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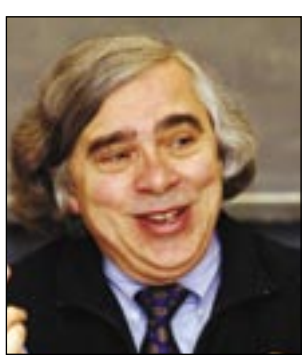
TechTalk
SERVING THE MIT COMMUNITY

MIT provides blueprint for future use of coal



Ernest J. Moniz

John Deutch

Leading academics from an interdisciplinary MIT panel issued a report today that examines how the world can continue to use coal, an abundant and inexpensive fuel, in a way that mitigates, instead of worsens, the global warming crisis. The study, "The Future of Coal—Options for a Carbon Constrained World," advocates that the United States assume global leadership on this issue through adoption of significant policy actions.

Led by co-chairs John Deutch, Institute Professor, Department of Chemistry, and Ernest J. Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems, the report states that carbon capture and sequestration (CCS) is the critical enabling technology to help reduce carbon dioxide emissions significantly while also allowing coal to meet the world's pressing energy needs.

According to Deutch, "As the world's leading energy user and greenhouse gas emitter, the U.S. must take the lead in showing the world CCS can work. Demonstration of technical, economic and institutional features of CCS at commercial scale coal combustion and conversion plants will give policymakers and the public confidence that a practical carbon mitigation control option exists, will reduce cost of CCS should carbon emission controls be adopted and will maintain the low-cost coal option in an environmentally acceptable manner."

Moniz added, "There are many opportunities for enhancing the performance of coal plants in a carbon-

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Hydrogel particles pave way for low-cost bedside diagnostics

Anne Trafton
News Office

MIT researchers have created an inexpensive method to screen for millions of different biomolecules (DNA, proteins, etc.) in a single sample—a technology that could make possible the development of low-cost clinical bedside diagnostics.

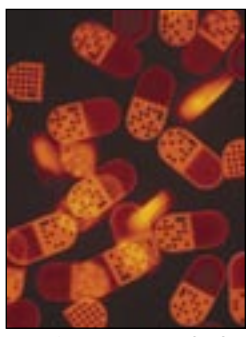

IMAGE / **DANIEL PREGIBON**

The work, based on tiny customizable particles, could also be used for disease monitoring, drug discovery or genetic profiling. Even though the particles are thinner than the width of a human hair, each is equipped with a barcoded ID and one or more probe regions that turn fluorescent when they detect specific targets in a test sample.

Using a new, extremely versatile technique, the researchers can produce a "virtually unlimited" array of particles to test for DNA, RNA, proteins and other biomolecules, said Daniel Pregibon, a graduate student in chemical engineering at MIT.

Pregibon is the lead author of a paper on the work

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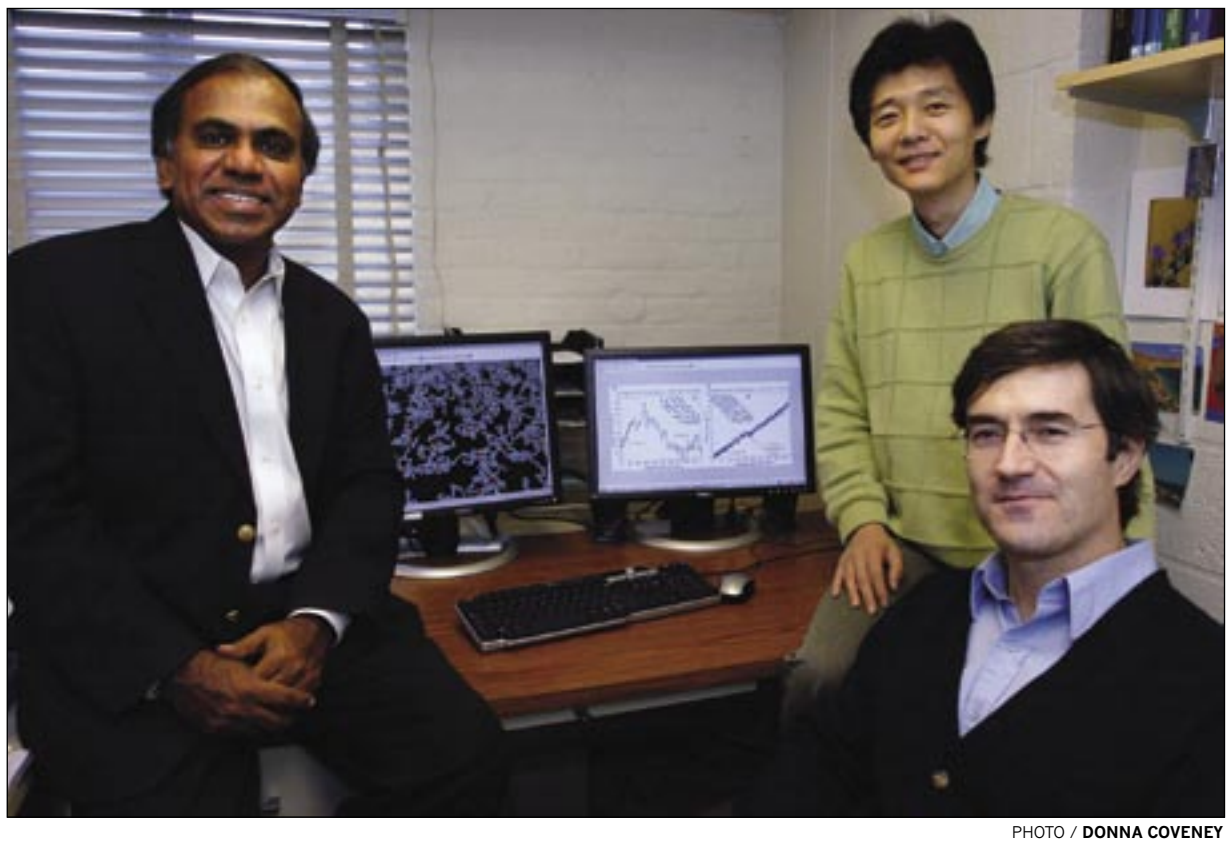

PHOTO / **DONNA COVENEY**

Seeing red

MIT researchers have developed a dynamic new model that can analyze the mechanics of red blood cell deformation at the molecular level. From left to right, the team includes Subra Suresh, professor of materials science and engineering, research scientist Ming Dao and postdoctoral associate George Lykotrafitis. See story, page 5.

Student-run Energy 2.0 focuses on clean tech innovation, investment

Deborah Halber
News Office Correspondent

Boston was recently named one of the top five cities in the United States for clean technology incubation. The 2007 MIT Energy Conference, "Energy 2.0: Solving Tomorrow's Energy Challenges through Entrepreneurship, Technology & Policy," made it clear that MIT is helping things hatch.

The sold-out conference, sponsored for the second year by MIT's Venture Capital and Private Equity Club, the MIT Energy Club and the MIT Sloan Energy and Environment Club, attracted 550 energy professionals, investors, entrepreneurs, policy makers, academics and graduate students to the Kendall Square Marriott on March 9-10.

The goal is to foster the local energy innovation community, according to conference managing director Brian F. Walsh, a second-year M.B.A. student at Sloan and co-director of the Energy and Environment Club.

"I think the 2007 MIT Energy Conference was a great success," Walsh said. "The conference's aim was to move the

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Program to replenish eelgrass in New England invigorates food chain and educates students

Andrea Cohen
MIT Sea Grant

A project led by MIT Sea Grant to bring a special plant back to Boston-area harbors is also giving students in Massachusetts and Rhode Island a hands-on education in the importance of healthy marine ecosystems.

Eelgrass—a delicate, flowering marine plant—is a primary source of food for many plants and animals, as well as a critical nursery and shelter for shellfish and finfish. It also filters pollutants from the water column, is a key component of the nutrient cycle and guards against shoreline erosion by quelling wave energy. In short, eelgrass is extraordinarily useful in maintaining healthy marine ecosystems.

Once abundant in New England waters, this species of plant was largely wiped out in the region in the 1930s due to a wasting disease. For decades, coastal development and pollution made the restoration of these grasses all but impossible. However, improved water quality in Massachusetts' coastal waters is now giving eelgrass a second chance. And this, in turn, has given middle and high school students the chance to get involved with bringing eel-

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M.B.A. student, former banker, plans for philanthropy

Sarah Foote
MIT Sloan

Everyone thought M.B.A. student Stephanie Ogidan Preston would play basketball in high school. At 6-foot-3-inches, she seemed a likely candidate for college play, too. But, characteristically, Preston, 27, has other plans: After completing her M.B.A., Preston plans to start her own foundation to help improve education in lower income neighborhoods in her hometown of Providence, R.I. She is already on the board of several philanthropic organizations, and there is no doubt in her mind that she can build her own.

Stephanie Preston

Preston began building her own life's path back when she chose to participate in track and field, rather than basketball; she excelled at the shot put and discus. Then, while an undergraduate at Duke University, she studied economics and Spanish, earning B.S. and B.A. degrees. While in Durham, she worked for Duke's Chronicle newspaper, selling advertising to businesses across the country. Despite the university's caveat against working more than 20 hours, she held two other part-time jobs.

After graduating, Preston returned home to Providence and moved into a house next door to her parents. She married and started a year-long manager trainee program at Bank Rhode Island. Accepted into the program without any banking experience, Preston fell in love with the industry: She became the youngest branch manager in the history of the bank. "In Rhode Island, especially in the neighborhood I grew up in, people equate success with moving out of that community. Again, going against the grain, I want to prove that you can be successful and still live here," Preston said.

Preston had set a few goals for herself when she returned to Rhode Island. One was to work in an industry that she had never worked in before; the second was to learn as much as she could from others—to become an "information magnet," as she likes to say; and the third was to give back to her community.

Preston first began to contribute to her community when she was just 15 years old. She taught math to 12- and 13-year-olds at Providence Summerbridge, a Breakthrough Collaborative program that helps middle school students become better prepared for high school. Preston said, "I went to a middle school that was for low-income students, and it completely changed the course of my life. Education is the great equalizer," she said. Preston also helps raise funds for the middle school she attended.

Before starting the Sloan M.B.A. program last fall, Preston left her job at the bank and became a master teacher at Summerbridge. She spent much of her time working with faculty, developing lesson plans, setting goals for faculty training and working to foster a love of teaching and a commitment to student success.

With her time at a premium these days, Preston said she chooses carefully which organizations she wants to work with. "If you have a passion for something you find the time for it," she said. Preston knows her sacrifice to attend Sloan will be worth it, and she is proud she is setting an example for her daughter, who often asks, "Are you going to school again?"

COAL

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constrained world—higher efficiency generation, perhaps through new materials; novel approaches to gasification, CO_2 capture and oxygen separation; and advanced system concepts, perhaps guided by a new generation of simulation tools. An aggressive R&D effort in the near term will yield significant dividends down the road and should be undertaken immediately to help meet this urgent scientific challenge."

Key findings in this study include:

• Coal is a low-cost per-BTU mainstay of both the developed and developing world, and its use is projected to increase. Because of coal's high carbon content, increasing use will exacerbate the problem of climate change unless coal plants are deployed with very high efficiency and large-scale CCS is implemented.

• CCS is the critical enabling technology because it allows significant reduction in carbon dioxide emissions while allowing coal to meet future energy needs.

• A significant charge on carbon emissions is needed in the relatively near term to increase the economic attractiveness of new technologies that avoid carbon emissions and specifically lead to large-scale CCS in the coming decades. We need large-scale demonstration projects of the technical, economic and environmental performance of an integrated CCS system. We should proceed with carbon sequestration projects as soon as possible. Several integrated large-scale demonstrations with appropriate measurement, monitoring and verification are needed in the United States over the next decade with government support. This is important for establishing public confidence for the very large-scale sequestration program anticipated in the future. The regulatory regime for large-scale commercial sequestration should be developed with a greater sense of urgency, with the Executive Office of the President leading an interagency process.

• The U.S. government should provide assistance only to coal projects with carbon dioxide capture in order to demonstrate technical, economic and environmental performance.

• Today, Integrated Gasification Combined Cycle appears to be the economic choice for new coal plants with CCS. However, this could change with further research development and demonstration, so it is not appropriate to pick a single technology winner at this time, especially in light of the variability in coal type, access to sequestration sites and other factors. The government should provide assistance to several "first of their kind" coal utilization demonstration plants, but only with carbon capture.

• Congress should remove any expectation that construction of new coal plants without carbon dioxide capture will be "grandfathered" and granted emission allowances in the event of future regulation. This is a perverse incentive to build coal plants without carbon dioxide capture today.

• Emissions will be stabilized only through global adherence to carbon dioxide emission constraints. China and India are unlikely to adopt carbon constraints unless the United States does so and leads the way in the development of CCS technology.

• Key changes must be made to the current Department of Energy research development and demonstration program to successfully promote CCS technologies. The program must provide for demonstration of CCS at scale; a wider range of technologies should be explored; and modeling and simulation of the comparative performance of integrated technology systems should be greatly enhanced.

The report is available online at web.mit.edu/coal.

About the MIT study: A group of MIT faculty has undertaken a series of interdisciplinary studies about how the United States and the world would meet future energy demand without increasing emissions of greenhouse gases. The first study, "The Future of Nuclear Power," appeared in 2003.

Generous financial support from the Alfred P. Sloan Foundation, the Pew Charitable Trusts, the Energy Foundation, the Better World Fund, the Norwegian Research Council and the MIT Office of the Provost is gratefully acknowledged. Shell provided additional support for part of MIT's studies in China.

E-mail outage affects 4,000

MIT's central e-mail system is quite complex, employing more than 20 servers to deliver almost 4 million mail messages every day, while filtering out roughly 10 million pieces of spam. It serves a community of more than 20,000 active e-mail users with remarkable reliability.

Last week proved an exception. On March 7, a post office server (po14.mit.edu) that provides service to about 4,000 users experienced a transient problem. After this server rebooted, the program that ensures the integrity of stored e-mail took far longer to run than anticipated by network staff.

Given the volume of queued-up e-mail, messages on po14 took longer to deliver than usual, with newer e-mails arriving before those that had been sent earlier. Most of the affected users had e-mail restored on March 8, and service was restored to the last remaining users on March 10. No e-mail was lost, in storage or in transit.

Information Services and Technology (IS&T), the department that maintains MIT's central e-mail system, is taking measures to reduce the probability of this type of outage happening again. It is in the middle of a project to provide redundant e-mail servers. This project began in early 2006 and will finish in July. In addition, IS&T is working to limit the number of users who will be affected by problems with any one server, as well as shortening the time needed for integrity checking.

The Email at MIT page at web.mit.edu/ist/topics/email includes a link for finding out which post office server you are on. When you aren't sure of the status of central MIT services such as the network, e-mail or telephone system, you can check the Services Status page, known as 3DOWN, at 3down.mit.edu. You can also contact the IS&T Computing Help Desk at x3-1101 or computing-help@mit.edu.

Seven research teams win Deshpande grants

The Deshpande Center for Technological Innovation at MIT has announced it is awarding $628,000 in grants to seven MIT research teams currently working on discoveries that could revolutionize medical diagnostics, X-ray technology, environmental cleanup, medical device technology, solar energy technology and electronics.

"Our goal is to assist in bringing MIT research projects out of the labs so they can have an even greater social, economic and academic impact," said Leon Sandler, executive director of the Deshpande Center. "This group of projects has great potential, and we look forward to working with the research teams to provide the resources they need to prove their commercial viability."

The spring 2007 grant recipients are:

Michael Cima, professor, materials science and engineering: Medicine delivery method for bladder disorders—a new device to provide medicine over a period of time that treats bladder disorders, from overactive bladder to interstitial cystitis to cancer (renewal from spring 2006 grant round).

Patrick Doyle, associate professor, chemical engineering: Rapid multiplexed analysis for molecular diagnostics—a new method to perform multitarget bioassays using microparticles that may enable clinical bedside diagnostics and easier, less-costly diagnosis of disease.

Klavs Jensen, Lammot Du Pont Professor, chemical engineering: High throughput cell microinjector—a new automated microinjector that promises high-throughput delivery of any molecule or nanoparticle into single cells to accelerate laboratory research.

Richard Lanz, senior research scientist, Nuclear Science and Engineering: Phase contrast X-ray imaging—a phase contrast approach to X-ray imaging that could impact a wide range of areas, from medical imaging to homeland security.

Tomás Palacios, assistant professor, electrical engineering and computer science: Gallium nitride high electron mobility transistors—a new approach to the fabrication technology of gallium nitride semiconductors to reduce the cost and improve the performance of electronic products.

Emanuel Sachs, professor, mechanical engineering: High efficiency multi-crystalline solar cells—a new approach to improve the efficiency of multi-crystalline solar cells that could lower the cost per watt of solar energy, allowing it to become more competitive with grid electricity.

Francesco Stellacci, assistant professor, materials science and engineering, and Jing Kong, assistant professor, electrical engineering and computer science: Superhydrophobic nanomaterials—a simple and rapid nanomaterial approach to controlling surface wetting that could impact how environmentally hazardous materials are cleaned.

Since 2002, the Deshpande Center has funded 61 MIT research projects with approximately $7.1 million in grants, acting as a catalyst for innovation and entrepreneurship and increasing the impact of MIT technologies in the marketplace.

MIT faculty interested in securing a Deshpande Center Ignition or Innovation Grant should submit a pre-proposal by May 7 for the fall 2007 funding round. For more information on how to submit a pre-proposal see: web.mit.edu/deshpande-center/instructions.html.

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President Emeritus Vest will deliver Commencement address

MIT President Emeritus Charles M. Vest will be the speaker at MIT's 141st Commencement on Friday, June 8, in Killian Court.

Vest is currently professor of mechanical engineering at MIT. In September, a nominating committee of the National Academy of Engineering unanimously recommended his candidacy for the presidency of the academy; if elected by the NAE's membership in mail balloting that closes at the end of this month, he will begin a six-year term on July 1.

Charles M. Vest

In making the announcement, MIT President Susan Hockfield said, "I am very pleased that Chuck Vest has agreed to give the 2007 Commencement address at MIT. During his 14 years as MIT's president, he quietly put his stamp on almost every aspect of the Institute and its life. At the same time, he achieved national and international recognition for his thoughtful insights into the crucial issues facing higher education and research in the United States and in our globalizing world. As he anticipates the next chapter of his career in Washington, it is the perfect moment for him to share with our graduates his reflections on the role of MIT in the world."

Professor Eric Grimson, head of the Department of Electrical Engineering and Computer Science, serves as chair of the 2007 Commencement Committee, composed of faculty, students and members of the administration.

Expressing his pleasure at the choice of Vest as Commencement speaker, Grimson said, "As one of the leading figures in science and technology policy today, and a strong spokesman for the role that research universities play in driving the country's economic future, Chuck Vest has much to say to our graduates, while the deep affection and respect that so many in this community have for him will make his appearance as our speaker all the more meaningful."

Vest earned his B.S. degree in mechanical engineering from West Virginia University in 1963 and his M.S. and Ph.D. degrees from the University of Michigan in 1964 and 1967, respectively. He is the recipient of 10 honorary doctoral degrees and is a life member of the MIT Corporation, the Institute's board of trustees.

As president of MIT from 1990 through 2004, Vest placed special emphasis on enhancing undergraduate education, exploring new organizational forms to meet emerging directions in research and education, building a stronger international dimension into education and research programs, developing stronger relations with industry and enhancing racial and cultural diversity at the Institute.

Vest has also worked to bring issues concerning education and research to broader public attention and to strengthen national policy on science, engineering and education. He chaired the President's Advisory Committee on the Redesign of the Space Station and serves on the President's Committee of Advisors on Science and Technology. He chaired the U.S. Department of Energy Task Force on the Future of DOE Science Programs, was vice chair of the Council on Competitiveness for eight years and is a past chair of the Association of American Universities.

Vest recently completed service as a member of the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction and of the U.S. Secretary of Education's Commission on the Future of Higher Education. He now serves on the Department of State Secretary's Advisory Committee on Transformational Diplomacy and the Rice-Chertoff Secure Borders, Open Doors Advisory Board Subcommittee.

A collection of Vest's essays, "Pursuing the Endless Frontier: Essays on MIT and the Role of the Research University," was published by the MIT Press in 2004; his new study, "The American Research University from World War II to World Wide Web," is forthcoming from the University of California Press.

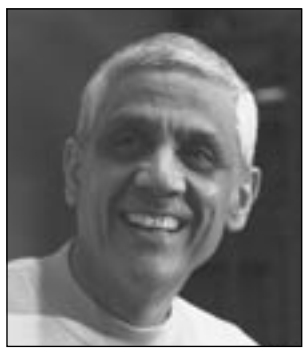
ENERGY 2.0

Continued from Page 1

effort in solving the global energy challenges forward, and I think we achieved this with high marks. Many attendees commented to the organizers that the 2007 MIT Energy Conference was the best energy conference that they have ever been to."

Clean technology, known as cleantech, which is rapidly becoming a defined investment category for venture capital, received a record $2.9 billion in the United States out of $25.5 billion of investments in 2006, according to Cleantech Venture Network.

"The time is right for a new wave of innovation," said MIT President Susan Hockfield in a welcoming address. "But we should not delude ourselves into believing we can find a single silver bullet. We must explore multiple approaches in technology, entrepreneurship and policy." She said Energy 2.0 would help build the needed connections between these different domains and praised the student organizers for their ambition, expertise and enthusiasm.



Vinod Khosla

Andrew Kadak

Vijay Vaitheeswaran

Among the speakers at the two-day event were Jeffrey Immelt, the General Electric CEO described by Business Week as on a mission to boost the company's creativity and growth; Daniel Yergin, cofounder and chair of Cambridge Energy Resource Associates, best known for his Pulitzer Prize-winning book, "The Prize: The Epic Quest for Oil, Money, and Power"; Martin Zimmerman, former Ford vice president, who recently served on the National Commission on Energy Policy and on the President's Council of Economic Advisors; and Vinod Khosla, founder and managing partner of Khosla Ventures, an influential Silicon Valley personality.

Panels were held on biofuels, U.S. climate policy, solar power, oil and energy security, hybrid vehicles and wind power.

MIT researchers Yet-Ming Chiang, professor of materials science and engineering; postdoctoral associate Hal Alper; and Joel Schindall, professor of the practice in electrical engineering and computer science and associate director of the Laboratory for Electromagnetic and Electronic Systems, presented their work at an MIT energy technology showcase.

The New England Energy Innovation Collaborative, one of the conference's platinum sponsors, announced that StarSolar Corp., an MIT-led team commercializing a technology that increases the efficiencies of photovoltaic cells, won its $150,000 Energy Business Creation Competition.

The MIT-New England Energy Showcase, a forum to display the latest and most innovative energy research and business endeavors from MIT and New England, attracted 1,000 attendees and featured exhibits from local energy start-ups such as Lowell, Mass.-based Konarka, which has developed a light-activated plastic; A123 Systems of Watertown, Mass., which uses nanoscale science to create a new generation of lithium ion batteries; and the Harvard, Mass., developer of the Fox Furnace, which generates hot water from food fats, oil and grease.

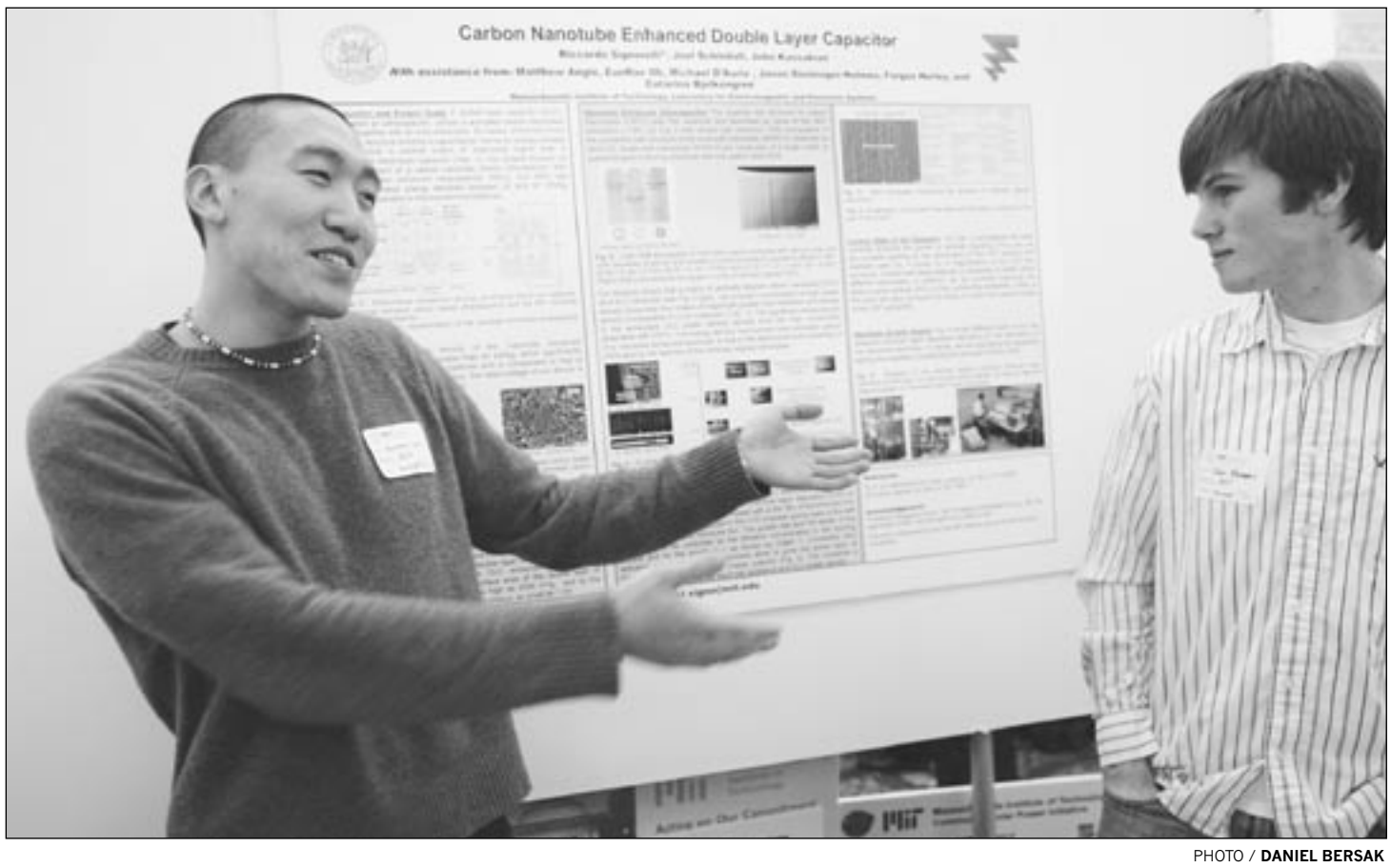


PHOTO / **DANIEL BERSAK**

Senior Andrew Lee welcomes sophomore Dan Rogers to a presentation on carbon nanotube capacitors.

ACM names three from MIT for computer science

The Association for Computing Machinery (ACM), an educational and scientific society uniting the world's computing educators, researchers and professionals, has recognized three MIT researchers among 41 of its members for their contributions to the practical and theoretical aspects of computing and information technology. The new ACM fellows, from some of the world's leading industries, universities and research labs, made significant advances that are having lasting effects on the lives of people throughout the world.

The MIT researchers are Arvind, the Charles W. and Jennifer C. Johnson Professor in Computer Science and Engineering, for his contributions to dataflow computing and verification; John Guttag, the Dugald C. Jackson Professor of Computer Science and Engineering, for his contributions to algebraic specifications and abstract data types; and Charles E. Leiserson, professor of electrical engineering and computer science, for his contributions to parallel and distributed computing.

"The contributions these computing scientists and professionals have made to our world and the way we live are remarkable," said ACM President Stuart Feldman. "Their work reflects outstanding displays of creativity and commitment to the computing community, which continues to drive innovation in industries and enterprises across the globe."

ACM will formally recognize the new fellows at its annual awards banquet on June 9 in San Diego. Additional information about the ACM 2006 fellows, the awards event and previous ACM fellows and award winners is available at www.acm.org/awards.

AWARDS AND HONORS

Subra Suresh, the Ford Professor of Engineering, has been elected an honorary member of the Spanish Royal Academy of Sciences. Suresh is one of two foreigners elected in 2007 to honorary membership in the academy, which covers physical, chemical, biological and mathematical sciences. Suresh holds joint appointments in the Departments of Materials Science and Engineering and Mechanical Engineering, the Biological Engineering Division and the Harvard-MIT Division of Health Sciences and Technology.

Moe Z. Win, associate professor in the Laboratory for Information and Decision Systems and in the Department of Aeronautics and Astronautics, is a recipient of the Wireless Educator of the Year Award, presented by the Global Wireless Education Consortium. The award recognizes distinguished college and university educators and their pivotal role in preparing tomorrow's wireless technology leaders. A pioneer in the field of ultrawideband communications, Win has created and taught multiple courses at MIT.

New center to explore possibilities of quantum information theory

William Smith
Research Laboratory of Electronics

What are the ultimate powers of quantum computers, quantum communications and quantum precision measurement systems?

MIT's new $3.5 million W.M. Keck Foundation Center for Extreme Quantum Information Theory (xQIT) has been inaugurated with $1.63 million in funding from the Keck Foundation, as well as funding from MIT and other sponsors, to discover answers to these fundamental, yet still unsolved, questions.

Professor Seth Lloyd of the Department of Mechanical Engineering and Jeffrey H. Shapiro, the Julius A. Stratton Professor of Electrical Engineering and director of the Research Laboratory of Electronics (RLE), will lead the new center.

The new center enables a major new push by MIT theorists in the international race to determine the ultimate capabilities of quantum information systems. Establishing these theoretical capabilities would be a step towards being able to exploit quantum effects for novel applications, including computers, communication networks and global positioning systems.

As technological advances drive contemporary systems and devices to ever smaller and faster scales, mastery of quantum mechanical effects is proving crucial to overcoming the current limitations of classical systems and creating the next generation of applications in which macroscopic quantum phenomena play an explicit role.

MIT President Susan Hockfield said, "The Keck Foundation has a distinguished history of supporting bold research efforts and laying the groundwork at pivotal moments to enable breakthrough scientific progress.

"MIT is grateful for the foundation's foresight in funding this new center at a time when much federal support is devoted to applications of quantum information science, but less to the fundamental quantum science theory needed to frame and solve some of the most important questions."

MIT's research team will pursue theoretical problems in three key areas: adiabatic quantum computing, quantum channel capacity and quantum sensing and control.

The new center, based in the RLE, unites theorists in five academic departments and five major research laboratories

See **QUANTUM** Page 6

PARTICLES

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that appeared in the March 9 issue of Science.

He and co-author Patrick Doyle, the Doherty Associate Professor of Chemical Engineering, believe their particles could become an effective and inexpensive way to perform medical diagnostic tests at a patient's bedside.

Current testing methods are cost-prohibitive for bedside use, Pregibon said. The MIT particles are inexpensive to manufacture, and their results are as accurate, if not more so, than the results from more expensive systems, he said.

The particles offer a new way to do "multiplexed detection"—testing a single sample for multiple targets. In the laboratory, a common (but expensive) multiplexing technique involves a planar microarray—a flat surface with many spotted probes that each test for different targets. The MIT researchers are taking this approach away from planar surfaces onto free-floating particles.

With the tiny particles, it is much easier to custom-design each biological test, said Doyle. "It's very easy to tailor what you give a customer. You could have 100 types of particles and mix them together," he said.

The researchers' particle fabrication method gives them exquisite control over the particles' shape and chemical characteristics.

As two streams of monomers (liquid precursors loaded with fluorescent dye or molecular probe) flow side by side through a microfluidic device, ultraviolet light repeatedly strikes the streams. A chemical reaction initiated by the light causes the liquid to solidify, forming a single particle with two distinct ends. Each particle takes on the shape of a "mask" (similar to a transparency film) through which the UV light is aimed.

One end of each particle is a fluorescent "dot pattern" barcode that reveals what the target molecule of the particle is, and the other end is loaded with a probe and turns fluorescent only if the target molecule is present. The particles can also be designed to each test for multiple targets, by adding several unique regions.

"We can make the particles, encode them and add functionality all in a single step," said Pregibon.

When a mixture of particles is added to a test sample, target molecules (DNA, proteins, etc.) will bind to the region of the particles containing the corresponding probe. This interaction can be detected by fluorescence, which is brighter when more of the target is present.

To rapidly "read" the particles, the researchers designed a custom "flow cytometer" using a microfluidic device and standard microscope. In this flow-through system, the oblong, disk-like shape of the particles ensures that they are precisely aligned for accurate scanning. Each time a particle flows past a detector, its barcode is read and the corresponding target is quantified.

The microparticles are inexpensive because they can be produced efficiently in a single step. The design of the particles also makes the scanning devices cheaper. With multiple distinct regions, the barcode can be read and the target quantified using a single fluorescent color, which greatly simplifies detection.

The particles are also unique in that they are made of a spongy polymer "hydrogel" called poly(ethylene glycol). That polymer enhances the sensitivity of the test because it is porous, allowing the target molecules to diffuse into it.

For the Science paper, the researchers created particles with DNA probes attached at one end. They demonstrated that the particles could accurately and reproducibly detect the presence of multiple target DNA sequences, and they antici-

See **PARTICLES** Page 6

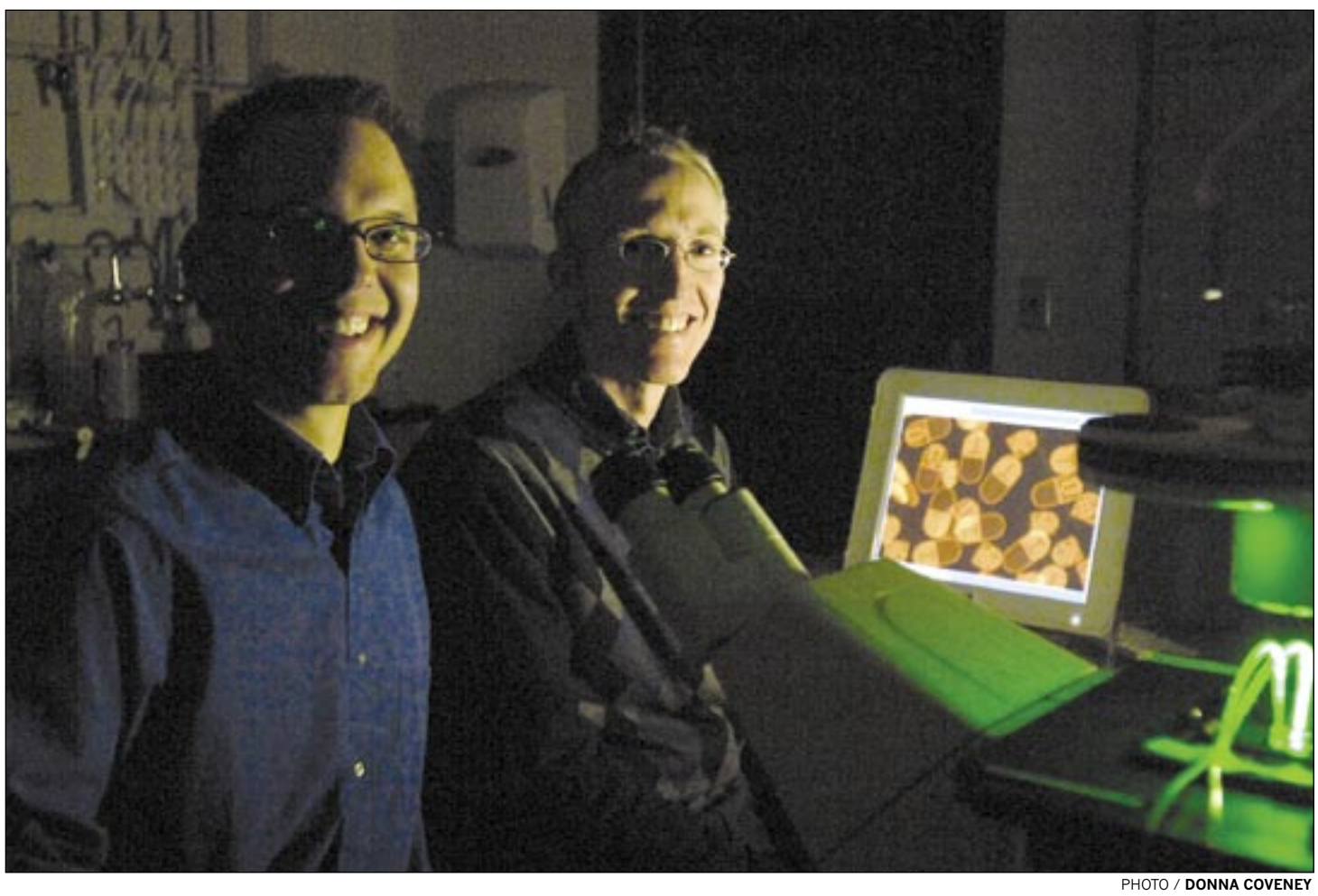

PHOTO / **DONNA COVENEY**

Graduate student Daniel Pregibon, left, and Associate Professor Patrick Doyle survey microparticles on a monitor in their lab. The microparticles are on a glass slide on the microscope: Green ultraviolet light is shone on it to help view the particles. The particles are designed to detect specific DNA sequences.

$100M gift to launch research center for psychiatric disease

The Broad Institute of MIT and Harvard has received a $100 million gift to launch a new research center that will combine the strengths of genomics and chemical biology to advance the understanding and treatment of severe mental illnesses.

The philanthropic gift from the Stanley Medical Research Institute, the largest ever given to an institution for psychiatric disease research, will support the creation of the Stanley Center for Psychiatric Research and fund research at the center over the next 10 years.

Based at the Broad Institute, the Stanley Center will bring together scientists from diverse fields and institutions to pursue collaborative projects. It will build upon the Broad Institute's current psychiatric disease research, which includes work on schizophrenia, bipolar disorder and major depression and unites leading neuroscience and clinical psychiatry researchers at MIT and Harvard. The gift will allow a major expansion of these programs as well as the initiation of new programs.

Eric Lander

In the United States alone, more than 8 million people suffer from schizophrenia and bipolar disorder, and some 17 million are affected each year by major depression. Although the illnesses tend to run in families, suggesting they are influenced by genetics, little is known about their molecular causes. Despite some advances in therapeutics, this dearth of molecular knowledge is a major stumbling block to developing novel, more effective treatments for psychiatric disease.

"Schizophrenia and bipolar disorder are among the most devastating psychiatric diseases in America," said Michael Knable, executive director of the Stanley Medical Research Institute. "Identifying the biological underpinnings of these illnesses requires diverse scientific skills and a robust spirit of collaboration. The Broad Institute is the ideal place for this important work, because of its collaborative environment, scientific excellence and expertise in genomics and chemical biology."

"Psychiatric disease is an enormous research challenge, because you can't study it in cell culture like cancer, or measure it with a blood test like diabetes," said Eric S. Lander, director of the Broad Institute and an MIT professor of biology. "Psychiatric disease may be the most important application for genomics. Genomic tools can help uncover the molecular mechanisms of the disease, which is essential knowledge for developing therapeutics. The Stanley gift is a crucial step toward that goal."

The new Stanley Center for Psychiatric Research springs from the Broad Institute's Psychiatric Disease Initiative, which includes MIT neuroscience researchers at the Picower Institute for Learning and Memory, McGovern Institute for Brain Research, Whitehead Institute for Biomedical Research and Department of Brain and Cognitive Sciences, and Harvard neuroscience and clinical psychiatry researchers at Massachusetts General Hospital and McLean Hospital.

The Stanley Center will be directed by Edward Scolnick, who founded the Broad Institute's Psychiatric Disease Initiative.

"Thanks to the far-reaching vision and unprecedented generosity of the Stanley family, we now have an opportunity to bring powerful new tools to bear on devastating psychiatric diseases," said Scolnick. "This work would not be possible without the extraordinary caliber and expertise of

See **GIFT** Page 6

New model shows molecular mechanics of red blood cells

Work could aid treatment of malaria and sickle cell anemia

Anne Trafton
News Office

Millions of times during their four-month lifespan, human red blood cells must squeeze through tiny capillaries to deliver their payload of oxygen and pick up waste carbon dioxide—functions essential to life.

Now, for the first time, MIT researchers have developed a dynamic, molecular-level model that describes how the cells deform their normal disc shape to pass through vessels that are often much narrower than the cells themselves.

Blood cells must rearrange components of their internal scaffolding (so-called cytoskeleton), allowing the cells to become almost liquid-like, in order to squeeze through the narrowest capillaries found in the body, the researchers report in a paper published in the March 12 online edition of the Proceedings of the National Academy of Sciences.

Studying the mechanics of how a blood cell can transform from a soft object to an almost fluid-like state will help researchers better understand several types of blood disorders, said Subra Suresh, senior author of the paper and the Ford Professor of Engineering with joint appointments in materials science and engineering, biological engineering, mechanical engineering and health sciences and technology.

"Now we can study how molecular structure affects the shape, which affects the mechanical properties, and both of which affect mobility," he said.

Mobility is a key factor in diseases like malaria and the genetic disorder sickle cell anemia, both of which render red blood cells unable to flow through narrow capillaries.

Red blood cells have a diameter of about eight microns, or millionths of a meter. As they flow through the body, they often encounter blood vessels, such as those in the brain, with a diameter of only about two microns. Each time the cells reach such a vessel, they must stretch into a bullet-like shape to squeeze through and then return to their original disc shape upon exiting the vessel.

The researchers' model shows that reorganization of the cytoskeleton could account for such deformation. Every red blood cell has a cytoskeleton, a sort of scaffolding made of protein molecules called spectrin, attached to the inside of its cell membrane in a brush-like network.

When the bonds within that protein network or between the network and the cell membrane are broken, holes open up in the cytoskeleton, allowing the cell to become more fluidic and squeeze through narrow passages. The researchers show that such a transformation can be achieved by breaking either of two types of cytoskeletal bonds—bonds between two molecules of spectrin or bonds between spectrin and another protein called actin, which is embedded in the cell membrane.

An input of either mechanical energy (such as squeezing or shearing) or chemical energy (such as ATP, an energy carrier used by cells), is enough to break those bonds and cause the necessary cytoskeleton deformation, according to Suresh. In

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Page 6

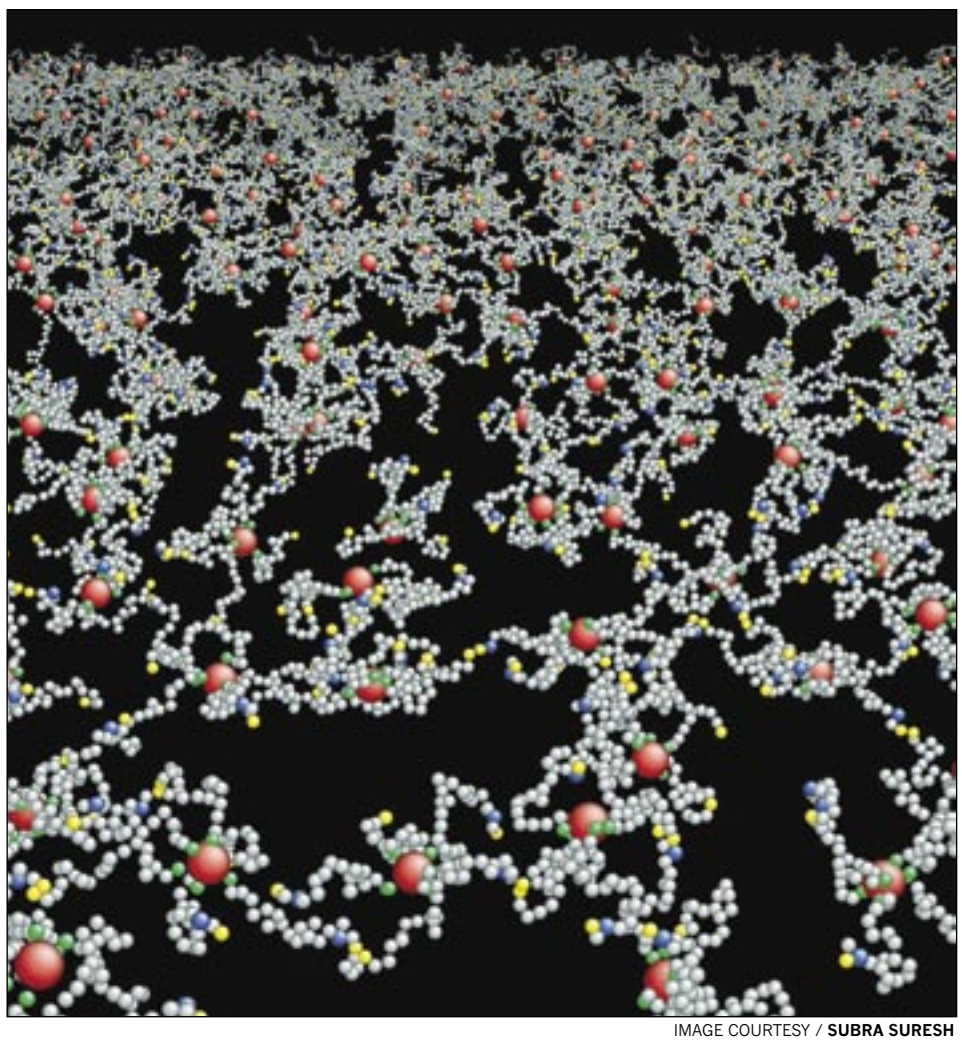

IMAGE COURTESY / **SUBRA SURESH**

Simulation of the cytoskeleton attached to the inside of the cell membrane of a human red blood cell. When the cell is subjected to shear stress, the bonds between actin molecules (large red beads) and spectrin molecules (small gray, green, yellow and blue beads) can break, allowing the cell to become more fluid-like.

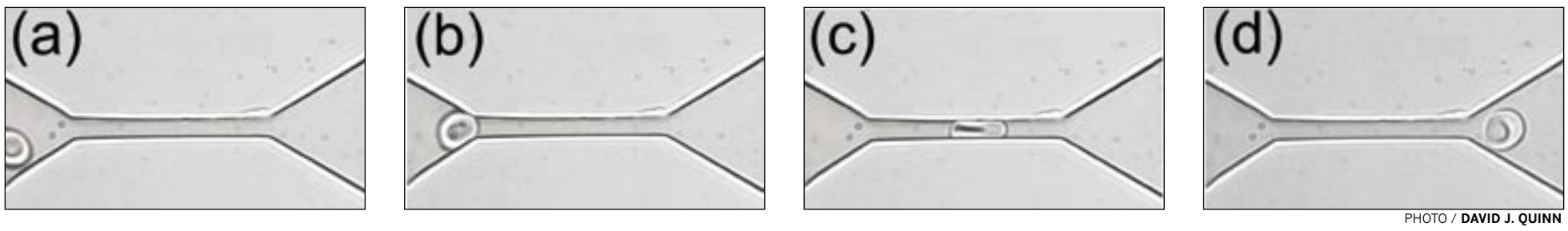

PHOTO / **DAVID J. QUINN**

An experimental in vitro demonstration of the 'fluidization' of a healthy human red blood cell through a microfluidic channel at room temperature. The series of images shows how the shape of a red blood cell changes as it squeezes through a 4-micron-by-4-micron channel.

'In Cod We Trust' explores interplay among weather, fish, people and faith

Emeritus Professor Brian Fagan of the University of California at Santa Barbara emphasized the complex interplay of climatic conditions and social and cultural development in his presentation, "In Cod We Trust: Fishing, Subsistence Agriculture and Climate Change, c. A.D. 900 to 1400," presented to an overflow crowd in E51-095 on Friday, Feb. 23.

Fagan noted that even for a period offering scanty evidence to scholars, it is clear that climate change was a major driver of social, political and economic change. The meeting was part of the MIT Seminar on Environmental and Agricultural History, sponsored by the history faculty and the Program in Science, Technology and Society.

European food supplies were greater and more reliable during the so-called "medieval warm period" of approximately 800 to 1300 A.D. Wine grapes were grown as far north as England, and cereal crops in Norway. Impacts of favorable weather included population growth and drastic deforestation, as fields were cleared for agricultural use.

The period, now believed to have been a global event, was characterized in Europe by dramatic seasonal differences. Summers were warmer and drier, while winter snow levels rose. This era ended abruptly in 1315, when catastrophic rainfalls began and continued until about 1321. These severe conditions destroyed crops and led to widespread epidemics among farm animals and famine-related diseases among people. The so-called "Little Ice Age" continued until around 1860.

Also during the eighth and ninth centuries, fish became a major part of the European diet. Wild fish were harvested close to shore, and fish farming was widely practiced. Fish consumption was driven in part by Christian symbolism. It was associated with feasting and atonement, attributes of frequently observed religious holidays.

The next talk in the series, "The Conquest of Nature: Water, Landscape, and the Making of Modern Germany," presented by David Blackbourn, Coolidge Professor of History at Harvard, will be held Friday, March 16, 2:30 to 4:30 p.m., in E51-095.

EELGRASS

Continued from Page 1

grass back.

Since 2004, MIT Sea Grant has been engaging public school students in hands-on learning, with classes growing eelgrass in recirculating aquaculture systems. Developed in collaboration with the Massachusetts Office of Coastal Zone Management, the eelgrass curriculum teaches students not only about the history and importance of eelgrass, but also includes biology and ecology, graphing data and water quality testing.

The eelgrass restoration project is also supported by the Environmental Protection Agency, the Massachusetts Division of Marine Fisheries and the city of Gloucester.

PHOTO / **MIT SEA GRANT**

Noah Meyers shows off eelgrass to be transplanted from Gloucester Harbor.

Last summer a team including scientists, educators and students spent a full day rescuing some 6,000 eelgrass plants from Gloucester Harbor, where dredging had begun to make way for a new 550-foot stormwater outfall pipe.

The plants were gathered by divers from about 18 feet down in the harbor. Volunteers separated them into individual shoots that were planted in several locations in Boston Harbor, at a depth of roughly 15 feet. The density and size of the eelgrass beds are monitored twice a year.

In a second effort last fall, another 6,000 shoots were gathered by divers and separated by students.

In an experiment to test different methods of storing and growing eelgrass, roughly half of the plants gathered in the fall are being housed in a 1,000-gallon tank at Gloucester's Maritime Heritage Center, where MIT Sea Grant has its marine finfish hatchery. The tank is stocked with sea stars, crabs, lobsters and fish, thereby recreating the plants' natural ecosystem and keeping algae in check.

The other plants were woven into a floating raft made of coconut fibers, now wintering underwater on a pier near the hatchery. Essentially a mattress of eelgrass, this method of maintaining and growing eelgrass is a new one, says Brandy Wilbur, MIT Sea Grant education coordinator and aquaculture specialist.

The researchers will continue to collect data through the winter to document the survival and growth of the eelgrass. Come spring, the plan is to transplant the eelgrass back into Gloucester Harbor and/or the Annisquam River.

For now, the eelgrass in transition offers visitors to the hatchery a chance to learn about the importance of healthy marine ecosystems. And students at Minuteman Regional High, Essex Agriculture High School, Rockport High School, Swampscott Middle School, Odyssey High School in South Boston, Wellesley's Dana Hall and The Gordon School in East Providence, R.I., are all experimenting with different methods of raising eelgrass, which can then potentially be reseeded in local waters.

Regardless of how many plants make it through the winter, says Wilbur, "this project has already been extremely successful because of all the collaboration and outreach."

For more information, or if your classroom is interested in participating, please visit seagrantdev.mit.edu/eelgrass.

Systems program helps a soldier to serve

Patty Eames and Lois Slavin
Engineering Systems Division

If one had to use a single word to describe Nathan Minami, it would be "patriotic." While the student in system design and management enacts his commitment to the American people in all his words and actions, his patriotism is best exemplified by his 14-year career in the U.S. armed forces.

Minami, who entered MIT's SDM program in 2006, will return to the military after graduation in June. Halfway through the academic year, he praised SDM for its emphasis on group assignments and collective learning. "Everything is teamwork in the military. After SDM, I will be returning with a better understanding of how to incorporate a variety of diverse perspectives for the collective good of the whole," he said.

Minami's path to working toward the collective good of the whole began with a vision—he'd be a doctor. Describing himself as a "lower-middle-class kid who never thought he'd get too far from San Diego," Minami worked hard to prepare for college, with medical school to follow.

To some eyes, he took the long way around. Inspired, perhaps, by his father's service in Vietnam and his grandfather's in World War II, he applied and was accepted at West Point.

There he enrolled in the first of three higher education programs supported by the U.S. Army: He earned a B.S. in Arabic and French languages with a focus on the systems engineering track at West Point; he earned a master's degree in national security studies with a Middle East concentration from the American Military University; and he came to MIT to pursue his third degree, an S.M. in MIT's system design and management program, in 2006.

Minami says that he came to SDM because it teaches what the United States Army and the world at large need—people who understand systems thinking and can manage and lead in complex situations.

"A single soldier and his equipment can be seen as a complex system," explained Minami. " He must be prepared to quickly assess a situation and determine how to communicate effectively with a wide range of stakeholders, from fellow soldiers to officers to Iraqi citizens, in environments that are often hostile and deadly. Deepening my understanding of complex systems will help me better serve my troops and my country."

Minami had many years and many miles to go between West Point and MIT. After completing his first military deployment—a 45-day peacekeeping mission in Macedonia in 1998—Minami was sent to Germany. While looking for an apartment, he also met his future wife. "My landlady, who had four daughters, also became my mother-in-law. I took the apartment, and I ended up taking the oldest daughter too," he said.

One week after marrying, Minami was deployed to a combat assignment in Kosovo. There he led more than 100 patrols in an effort to maintain peace between Albanian and Serbian ethnic groups, working with several other international military units and the Office of the United Nations High Commissioner for Refugees.

Minami and his wife, Melissa, then moved to Hawaii, where he trained infantry units in combat techniques and managed an exercise and training program that helped prepare 15,000 soldiers for deployment to Iraq and Afghanistan.

Shortly before his 15-month deployment to Iraq in December 2003, Nathan and Melissa had their first child, Selina. Leaving for his next combat mission was especially hard: Selina was on the verge of taking her first steps. "She started walking a week after I left," he recalled. Today Nathan is delighted to be at home with his family as his nine-month-old son, David, begins walking and talking.

Minami considers his deployment in Iraq as an infantry company commander in the 25th Infantry Division to be one of his biggest accomplishments. He and his troops assisted with reconstruction projects, governance and training soldiers in the Iraqi army—in addition to participating in combat operations. Humbly acknowledging that he could only have done it with the help of many others, he said, "I deployed to Iraq with 146 soldiers and brought 146 soldiers home. Not one died and not one had to be medically evacuated."

PHOTO COURTESY / **NATHAN MINAMI**

MIT graduate student Nathan Minami, far right, confers with fellow soldiers in Iraq.

Writing contest seeks submissions

The Ilona Karmel Writing Prizes Competition, sponsored by the Program in Writing and Humanistic Studies, is accepting manuscript submissions from undergraduate and graduate students. Prizes carry cash awards and are given to students whose essays, plays, poetry, fiction and technical papers are judged to be of the highest quality by a committee of faculty and staff members.

William Corbett, director of student writing activities in the Program in Writing and Humanistic Studies, is the competition chair. He encourages all interested students to submit their best efforts and also asks faculty members who receive outstanding undergraduate papers to urge the students to enter the competition.

The deadline for entries is 5 p.m., Friday, April 6.

Nominations for mentoring awards announced

Nominations of individuals who support and guide new generations of entrepreneurs are being accepted by the MIT Sloan School of Management for the 2007 Third Annual Adolf F. Monosson Prize for Entrepreneurship Mentoring.

Created to honor the memory of MIT graduate Adolf "Sonny" F. Monosson, Class of 1948, the award recognizes entrepreneurship mentors who have shown a deep commitment to investing time, energy or capital to help new generations of business pioneers.

Edward B. Roberts, the David Sarnoff Professor of Management of Technology at MIT Sloan and founder and chair of the MIT Entrepreneurship Center, heads the committee that administers the prize.

Deadline for receipt of nominations is Thursday, March 15. The winner will be honored at a reception in the spring. Nominations should be sent to Roberts at MIT E52-535, 50 Memorial Drive, Cambridge MA 02142, or to eroberts@mit.edu.

CELLS

Continued from Page 5

the future, the researchers plan to study how the interplay of those types of energy inputs affects the cells.

The new model could also be used to study several types of blood disorders, including malaria, as the cell membrane and cytoskeleton are altered by the presence of the parasite inside the cell.

In earlier work, Suresh and colleagues showed that as malaria infection progresses, red blood cells become less deformable, which explains why it is harder for them to squeeze through narrow vessels. Using the new model, researchers can study how the infection affects the blood cells on a molecular level to make them less deformable.

Other diseases that could be studied are the genetic disorders sickle cell anemia and spherocytosis. In patients with sickle cell anemia, red blood cells take on a sickle shape that prevents them from flowing through blood vessels. Spherocytosis causes red blood cells to become spherical so they can't deform properly to get through small capillaries.

The lead author on the PNAS paper is Ju Li, a former MIT graduate student and assistant professor at Ohio State University. Other authors are George Lykotrafitis, a postdoctoral associate in MIT's Department of Materials Science and Engineering (MSE), and Ming Dao, an MIT research scientist in MSE.

The research was funded by the National Institutes of Health.

PARTICLES

Continued from Page 4

pate similar results with RNA, proteins and cytokines.

The researchers are focusing on bedside diagnostics and "theranostics"—the emerging concept of providing personalized diagnostic therapy. This method for tailoring therapies to each patient could be a breakthrough for treating diseases like cancer and cardiovascular disease. The particles could also be used to genetically profile individual patients and screen for bioterrorism or other hazardous environmental agents.

Mehmet Toner, a professor of surgery at Harvard Medical School, is also an author on the Science paper.

The research was funded by the National Science Foundation and the Dumbros Fellowship.

GIFT

Continued from Page 4

the MIT and Harvard community. We are grateful for their involvement and eagerly anticipate the scientific fruits of our shared effort."

The major projects that will be undertaken at the Stanley Center for Psychiatric Research include systematic surveys of the human genome to identify genes that contribute to schizophrenia and bipolar disorder and high-throughput chemical screens to uncover novel modes of treatment.

"Unlocking the mysteries of the brain and its associated diseases is one of the most formidable challenges in biomedicine today," said MIT President Susan Hockfield. "The Stanley Center for Psychiatric Research will help bring neuroscientists together to reach this critical goal."

Cambridge-MIT Program offers opportunity

Anna Babbi Klein
Office of the DUE

During the past six years, the Cambridge-MIT Undergraduate Student Exchange Program (CME) has provided MIT students with the opportunity to study at Cambridge University for a full year. The Cambridge-MIT Institute (CMI), a strategic alliance between MIT and Cambridge University, recently announced extending their financial support for this critical program for another year.

The ongoing support for CME is part of MIT's commitment to providing global educational opportunities for students. Daniel Hastings, Dean of Undergraduate Education, stressed the importance of CME as a global opportunity and explained that MIT is "committed to providing a stable base for this excellent program over the next several years."

CME is one of MIT's core programs that enable students to understand and to work with people from diverse nations and cultures.

In the 2007-2008 academic year, CME will enable 25 MIT students to benefit from a change in country, a change of culture as well as a difference in teaching and learning styles. CME participants are immersed in British culture and have easy, direct access to the rest of Europe and even part of Africa. At the same time, they are fully matriculated at Cambridge University and as such, they live and study side by side with Cambridge University students for the full academic year.

CME is administered by the Study Abroad and Distinguished Fellowships Office, which is part of the MIT Careers Office. For more information, please visit the Study Abroad web site at web.mit.edu/studyabroad.

QUANTUM

Continued from Page 4

and centers in a coordinated project that will be one of the largest theoretical research efforts at MIT. In addition to Lloyd and Shapiro, senior investigators include Professors Edward H. Farhi, Jeffrey Goldstone, Leonid S. Levitov, Sanjoy K. Mitter, Peter W. Shor and Jean-Jaques E. Slotine.

Said MIT's Vice President for Research Claude R. Canizares, "One of the most exciting things about the Keck Foundation's support for the new center is that it creates a locus of interdepartmental and interdisciplinary common purpose among MIT's researchers in quantum information theory. Our individual, world-leading efforts in quantum information science can now be integrated in a way that will improve the chances of success in the three important research areas of xQIT."

Lloyd, the program's principal investigator, said, "The Keck-funded center on extreme quantum information theory gives us a huge opportunity to uncover the truth about the universe at its most fundamental scales. xQIT assembles an unmatched team of scientists and engineers to attack some of the toughest problems in the field."

Prof compares business models' impact on economic development

PHOTO / **DONNA COVENEY**

Alice Amsden, professor of political economy, gave a talk March 5 as part of the spring colloquium of the Program in Science, Technology and Society.

Stephanie Schorow
News Office Correspondent

Which businesses are most likely to further growth in developing nations: POES (privately owned national firms), FOES (foreign-owned enterprises) or SOES (state-owned enterprises)?

This was the question posed by Alice Amsden, the Barton L. Weller Professor of Political Economy, on Monday, March 5, during a talk titled "Nationalism and the Firm," part of the spring colloquia of the Program in Science, Technology and Society exploring "Big Questions."

The answer, as Amsden explained with a chart of the "12 apostles"—developing countries such as Argentina, Brazil, Chile, India and Thailand—was that POES trumped both FOES and SOES.

Conventional wisdom may assume that large, foreign-owned firms have access to capital, have well-trained managers and are more able to make "big jumps" in development and job creation, Amsden said. But actually, she said, large corporations are "very bureaucratic" and averse to risk. "They have to follow certain rules," she said. In Latin America, for example, multinational firms "sat like fat chickens" due to government protection.

By contrast, nationally owned, private firms are far more entrepreneurial and will leap on opportunities and new ideas.

"I'm a big fan of these big national firms; they are necessary in changing the old Western imperialism," she said. "These guys are a breath of fresh air."

Thus, she believes it is better to encourage POES, which will in turn create local CEOs and business leaders. That doesn't mean POES and FOES are always in conflict. "There's enough for everybody," she said. The exception may be in areas like technology where "whoever gets there first crowds out the others."

What makes some developing nations do better than others is "pre-war manufacturing experience." Such countries knew how to start a project, she said, adding as she tapped her head, "Everything was up here."

Countries that had premodern manufacturing experience such as China, India and Mexico ("These are countries with great art, great cuisine") and those with an émigré population also have a developmental advantage. Another leg up came from "the hated influence" of colonialism, which created manufacturing infrastructure. "Decolonization was one of the most important movements of the 20th century," yet its full effects have yet to be fully explored, Amsden said.

Amsden's remarks sparked a heated discussion. Acknowledging it might be a "semantic quibble," Leo Marx, MIT emeritus professor of American cultural history, attacked Amsden's use of the word "nationalism," saying nationalism was a negative, destructive force in history and that it "continues to bedevil the world." Amsden said she would consider Marx's comments.

Other points debated included whether Thailand could be considered a "colony" (and thus had "nobody to kick out"), the role of Indian immigrants in Africa and the lessons of Bolivian nationalism. Wycliffe Muga, a Knight Science Journalism Fellow at MIT, questioned Amsden's suggestion that African oil-producing countries form a group like OPEC.

The STS "Big Questions" colloquia series (web.mit.edu/sts) continues through May; future topics range from the 1970s energy crisis to architectural technology to the notions of "culture" and "nature."

As opinions flow through blogs and Internet, political power relocates, diffusely

Stephanie Schorow
News Office Correspondent

There are many ways to define power, but Manuel Castells, Distinguished Visiting Professor of Technology and Society, defines power as the ability to make people think the way you want them to think—or to convince those who disagree that they can't do anything about it.

"The battle (for power) is in the people's minds," said Castells, communication professor at the Annenberg School for Communication at the University of Southern California, during a March 12 lecture on "Communication Technology, Media and Power," part of the spring colloquium held by MIT's Program in Science, Technology and Society.

Manuel Castells

Now, however, new information technology has shifted the battlefield, Castells said.

Political battles have been traditionally waged in the "public space" of mass media—television, newspapers and radio. The emergence of the Internet and mobile informational technology "has reshaped the public space."

Perhaps the most dramatic example of this shift is the mobile-phone video capturing Sen. George Allen's "macaca" remark. The video was widely distributed over the Internet and Allen was defeated, giving Democrats a Senate majority.

But the Internet is not just new technology, it's a new culture. Italian Prime Minister Silvio Berlusconi misread that culture; he sent a political text message just before an election to 30 million phones, thinking the phone was "just like a TV," Castells said. Italians, who saw the phone as a personal device, thought otherwise, and Berlusconi went down in defeat.

"Throughout history, communication and information are fundamental sources of power and counterpower in our societies—of both domination and social change," Castells said. Everything "depends on how people think and what they believe in."

That does not mean power is in the hands of the media. Mass media is constrained by market forces ("they must win an audience") and journalists' own ethics. But mass media "constitutes the space where power is decided," Castells said. And "what is not in the mass media does not exist."

Thus "a political message is necessarily a media message," Castells said. Furthermore, the "most powerful message is a simple message attached to an image." And that image is often a face. "People vote for faces."

Indeed, character assassination has become a primary political tool all over the world; with no scarcity of damaging material to dig up on opponents, media politics has become scandal politics, Castells said. The result is a general mistrust of all politicians. Democracy "is at an historical low point," he noted. Latin Americans, for example, don't want dictatorships, but they don't like what they see of Western democracy.

The emergence of what Castells calls "mass self communication" is changing political dynamics. Instead of information passing from "one to many," it may go from "many to many"—whether via blogs, chat forums, wikis or places like MySpace.

Consider some statistics: There are 60 million blogs worldwide; one is created every second and 55 percent of new bloggers are still posting after a month. Two-thirds of blog posts are in non-English languages. Only 9 percent of blogs are strictly political; still, that's a lot of blogging, he said.

Also, studies indicate an interest in the Internet increases political interest and activity, he said.

Most importantly, the Internet increases the belief that you have power. And the belief that you have power, in Castells' formulation, constitutes real power.

Kenneth Amis performs with Wind Ensemble

Lynn Heinemann
Office of the Arts

Is it the world's longest tuba concerto? Frederick Harris, director of MIT's Wind Ensembles, and composer-tuba player Kenneth Amis believe the 30-minute long "Concerto for Tuba," composed by Amis on a commission from the MIT Wind Ensemble (MITWE), might hold that record.

Kenneth Amis

Amis will perform his concerto with MITWE on Saturday, March 17 at 8 p.m. in Kresge Auditorium. The concert titled, "MITWE Celebrates Its Own," features ensemble members as soloists and as composers.

"I didn't set out to write something that long," said Amis, who is also assistant conductor of MITWE. Noting that he'd been commissioned to write a piece only half as long, Amis said, "The notes just kept coming and the various motifs and musical ideas needed time to develop."

The concert will also feature Lori Huberman, a senior in biology, as soloist in the Boston premiere of "Concerto for Flute and Wind Orchestra" by Mike Mower. In addition, Scott Stransky, a graduate student in earth, atmospheric and planetary sciences, will conduct the premiere of his "Suite from an Imaginary Movie."

Tickets are $5 at the door or from zaptix.com (zaptix.com/browse/?action=listing&id=78).

Amis is a longtime member of the Empire Brass Quintet and holds the International Brass Chair at the Royal Academy of Music in London. A former member of the Tanglewood Festival Orchestra and the New World Symphony and soloist with the English Chamber Orchestra, he has served on the faculties of several Boston-area universities and the Pacific Music Festival in Japan. In 2003, he received the New England Conservatory of Music's Outstanding Alumni Award. An active composer, Amis has been commissioned to write for both professional and collegiate ensembles. This summer, he will be the composer-in-residence at the South Shore Conservatory's Summer Music Festival.

Prior to the MIT concert, Amis and MITWE performed the same program at Foxborough High School (FHS), concluding with Aaron Copland's "Down a Country Lane" (1962), performed with the FHS Wind Ensemble.

Concerto competition winner will solo with MITSO

Lynn Heinemann
Office of the Arts

Graduate student Elisabeth Hon, one of two winners of the 2007 MIT Symphony Orchestra (MITSO) Concerto Competition, will be the soprano soloist for Mozart's "Exsultate Jubilate" in the orchestra's concert on Friday, March 16 at 8 p.m. in Kresge Auditorium. Also on the program, conducted by Paul Biss, is Beethoven's Symphony No. 1, Stravinsky's Firebird Suite and Grieg's Peer Gynt Suite. Tickets are $5 at the door and at zaptix.com/.

Elisabeth Hon

Hon, who is currently pursuing a Ph.D. in the speech communication group of the Research Laboratory of Electronics, has a long-standing love for Mozart's "Exsultate Jubilate": She has wanted to perform it since she first heard the "Alleluia" section while in high school.

Modestly noting that the piece was "too hard for me then," Hon pursued her academic career first, earning a bachelor's degree in electrical engineering and a certificate in music performance from Princeton University. She continued her vocal training through MIT's Advanced Music Performance (AMP) program, finally realizing her dream when she performed the "Exsultate" with piano accompaniment at her AMP recital last spring.

Her voice teacher, Kerry Deal, affiliated artist in the music and theater section, said that Hon has been "one of my star students at MIT for the past three years. She has the natural dramatic temperament and high level of musicianship that have made her wonderful to hear in both vocal repertoire recitals and as a soloist with the MIT choral groups."

Now Hon is excited about performing the "Exsultate" again. MITSO's full orchestral arrangement will add a "huge dimension to the sound and the scoring," she said.

"It's great to see how a year's growth can bring new life to (the) music," she added.

Hon's busy spring season will continue with her AMP recital on April 20 and an appearance as featured soloist in a performance of Giacomo Carissimi's "Japhte" with the Oriana Consort on April 29 (at the Swedenborg Chapel, Quincy and Kirkland streets, Cambridge).

Senior Matthew Roitstein, also a winner in MITSO's Concerto Competition, will perform C.P.E. Bach's concerto for flute in D minor at the symphony's May 20 concert.

Goleman will discuss 'social intelligence'

Daniel Goleman, who covers behavioral science and health for the New York Times, will deliver a talk titled "Social Intelligence" on Thursday, March 15, from 5 to 6:30 p.m. in W79-MPR—the Simmons Hall Multipurpose Room—at MIT. The talk is free and open to the public.

Twice nominated for the Pulitzer Prize for reporting, Goleman is the author of numerous books, including "Emotional Intelligence," "The Meditative Mind" and "Social Intelligence."

Goleman received the B.A. degree magna cum laude from Amherst College and the Ph.D. in psychology from Harvard University. He has traveled widely studying Buddhist and other spiritual systems of psychology.

Goleman's talk at MIT is sponsored by Residential Scholars @ Simmons Hall, Buddhist Community at MIT, The Prajnopaya Foundation, and Mandala @ MIT.

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STEM program fosters purpose, positive thinking

Middle school students get used to college goals

Erin Michael Salius
Engineering Outreach Programs

If the 40 middle school children who arrive at MIT on the first Saturday of each month seem well acclimated to undergraduate life at MIT, it is for good reason. At least once a month since September, these local public school students have traveled to campus to participate in a unique mentoring opportunity sponsored by the STEM Program (mit.edu/stem). STEM, which stands for Science, Technology, Engineering and Math, provides year-round educational enrichment for underserved youth from Boston and Cambridge.

After attending a five-week intensive academic experience on campus in the summer, the sixth through ninth grade STEM participants meet regularly with MIT students to build study skills, practice time-management techniques and talk about different challenges they face every day in school. In addition to the scholastic training and emotional support they receive from their mentors, STEM middle schoolers also get an insider's glimpse at what it's really like to attend a university like MIT. Over the past six months, they have toured campus, visited the MIT Museum, conducted experiments in labs and listened to presentations about cutting-edge research. And on March 3, they experienced yet another important "rite of passage" for any college student: movie day in the dorms.

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Taking the afternoon off for a much-needed study break from problem sets and lab reports, STEM mentors and mentees gathered together over brunch in one of MIT's dorms to watch an inspirational film. The movie about a young girl from the inner city who aspires to realize a seemingly impossible dream provided a forum for discussing each student's own aspirations in life—as well as potential stumbling blocks they might have to contend with along the way.

One seventh grader admitted to his mentor, "My greatest fear is to look at myself…a few years or decades from now and see my life totally messed up. I will overcome that fear by trying my best in school, getting a good education and job so I can live happy with my family."

It is exactly this sense of purpose and positive thinking that the STEM Program hopes to inspire in every middle school student it serves. The kids are getting the message. As an eighth grader put it, he has learned that "we should not be afraid of things we can't do, and instead do all that we can."

The STEM Program is directed by Nicole Stark of the Office of Engineering Outreach Programs in the School of Engineering, which also oversees academic-year and summer opportunities for high school students. MIT offers a number of community outreach programs that target students in grades K-12, including underserved youth. For more information, visit web.mit.edu/outreach/.

Work in progress

At top, STEM students Terrain Edwards-Grant, Darren Chanel-Volmar and Jamie Edwards support one another's success. Center, STEM program mentor Ernest Alba, left, studies with mentee Kevin Liang. At right, Colin Smith, left, digs into homework with his STEM mentor, Clinton Scroggins. All photos by Erin Salius.