of the night through Cambridgeport, just as the toddler was making his own solitary trip home in the damp chill on Friday, May 8. The child had apparently traveled about 10 blocks from his father's house to his mother's, when Mr. McNeely saw him and notified his Safe Ride supervisor and the police.

Safe Ride passenger Laura Sever, a senior in electrical engineering, got out of the van to comfort the little boy and keep him from running away.

"What I wanted to say was, 'It's okay, we'll take you home.' But we

didn't know where he lived," said Ms. Sever. "So I squatted down on the porch next to him and just started talking. I had a really tough time understanding him because he's so young and didn't enunciate very well. It took quite a while to figure out his name," she said.

"Apparently the porch he was on really was where he lived. But we didn't know that," said Ms. Sever, who said she often relies on Safe Ride for transportation home after working late on campus.

Another Safe Ride driver, Zach Roscoe, heard the call and came to help, wrapping his jacket around the little boy. MIT Campus Police and Cambridge Police officers arrived shortly afterward.

Mr. McNeely said the Cambridge police had been looking for the toddler after receiving a call from someone who reported seeing the child in a nearby park. Police officers took the child to Cambridge Hospital, where he was reunited with his family later that morning.

The child's grandfather told the Boston Globe: "My grandson stayed over my son's house, and my grandson, he wanted to come home. Everyone was sleeping, so he got up and he came home. You know, opened the door and started walking home. I'm surprised that he knew his way home."

Kids display science projects—and see MIT's

The spin rates of the Turbo Bumblebee and other yo-yos and the effect of different light sources on radish seedlings were among the science projects brought to MIT last Tuesday by some 200 seventh- and eighth-grade students from the Cambridge public schools.

The children were joined by about 200 MIT student volunteers who talked to them about their projects and led them on tours of MIT laboratories for the sixth annual MIT/Cambridge Science Expo. The non-competitive Expo included T-shirts for all and culminated with a Battle of the Robots presented by MIT students.

"We want to encourage the students to pursue science, and show them how interesting it can be and how much fun they can have," said freshman Anita L. Chaudhuri. Ms. Chaudhuri was coordinator of the event with Ashok C. Chander, a sophomore in biology.

After the students set up their projects—which were displayed on posters with titles like "Flower Power" and "It's Alive"—they divided into

two groups. One group toured MIT labs to view the "cool stuff" going on there; the other stayed with their projects to discuss them with MIT student Science Evaluators.

The latter exercise could not have been quick work: most projects came complete with working hypotheses, a list of materials used, experimental results, and sometimes photos, graphs, and bibliographies. The two groups eventually switched so everyone could tour labs and meet with MIT evaluators.

This year the students toured the MIT Museum, the Artificial Intelligence Laboratory, the wind tunnel, the cyclotron building and the Edgerton Center. They could also drop by a number of demonstrations in the Johnson Athletics Center, including one on magnets by Mr. Magnet (a.k.a. Paul Thomas of the Plasma Science and Fusion Center) and one on MITee Mouse, a robot that traverses a maze. (The robot was run by David Otten, a principal research engineer in the Labo-

ratory for Electromagnetic and Electronic Systems.)

"Oh wow! It cut those corners like it was Knight Rider or something," said one student watching the MITee Mouse demo.

At the closing ceremony, the students were addressed by Cambridge Mayor Frank Duchay; Bobbie D'Allessandro, superintendent of Cambridge schools; and MIT's Paul Parravano, assistant for community relations in the President's Office.

The first Science Expo was organized by the Educational Studies Program in the spring of 1993. Since then it has been run annually by the Public Service Center and its staff of MIT students following essentially the same schedule and goals. The Expo has been steadily increasing in size each year as the event is increasingly recognized within the Cambridge schools and around MIT. For more information, see the web site at <<http://web.mit.edu/pscenter/www/expo.html>>.

Elizabeth Thomson

Janney and Baryshnikov create electrocardio-choreography

When Mikhail Baryshnikov performs "HeartBeat:mb" this week as part of the White Oak Dance Project, he won't be dancing to classical ballet music by Tchaikovsky or Copland. Instead, he'll be accompanied by sounds generated by his own body through a device created by interactive architecture artist and composer Chris Janney, who received the SM in visual studies from MIT's Center for Advanced Visual Studies (CAVS) in 1978.

Mr. Janney first conceived "HeartBeat" in 1981 when he was a research fellow at the CAVS. The

work was premiered by Sara Rudner of the Twyla Tharp Dance Company at Boston's Institute of Contemporary Art in 1983.

The bioengineering device, developed by Transkinetics, Inc., captures the electrical impulses to the heart and surrounding muscles via wireless telemetry. Placed on the performer's chest and amplified through filters and a sound system designed by Mr. Janney, the machine provides a percussive track layered over music based on jazz scat and Indian tabla rhythms and Mr. Janney's recitation of medical texts.

"The pace of the thump-thump-thump both elicits his movement and reacts to it," wrote Newsweek in January. "Baryshnikov is practically translucent here: we see the still unsurpassed elegance of his classical technique, but we see it shaping moves that emanate directly from his personality, his very blood and breath."

Mr. Janney has been working on

interactive architectural sound and light installations since 1989. He is best known locally for his "Soundstair" in Boston's Museum of Science, a project similar to one he created while at MIT, in which musical sounds are triggered by a person's movements up and down a flight of stairs. Mr. Janney is a professor in the School of Architecture at Cooper Union College in New York City, where he teaches Sound as a Visual Medium.

Last week, Lynn Heine-mann of the Office of the Arts asked him about the Heart-Beat project.

Arts at MIT

LH: What prompted the creation of "HeartBeat"?

CJ: When I developed the piece, my father had recently died of a heart attack (in 1979) and the Jarvik-7 artificial heart had been invented (in 1983). These coincidental events made me ponder the juxtaposition of the heart as both a sophisticated pump and as the seat of the soul, as we've read in literature and poetry. The medical-text section of the score is about the heart's function as an almost totally cold, anesthetic machine. The other end of the spectrum is the score's inclusion of the music of Barber and the whispered track singing jazz scat phrases. The heart is really a machine that gives life, just as rhythm is the foundation of life.

How did Baryshnikov become aware of the "HeartBeat" project?

About two years ago, Misha [Baryshnikov] asked Sara Rudner to create something for his company. Sara and I thought that while it would be nice to create something for Baryshnikov's company, it would be even better for him to do "HeartBeat" as a solo. He premiered the piece in Paris and New York City and is performing in Boston as the first stop in a ten-city US tour.

Was there a lot of change in the choreography from Ms. Rudner's version to Mr. Baryshnikov's?

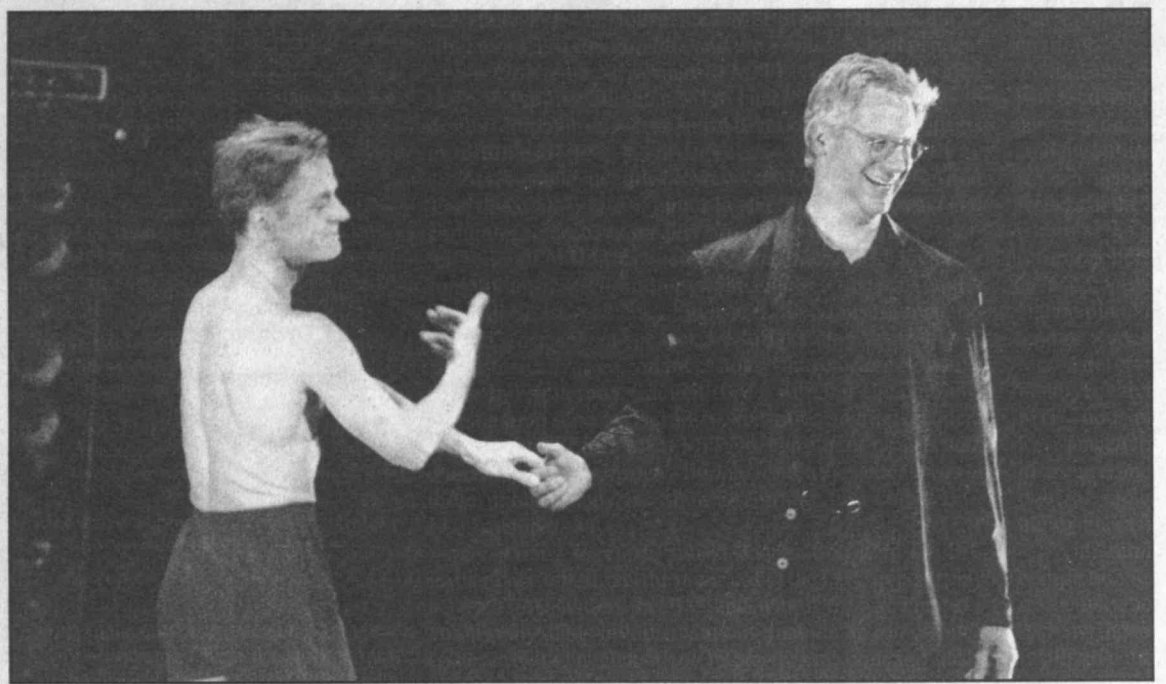
As a structured improvisation, it's completely different. The exploration of structured improvisation is a whole new thing for Misha. I'm the creator and composer and the choreographic direction is by Sara, but the actual improvisational movement is by Misha.

So that is why the title includes the initials "mb"?

I've done it in many different ways over the last 20 years, so I've always called it "HeartBeat" and then added something that's more of an identification than a metaphor.

Does the musical accompaniment also vary?

Originally wrote the piece for three singers, performing jazz scat and tabla rhythms over the rhythm of the heart, which of course speeds up and slows down, causing the singers to follow the



Mikhail Baryshnikov (left) and Christopher Janney take a bow in Paris.

Photo by Terrell Lamb

rhythm of the performer's heartbeat. Since Misha travels with a string quartet and a concert pianist, I scored it into a sampler keyboard, which looks like a piano but can create any sound you want. I recorded my voice reciting the various numbers and medical phrases and then the keyboardist plays it in time to Misha's heartbeat. In this particular variation, the string quartet plays Samuel Barber's Adagio for Strings as the third section. Because it's just for strings with no percussion, the heartbeat and the strings co-exist quite well.

As an improvisation, how do the musicians know when the piece is over?

It's like jazz. There are sections and subsections, but Misha decides how long he wants to stay in one section or how fast he wants to move in a particular section. It's left up to the moment. The musicians watch Misha for their cues.

How many variations of "HeartBeat" have there been?

Too many to count, and not just in dance. I've often lectured while wearing the "HeartBeat," to hear my heart as I talk about my projects. I've done pieces with poets who read over the sound of their heartbeat. On May 5 in New York City, the jazz sax player Stan Strickland played over the sound of his heartbeat with two singers and myself doing the voice parts.

I even put the "HeartBeat" device on my son during his christening when he was one year old. Stan played a flute piece, in the church, over my son's heartbeat. My son is the only one I can think of who was not consciously a performer, aware of what was going on. It was a very beautiful piece.

Do you record these events?

I don't record much. The whole idea of structured improvisation is about being present in the moment. It's very hard to get a sense of this piece from a

recording or even from a video tape. The theater's large sound system provides a lot of rich low end which feels like a blanket of sound just wrapping around you. It's very hard to recreate that in video or audio, so I don't try

much. I just urge people to come see the real thing.

"Heartbeat:mb" plays Thursday-Sunday, May 14-17 at Boston's Shubert Theater. Tickets are available through Telecharge at (800-447-7400).

Arts News

■ The New York Times praised the List Visual Arts Center's "ambitious and carefully wrought" *Mirror Images: Women, Surrealism and Self-Representation*, in a lengthy review which concludes, "Bigger and splashier exhibitions devoted to this subject will surely be coming along, but they will all probably in some way take off from this one." The show is on view through June 28.

■ Junior Eto Otigbe has been named the 1997-98 Cordover Scholar in the Arts. The award, given to someone who has financial need and is active in the arts, was established in 1996-97 by Ronald H. Cordover, who graduated from MIT in 1964 with a degree in electrical engineering. Mr. Otigbe won third prize in the first annual Harold and Arlene Schnitzer Prize in the Visual Arts in 1996, received the 1997 List Foundation Fellowship in the Arts, inaugurated an annual poetry slam for students from the area, helped bring the Last Poets to MIT, initiated field trips to Boston-area artistic and cultural events of special interest to the black community, and won the 1998 Dr. Martin Luther King Student Leadership Award. "Could any of us ask for a

better model of how the arts inform the lives of the students at MIT?" asked Associate Provost for the Arts Alan Brody.

■ Open City, a new Boston theater company, had MIT connections even before its first show opened—Myles Crowley, administrative assistant in the News Office, and Thomas R. Consi, research engineer in ocean engineering, are two of its seven founders. Since last fall, the MIT connections have grown: Sarah Cohen, a sophomore in biology and Shakespeare Ensemble member, volunteered with setting up the theater's space. Kristin "Nummi" Nummerdor (SB '94) designed the company's brochure, and EECS graduate student Eddie Kohler, a Dramashop member, created posters. Michael Kreutz, administrative assistant in economics, lent his talents to Open City's first show as musical director and accompanist, and Charlotte Peed, a senior secretary in architecture, appears as Kitty in the theater's current production of *Six Degrees of Separation*, the tragicomedy by John Guare, running May 13-June 13 at the Paramount Penthouse, 58 Berkeley St., Boston.

Village people



Ghadames, a small Libyan village in the Sahara Desert, provides a fascinating example of vernacular earth architecture. An exhibition about this historic village, Ghadames: The City of Shades, can be seen at the Rotch Visual Collections, Rm 7-304, through May 20.

Institute Arts

For more arts-related information call the 24-hour hotline at 253-ARTS or consult the World Wide Web at <<http://web.mit.edu/arts>>.

* Open to public
** Open to MIT community only

May 13-24

MUSIC

Concert of Student Compositions*—May 13. Original music written by students taking 21M304 (Advanced Music Writing). 3:30pm, Killian Hall. x3-2826.

MIT Sinfonietta*—May 14. Vivaldi's Concerto for four violins in b minor, Dvorak's Serenade for String Orchestra & Mozart's Piano Concerto No. 9, featuring faculty member Marek Zebrowski, & Sinfonietta members Max Chen '99, Sandy Choi '99, Jo Marie Sison '01 & Danny Yu '98. 8pm, Kresge Aud. x5-9647 or <strings@mit.edu>.

MIT Gospel Choir Spring Concert*—May 16. Bryan Spriggs, director. With solo gospel artist Wanetta Shepard and the Alpha and Omega Steppers of New Covenant Christian Center 7:30pm, Lobdell Dining Hall (Stratton Student Center 2nd floor, 84 Mass

Ave). See <<http://web.mit.edu/adwinth/www/porfolio/index10.html>>.

Live Jazz at Muddy Charles Pub*—Wednesdays. The Pat Battstone Quartet. 8:30-10:30pm, Rm 50-110. x3-4012.

MIT Guild of Bell Ringers*—Mondays, 6:30pm, 2nd floor balcony of Lobby 7. x3-3573. Info: Jeremy Lueck, <jlueck@mit.edu>.

FILM/VIDEO

4th Annual Media Spectacle*—May 14. MIT-made Media Spectacle. Films/videos/hypertext produced by MIT & Wellesley affiliates. 7pm, Rm 3-133. Chris Pomiecko x3-3599 or <cpomiecko@mit.edu>.

"Mirror Images: Artist Documentaries" *—May 17. *Ana Mendieta: Fuego del Tierra* (Kate Horsfield, Nereyda Garcia-Ferraz, Branda Miller, 1988). Other documentary TBA. Presented in conjunction with *Mirror Images...* at the List Ctr (see below). 2pm, Bartos Theater. x3-4400.

EXHIBITS

List Visual Arts Center (E15)*: *Mirror Images: Women, Surrealism and Self-Representation*. Self-representations by three generations of women Surrealist or Surrealist-influenced artists from 1928-1996. Show runs through June 28. Hours: Tues-Thurs & weekends noon-6pm; Fri 12-8pm; closed holidays. x3-4680.

MIT Museum* (N52): *Piranesi in Perspective: Designing the Icons of an Age*. Examination of Giovanni Battista Piranesi's (1720-1778) career as an etcher, archaeologist & as a promoter of Rome extraordinaire. Through June 14. Ongoing Exhibits. *Gestural Engineering: The Sculpture of Arthur Ganson*; *LightForest: The Holographic Rainforest*; *Holography: Artists and Inventors*; *MIT Hall of Hacks*; *Light Sculptures by Bill Parker*; *Math-in-3D: Geometric Sculptures by Morton C. Bradley, Jr.*; *MathSpace*. 265 Mass Ave. Tues-Fri 10-5, Weekends 12-5. x3-4444.

Wolk Gallery: *Reflections: Drawings and Projects by Wellington Reiter*. Companion exhibition to *Piranesi in Perspective*. Through July 7. Rm 7-338 x8-9106.

Hart Nautical Gallery—*Ships for Victory: American Shipbuilding's Finest Hour*. Shipbuilding production during World War II. *Ship Models: The Evolution of Ship*

Design. Ongoing. Daily 9am-8pm. x3-5942.

Wiesner Student Art Gallery—*Schnitzer Prize Winners' Exhibition*. Featuring the three student winners of the 1998 Schnitzer Prize in the Visual Arts: Eto Otigbe '98, Kevin Simmons '98, Kim Eng '99. Opening Reception—May 14, 3-5pm. May 12 through June 14. Wiesner Student Art Gallery (2nd floor, Stratton Student Ctr). x3-7019.

The Dean's Gallery—A.E. Ryan: *Dangerous Cooks & Falling Arches*. Carefully crafted wall constructions made from transformed, discarded decorative woods & metals, fabrics & ephemera, to acrylic paints & gels. Through June 20. Rm E52-466. Weekdays 9am-5pm, x3-9455 or <<http://web.mit.edu/deans-gallery/www/>>.

Compton Gallery—MIT Master of Architecture Theses 1997/1998. Drawings and models by recent graduates show a range of architectural thought and process, and a diversity of projects and scale. Through May 22. Compton Gallery (Rm 10-150). Weekdays 9-5. x3-7791.

Rotch Visual Collections—*Ghadames: The City of Shades*. Exhibition on a small historic town in the Sahara Desert. Through May 20. Rm 7-304 x3-2955.

Women's Studies. Permanent exhibition of archival photographs documenting the role of women at MIT over the decades. Rm 14E-316. x3-8844.

Doc Edgerton Strobe Alley. Photographs, instruments and memorabilia and hands-on experiments. Bldg 4, 4th floor. x3-4629.

OTHER

Visual Arts Exchange Program Application Deadline for Fall 1998***—May 22. Cross-registration for five students at Mass College of Art and five to the School of the Museum of Fine Arts for selected classes in painting and drawing. Info/applications: Renée Caso <yammie@mit.edu> or Linda Woolford <woolford@mit.edu>.

"Flock Mentality" Slide Presentation*—May 22. Stephen McHale, graduate student in architecture, discusses his public art project in which pink flamingo lawn ornaments migrated into Boston. 5pm, Rm 3-133. 661-6771, x8-9264 or <stevemac@mit.edu>.

Applications for Wiesner Student Art Gallery** All students welcome to apply to put up an exhibit. x3-7019.

Newest knowledge on growth and death of cells presented

■ By Deborah Halber
News Office

By delving into the innermost workings of cells, four MIT researchers who spoke at the technology track on life sciences and bioengineering at the ILP Research Directors Conference are delivering useful substances to cells to control disease, making progress on understanding how and why cells age, seeing living cartilage in the body to monitor the progression and treatment of degenerative disease, and uncovering the secret of cancer cells' mind-boggling ability to reproduce themselves forever.

CONFERRING IMMORTALITY

Robert A. Weinberg, the Ludwig Professor for Cancer Research and the American Cancer Society Professor of Biology, described how cancer cells—unlike normal cells—need no influx of growth factors to multiply indefinitely in a petri dish. They make their own growth factors, which they release outside the cell and which in turn stimulate the cell to produce more growth factor.



Weinberg

There must be at least two changes to a cell to transform it from a normal cell to a cancer cell, said Professor Weinberg, a founding member of the Whitehead Institute for Biomedical Research. It must develop the ability to

produce its own growth factor, and it must learn to resist the inhibitory signals from neighboring cells that keep normal cells from proliferating out of control.

The third insidious characteristic of cancer cells is that they do not have the "generational clock" of normal cells that stop them from growing after a certain number of generations. While normal cells seem programmed to stop multiplying after 50 or 60 generations, cancer cells, with enough space and nutrients, will simply grow forever. This raised the question of how normal cells "know" how many times they had doubled in the past.

The answer seems to lie within the ends of chromosomes, called telomeres. These tips, made up of specific gene sequences, protect the chromosomes from damage like plastic tips protect the ends of shoelaces, Professor Weinberg explained.

When cells replicate, they fail to copy the entire telomere sequence, so with each reproduction, the telomeres grow a little shorter. This leads to cell death. Scientists speculate that this innate ability of cells to bring about their own demise is a protective mechanism that keeps premalignant cell populations from turning cancerous.

However, about one cell in a million solves the problem of telomere collapse by generating an enzyme called telomerase. Cancer cells are the only cells that produce this enzyme, effectively creating their own means to immortality.

Professor Weinberg's recent efforts to "immortalize" normal cells by giving them the ability to make telomerase

led to cells that grew for a far longer time than normal cells, but they did not proliferate indefinitely. "We believe we may learn how to immortalize these cells," he said, leading to a better understanding of the genetic basis of human cancer.

'SEEING' INSIDE LIVING TISSUE

Martha L. Gray, the J.W. Kieckhefer Associate Professor of Electrical Engineering and co-director of the Harvard-MIT Division of Health Science and



Gray

Technology, described her team's progress on watching cartilage degradation and repair. To Professor Gray and others trying to "see" the 1 to 2mm of sponge-like tissue called cartilage that encases our bones, an X-ray is of little help. Cartilage damage might show up as a decreased space between two bones, but that's not much to go on when you're trying to diagnose and treat a case of arthritis so severe that the tissue has been eroded to nothing.

With magnetic resonance imaging (MRI), however, one can see cartilage and look for the absence or disruption of tissue. Taking that a step further, Professor Gray has come up with a way to measure the concentration of ions within the fluid of affected tissue. The ions indicate the presence or absence of proteoglycans—brush-shaped molecules that give cartilage some of its bone-protective qualities.

By using MRI data to quantify the concentration of ions, researchers have found a way to "see" living cartilage, detect any changes before the tissue is badly disrupted, monitor disease progression and choose appropriate therapeutic strategies.

AGING CELLS

"What is it like to be an old cell?" asked Professor of Biology Leonard P. Guarente, who addressed the molecular cause of aging. He is especially interested in old yeast. While most of us can't tell young yeast from old yeast, researchers can do so by watching the cells divide. They divide by budding, with a daughter cell of new material breaking off from the mother cell, which gets older with every division. The mother cell can divide 20 times before it stops.

By watching yeast divide, Professor Guarente has found that there are changes in the nucleolus—a section of the nucleus—of cells that are aging. He has found that in the nucleolus of older cells, some of the cell's genetic material, a circular piece of ribosomal DNA, pinches off from a chromosome and accumulates in the cell, causing it to enlarge.

These "circles" of material happen with aging and at the same time cause aging, he said. The circles double with every cell division, growing exponentially, producing more and more ribosomal proteins that poison the cell and eventually kill it.

They solve a short-term problem for the cell—trying to repair damage to rDNA—while establishing its mortality. One of the next steps is to determine if the same process happens in

human cells that, like yeast, undergo asymmetrical cell division. These kinds of cells are found in the skin, kidney and liver as well as the blood.

AN ENGINEERING APPROACH

Douglas A. Lauffenberger, the Joseph R. Mares Professor of Chemical Engineering and director of the Center for Biomedical Engineering, said an engineering approach to manipulating cell function can provide a more effective way to deliver useful substances to cells.

Once a useful substance like a growth factor or a protein binds with a cell, many dynamics can occur, he said. Researchers in biomedical engineering consider the interaction of all the components of the cell, like the many components of an engineering system. "If you can control one step, you can do as much or more at a systemic level," he said.

Gels featured in talk on sensors and detectors

Specially designed gels that shrink or swell in response to factors like temperature and pH, and "molecular wires" to detect various chemicals were the subjects of two talks at the Sensors, Actuators and Detectors session of the Industrial Liaison Program's Research Directors Conference last week.

Gels are jello-like materials made of cross-linked networks of polymers that contain a fluid. In response to different environmental factors they can be made to contract or swell—processes that correspond to the folding and unfolding of the polymer.

They can also be designed to detect and capture specific molecules. In the latter case, "the gel absorbs the target molecule when collapsed, and releases it when swollen," said Toyochi Tanaka, the Otto and Jane Morningstar Professor of Physics. "We have made such a 'target recovery' system."

Professor Timothy M. Swager of chemistry described an approach to creating ultra-sensitive detectors for chemicals such as TNT. Traditional chemosensors, or individual molecular devices that can detect chemicals, are useful, but only to a point. "If you want to go to very, very low concentrations of the chemical of interest, it becomes much more difficult," he said.

His solution? "Hard-wire" individual chemosensor molecules together into a "molecular wire." This results in a much more sensitive device due to the "additive effects of all these different receptors," Professor Swager said. His team has developed several different types of molecular wires.

Also at the session, Professor Stephen D. Senturia talked about the remote detection of chemical agents, pollutants and other compounds using microelectromechanical systems (MEMS). The MEMS device he and his colleagues are developing is key to an advanced spectroscopy technique for detecting such compounds. Dr. Senturia is the Barton L. Weller Professor of Electrical Engineering.

Associate Professor Kenneth S. Breuer of the Department of Aeronautics and Astronautics concluded the session with a talk on "MEMS Sensors and Actuators for Measurement and Control of Flows."

Elizabeth A. Thomson

Conference highlights many research projects

(continued from page 1)

Management. The Program on the Pharmaceutical Industry, for example, brings together researchers from the schools of management, engineering, science, and humanities and social science.

One project in that program involves looking at ways of making the clinical testing process more efficient. Currently that process "makes up the majority of costs in drug development," said Professor Allen. He also described research aimed at discovering what effect various medications (such as those for allergies) have on worker productivity. The work is based on productivity data and health records for about 3,000 insurance workers.

Professor Allen also emphasized the importance of industrial collaborations to MIT research. "If you were to attend a meeting of MIT's Lean Aerospace Initiative, you'd see people in industry making research presentations alongside MIT students and faculty. The goal is to increase the bidirectional technology transfer," he said.

SCHOOL OF ENGINEERING

Imagine highlighting, in 25 minutes, the research and educational initiatives for a school with eight departments and some 20 laboratories, programs and centers. John B. Vander Sande, associate dean of the School of Engineering and a professor in the Department of Materials Science and Engineering, was faced with that challenge.

Among his comments: the School is listening to industry feedback about its students. For example, he noted that industry "tells us MIT students are brilliant, but don't know how to work in teams. They also aren't always the best communicators, either orally or in writ-

ing." The School is instituting curriculum changes to address such issues.

Swinging over to research, Professor Vander Sande described projects including the development of molecularly engineered films of materials only one atomic layer thick. That work is led by Professor Paul Laibinis of chemical engineering.

ARCHITECTURE/PLANNING

A slide of a weathering Buddha was key to Professor Bernard J. Frieden's description of one research project in the School of Architecture and Planning. The image was actually a computer simulation by Julie Dorsey, associate professor of design and computational and building technology, showing how a new statue would weather with time. Such simulations, which can also be applied to building facades and other architectural features, could be a useful tool to architects who want to know, in advance, what their creations will look like in the future.

Dr. Frieden, associate dean of the school and Ford Professor of Urban Development, also described studies of how cities use publicity to advance themselves and particular projects. That work, by Professor Lawrence Vale of urban studies and planning, will be the focus of a faculty seminar this fall.

Professor Frieden concluded with a project he himself is working on: issues surrounding the closing of military bases and their conversion to airports and other private-sector facilities. "It is not yet clear whether the bases ought to be considered a bonus from the end of the Cold War or the 'yard sale at the end of history'—unwanted property, available only to buyers willing to make their way through a maze of bureaucratic obstacles," he said.

HUMANITIES/SOCIAL SCIENCE

"Who would have thought that MIT would become one of the world's great centers for the study of Shakespeare?" said Philip S. Khoury, dean of the School of Humanities and Social Science and a professor of history. Yet that is indeed the case, due to an MIT program for the study and interpretation of the bard's plays via multi-

media technology.

Professor Khoury also described an award-winning project for learning languages in which interactive multimedia stories "totally immerse a student in the language and culture" of the main character. For example, in "A la rencontre de Philippe," the first of the series, students help Philippe navigate around Paris.

"The student is no longer just sitting in the language lab passively absorbing French," Professor Khoury said. The researchers have also developed programs for German, Japanese, Spanish and soon Chinese.

Both the Shakespeare and language programs were developed through the school's Laboratory for Advanced Technology in the Humanities.

SCHOOL OF SCIENCE

An experiment going up on the space shuttle on June 2 will search for a phenomenon predicted but as yet unseen by physicists: antimatter. The experiment, a particle physics detector known as the Alpha Magnetic Spectrometer, is led by Nobel laureate Samuel Ting, the Thomas Dudley Cabot Professor of Physics at MIT.

The AMS was one of the projects that Robert J. Birgeneau, dean of the School of Science and Cecil and Ida Green Professor of Physics, shared with his audience as an example of the cutting-edge research being conducted through the school.

"In addition to the matter that makes up you and me, there should be antimatter, the exact complement of matter," explained Professor Birgeneau. Similarly, "just as we have a universe made of matter, it's equally likely that there are universes of antimatter with antipeople. So where are these other universes?"

To find out, Professor Ting and colleagues designed AMS to look for "remnants of antiuniverses created at the same time our universe was created."

Professor Birgeneau noted that even if AMS does not provide evidence for antimatter, there has never been such a high-resolution detector in space before. "So I guarantee that interesting things will be observed."

It's a fact

The five yachts that defended America's Cup between 1893 and 1920 were all designed and built by Nathanael Herreshoff, a member of the MIT Class of 1870. He also designed and built the Navy's first torpedo boats.