

## Harvard-MIT Division of Health Sciences and Technology

The Harvard-MIT Division of Health Sciences and Technology (HST) brings together the Massachusetts Institute of Technology (MIT), Harvard Medical School (HMS), Harvard University, Boston-area teaching hospitals, and an assortment of research centers in a unique collaboration that integrates science, medicine, and engineering to solve problems in human health. Over 400 graduate students of science, medicine, engineering, and management take their training side by side at HST and are guided into vibrant careers as medical pioneers by HST's more than 60 full-time faculty.

HST trains its students to have a deep understanding of engineering, physical sciences, and the biological sciences complemented by hands-on experience in the clinic or in industry. Our students delve into the underlying quantitative and molecular science of medicine and biomedical research. Our faculty and graduates share a rare "dual citizenship" in medicine and fields as varied as physics, chemistry, engineering, computer science, and business. This interdisciplinary approach to biomedicine, conceived at HST in 1970, creates a unique culture that drives progress from the laboratory bench to the patient's bedside.

HST is committed to exploring the fundamental principles underlying health and disease; devising innovations that lead to new diagnostics and therapeutics that reduce human suffering; and training the next generation of physicians, scientists, and engineers to do the same. Our research centers and initiatives focus on technological specialties such as medical imaging, informatics, biomarkers, tissue regeneration, biomedical devices and systems, and micro- and nanoscale technologies. They bring together scientists, engineers, and physicians to apply these technologies across medical specialties in investigations that range from basic science explorations to applied research and development.

### HST Community

HST has 65 faculty members and 183 affiliates. Thirteen faculty members have primary appointments in HST, 52 have joint appointments in HST and another department at either Harvard or MIT. These numbers include faculty who have been newly recruited to Harvard/MIT as well as those who have primary appointments in other academic units but are newly appointed as joint or affiliated faculty in HST.

#### HST faculty, AY2007

Appointment type	Men	Women	Total	Underrepresented minorities
Primary/dual	11	2	13	3
Primary/dual, plus joint/second	59	6	65	7

In September 2006, 427 students were enrolled in HST's eight graduate programs. In addition, 27 students participated in our Summer Institute programs, and 150 undergraduate and 100 graduate students were members of the BioMatrix mentoring program. At HST's graduation ceremony in June 2007, we celebrated 87 newly conferred degrees, bringing the number of HST alumni to more than 1,250.

#### **Enrollment in HST degree programs, AY2007\***

<b>Degree program</b>	<b>Number of students</b>
Master's programs	55
MD	199
PhD	181
<b>Total</b>	<b>427</b>

\* Eight students simultaneously enrolled in HST MD and HST PhD programs are counted in both categories, but HST/MD students pursuing a PhD in another department at Harvard or MIT are only counted as MDs.

**HST Advisory Board and Council.** Realizing that the "bench to bedside" paradigm requires successful commercialization of new products and tools, HST has instituted a number of initiatives to bring members of the private sector closer to HST. In 1998, HST formed an Advisory Board and Council. The board has 11 members and was chaired during this academic year by Joshua Tolkoff. The board meets five times a year and attends two council meetings. The Advisory Council has 39 members and meets twice a year. The Advisory Board and Council are comprised of leaders in the medical device, biotech, venture capital, legal, and academic sectors, and have proved to be a valuable resource to HST on numerous fronts. This year the board and council, along with the HST Alumni Association board, sponsored HST's annual fundraiser for student support, An Evening of Anatomy. Held at Boston's Museum of Science on November 13, 2006, the event raised over \$70,000 and attracted 200 people.

**HST Alumni Association.** HST alumni banded together in March 2006 to form the HST Alumni Association, dedicated to increasing and strengthening the ties among alumni as well as between them and the HST community. The Alumni Association plans to provide resources to HST alumni for career development; to encourage regional activities for HST alumni; to build and populate an alumni web portal; to create at least one HST alumni event each year; to promote career opportunities for current HST students through internships and employment; to facilitate alumni/student interaction; to help develop a fundraising program targeted at alumni; and to foster HST brand recognition.

This year the alumni focused on three major initiatives: alumni/student roundtables, an annual alumni gathering, and an annual fundraiser (cosponsored with the Advisory Board and Council). The HST Alumni Association and the Joint Student Council created the Alumni/Student Roundtable Initiative to increase informal interaction between the two groups. Roundtables consist of an HST alumnus meeting with a small group of students over a meal to discuss a variety of personal and professional topics. The group held nine roundtables in AY2007. An alumnus who wishes to remain anonymous funded the Alumni/Student Roundtable Initiative.

The annual Alumni Association gathering was held at Legal Sea Foods on August 17, 2006 and was attended by over 80 faculty, staff, students, advisors, and alumni. Genzyme Corporation and David D. Fleming funded the gathering.

**HST Forum.** The 20th annual HST Forum was held on March 8, 2007 at the Athinoula A. Martinos Center for Biomedical Imaging in Charlestown. The forum featured a student poster session and keynote speech by Bruce R. Rosen, MD, PhD '84, entitled "Image is Everything." Dr. Rosen is the director of the Martinos Center and a professor of radiology at HMS. The student poster session, generously underwritten by gifts from Les Laboratoires Servier and NeuroMetrix, Inc., featured 78 student research posters that reflected a wide spectrum of research and represented all HST programs.

**HST Graduation.** Judah Folkman, MD, Julia Dyckman Andrus professor of pediatric surgery and professor of cell biology at HMS, and director of the Vascular Biology Program at Children's Hospital Boston (CHB), delivered the keynote address at HST's commencement on June 6, 2007. Eighty-seven degrees were awarded to 86 graduates. Twenty-five students graduated with PhD degrees, 21 received master's degrees, and 41 graduated with MD degrees. Ten students graduated with honors: eight *cum laude* and two *magna cum laude*.

**HST Faculty Research Retreat.** Twenty-eight members of HST's faculty—HST's research "nuclei"—along with seven staff members, met on June 26 at the Wellesley College Club for HST's third annual daylong retreat devoted to research presentations. Talks were presented by representatives of the Children's Hospital HST Informatics Program (CHIP) and the Wellman Center for Photomedicine at Massachusetts General Hospital (MGH), by several members of HST's faculty, and by one HST staff member. The talks were held to 10 minutes each, followed by a short discussion. This format contributed to a fast-moving program that introduced the participants to a wide range of research projects that present the potential for new interactions and collaborations. One talk focused on how to successfully publicize science news. At the end of the presentations, faculty discussed the implications of the proposed evolution of HST's Medical Engineering and Medical Physics (MEMP) PhD program.

**HST Faculty Poster Session.** Fifty faculty members affiliated with HST presented posters at the third annual HST Faculty Poster Session, a successful event that is an integral part of the fall academic schedule. The session allows faculty members to showcase their research and attract HST students to their labs, while also introducing new HST students to the rich and varied research opportunities available to them.

**HST Fundraising.** This year the HST Development Office launched a successful program to increase contributions and attract new donors. Activities included thanking current donors and developing a series of new publications—both online and in print—to cultivate prospects. This year, total unrestricted giving increased by 58 percent and the Irving M. London Society, HST's annual giving fund, had 145 new donors.

## Research Programs

HST research programs enhance HST's educational focus and facilitate progress in areas where the combined efforts of Harvard and MIT will yield outcomes superior to the efforts of the individual institutions. HST has made several advancements in its key research focus areas, as described below.

### Biomedical Imaging

HST MEMP student Peng Yu and affiliate Bruce Fischl of the Martinos Center applied mathematical modeling techniques to brain images to help researchers “see” how cortical folds develop and decay in infants and the elderly. The technique may help facilitate the early diagnosis of autism.

HST faculty member Greg Sorensen of the Martinos Center used magnetic resonance imaging to identify biomarkers that help identify and quantify an anti-angiogenesis drug's effect on the body in a phase 2 clinical trial. This technique may help improve the efficiency of drug development.

HST faculty member Brett Bouma and affiliate Guillermo Tearney of the Wellman Center for Photomedicine devised a new imaging probe using infrared laser light to deliver cellular-level resolution and ability to image a wide internal field. The prototype device has potential to dramatically improve early diagnosis of certain cancers and heart disease.

### Biomedical Informatics and Integrative Biology

HST MEMP student Tarjei Mikkelsen published twice in *Nature*, once for his sequencing of the opossum genome, and a second time for his genome-wide chromatin maps for embryonic stem cells. These maps suggest that cells contain an explicit code that reveals their history and alludes to their destiny.

HST MEMP student Timothy Lu applied synthetic biology to create a bacteriophage designed to eradicate biofilms—reservoirs of bacteria that become the sources of persistent infections in food processing and medical environments. The work may lead to libraries of phages that can be applied to attack various types of films.

Several HST affiliates working at CHIP developed a forecasting model that has the potential to increase the efficiency of drug development by helping to identify drugs likely to fail based on information about past successes and failures.

### Functional and Regenerative Biomedical Technologies

HST faculty member Sangeeta Bhatia devised multifunctional nanoparticles that home to tumors and clump there, allowing them to be visualized using magnetic resonance imaging and poisoning them for use as drug delivery tools.

HST faculty member Mehmet Toner applied microfluidics to create a business card-sized AIDS monitoring test kit. The kit will allow low-cost and low-tech monitoring of T cells—a key index of the severity of the disease. Toner and his colleagues are beginning testing of the kit in Africa and South America.

HST MEMP student Grace Kim helped develop an implant that contains nanoparticles that detect evidence of tumor growth and help determine the effectiveness of chemotherapy in cancer patients.

In addition to these and other accomplishments, HST is poised for changes that will enhance its research in the coming year:

**Space.** The renovation of MIT Building E25 began in 2006. This project, which will bring professors Edelman, Bhatia, Stultz, and Gray into the same building to join several other HST researchers, has a completion date of November 2007. The project will also bring HST staff down to the second floor, enhancing HST visibility in Building E25 and bringing staff closer to the student lounge on the third floor. HST anticipates that this renovation will significantly improve the faculty and student community through increased interactions and collaborations. The project is also a step towards building an HST space where we can invite partners and collaborators to come in and explore everything that HST has to offer.

The renovation of HST's Martinos Center's Building 75 at its Charlestown campus began in the spring of 2007 and the lease has been assumed by the Martinos Center. HST anticipates that this space will be open during AY2008. This building will house new imaging equipment, including a 15-Tesla spectrometer and a PET imaging laboratory.

**Organizing/unifying activities at other sites.** An ongoing goal of HST is to continue to facilitate MIT-Harvard interactions and collaborations, including interactions with the Harvard teaching hospitals.

In 2006, HST inaugurated the MIT Athinoula A. Martinos Imaging Center. The center, directed by HST faculty member John Gabrieli, is now a fully operational brain imaging research center located at the McGovern Institute for Brain Research at MIT.

HST has continued to recruit new MIT faculty, as well as Harvard Faculty, including David Cohen, Randy Buckner, Utkan Demirci and Jeffrey Karp. MGH, CHB, Beth Israel-Deaconess Medical Center (BIDMC), and Brigham and Women's Hospital (BWH) have all approached HST with requests to participate in recruiting new faculty.

In 2006 HST added a new hospital-based research center, the Brigham and Women's Hospital Biomedical Engineering Center, located in Cambridge on Landsdowne Street, dedicated to pioneering technological advances that can be rapidly translated to the clinical setting particularly in the areas of functional and regenerative medicine, nanoscale technologies, chemical biology, and technology for global health.

In addition, the NIH Blueprint for Neuroscience Research awarded HST's Martinos Center a grant for training in neuroimaging. This new program unites faculty and students from MGH, HST, the MIT Department of Brain and Cognitive Sciences, the Harvard Department of Psychology, and HMS to provide advanced training in multimodal neuroimaging for individuals from a wide range of backgrounds and expertise.

## Educational Programs

HST's educational programs are dedicated to training the next generation of leaders in medicine and science who are committed to bringing new advances to understand, prevent, treat and cure disease. Today, HST is among the largest biomedical engineering and physician scientist training programs in the United States, with 427 students enrolled in its eight graduate degree programs during AY2007.

In all of HST's unique educational programs, students are trained to have a deep understanding of engineering, physical sciences, and the biological sciences, complemented with hands-on experience in the clinic or in industry. HST graduate students work with eminent faculty and affiliated faculty members from the Harvard and MIT communities. Admission is very competitive for all of the programs, with acceptance rates between 5% and 10%. Whether pursuing careers in medicine, research, industry, or government, HST graduates have made outstanding contributions to advances in human health care.

## Initiatives

**GEMS Program.** During AY2007, HST launched the Howard Hughes Medical Institute (HHMI)-MIT Graduate Education in Medical Sciences (GEMS) program. GEMS was one of 13 awards made by HHMI. Some 51 universities vied for this new HHMI program, known as the Med into Grad Initiative: Integrating Medical Knowledge into Graduate Education. Dr. William Galey of HHMI explained that this funding program seeks "...to facilitate development of training programs that improve the understanding of medicine and pathology by PhD scientists conducting biomedical research." The GEMS program is offered under the auspices of HST through a collaborative effort among MIT, HMS, and three Harvard teaching hospitals (MGH, BWH, and BIDMC). GEMS is a part-time certificate program that can be taken concurrently with doctoral studies and research by students in the MIT's schools of Engineering and Science to gain exposure to biomedical and clinical sciences, including translational medicine. This educational experience addresses a national need articulated by HHMI: the growing gap between advances in basic biology and the translation of those advances into medically relevant therapies and tools for the improvement of human health.

Over 40 current MIT graduate students attended a GEMS information session held on campus in November 2006. Six highly qualified students were selected to form the first GEMS class, beginning its curriculum in February 2007.

GEMS students are being trained to bridge the widening chasm between concept and functional execution with a supplementary curriculum that entails: (1) a human pathology course, including molecular and cellular mechanisms of disease; (2) a medical pathophysiology course—a kaleidoscope of HST's pathophysiology curriculum; (3) an individualized clinical experience working with experienced mentors who move seamlessly between clinical medicine and basic biological research; (4) a seminar showcasing examples of translation; and (5) HST's Graduate Seminar, attended by all HST PhD candidates, focusing on the professional skills needed to succeed in interdisciplinary research (such as ethics, responsible conduct of research, and communication).

**Bioastronautics Training Program.** During AY2007, HST launched the Bioastronautics Training Program as a new option within HST's longstanding MEMP PhD program. Funded by the National Space Biomedical Research Institute (NSBRI), the program combines training in biomedical sciences, aerospace engineering, and space medicine, and is integrated with a similar program at Texas A&M University. The combination of science and engineering coursework, clinical experience, research internships, and thesis research prepares students for a broad range of possible career opportunities.

The challenge of bioastronautics is to protect the astronaut. An astronaut who travels for long periods far from Earth is affected by weightlessness, space radiation, and psychological stress, and is utterly dependent on artificial life support. Bones and muscles, cardiovascular regulation, and sensory-motor control depend on gravity on Earth and require protection during space flight. Bioastronautics supplies safety during and following long flights, including provision of air, water, food, and telemedicine, while dealing with the scientific issues of gravitational biology.

Four current MEMP students with appropriate research interests joined the Bioastronautics Training Program in AY2007. A successful recruiting and admissions cycle has resulted in two new bioastronautics students set to matriculate in September 2007. In the fall of 2006, Erika Brown, an HST bioastronautics student, completed an internship at ZERO-G Corp. and Kennedy Space Center, resulting in an unexpected contribution to facilitating Dr. Stephen Hawking's opportunity to experience weightlessness aboard a Zero-G aircraft. During the summer of 2007, two other HST bioastronautics students, Erez Lieberman and Dan Buckland, participated in the inaugural year of the Bioastronautics Summer Program at Baylor College of Medicine and Johnson Space Center; this summer program included an intensive week of lectures on all aspects of space life sciences from leaders in the field, followed by a one- to three-month-long research internship at Johnson Space Center.

**Other Training Grants.** In addition to new training grant funding from HHMI and NSBRI supporting the GEMS and Bioastronautics programs described above, the current academic year marked renewal of three other training grants central to HST's educational mission. First, the National Institutes of Health/National Science Foundation awarded HST a three-year renewal of the Bioengineering and Bioinformatics Summer Institutes grant supporting HST's Summer Institute in Biomedical Optics (see "Summer Institutes" below). Second, NIH/National Institute on Deafness and Other Communication Disorders awarded HST a five-year renewal of the training grant supporting students in HST's PhD program in Speech and Hearing Bioscience and Technology (SHBT). Finally, the National Library of Medicine (NLM) awarded HST (via Harvard) a five-year renewal of the biomedical informatics training grant supporting postdocs in the Biomedical Informatics Training Program, some receiving an SM from MIT.

Harvard's Biomedical Informatics Research Training Program, directed by Robert A. Greenes, MD, PhD, professor of HST with appointments at HMS and Harvard School of Public Health, was one of 18 programs to receive part of a \$75 million award from the NLM for information research training. The grant is administered through HST in cooperation with MIT, Tufts University, Boston University, and affiliated teaching hospitals, and provides support for 24 pre- and postdoctoral trainees each year.

**Summer Institutes.** Since 2003, HST has offered a variety of summer programs that aim to expose talented undergraduates, and particularly underrepresented minorities, to research in general and to HST in particular. During the summer of 2007, 27 students participated in three different tracks:

- The Biomedical Optics Summer Program, offered in partnership with the Wellman Laboratories of Photomedicine at MGH.
- The Research Experience for Undergraduates in Biomedical Engineering Education, offered as part of HST's involvement in the NSF-funded Vanderbilt-Northwestern-Texas-HST Engineering Research Center for Biomedical Engineering Education.
- The Summer Program in Bioinformatics and Integrative Genomics, offered in conjunction with the NIH-funded National Center for Biomedical Computing: Integrating Informatics from Bench to Bedside. Students in this program participate in some aspects of MIT's Summer Research Program (MSRP), which brings members of underrepresented minorities and individuals from economically disadvantaged backgrounds to MIT for a summer research experience.

In addition to our own summer programs, HST works closely with the MSRP leadership to place MSRP students for summer internships in the labs of HST faculty members.

Students in these summer programs attend lectures, hear talks from leaders in the field about their research, and participate in laboratory work under the supervision of a faculty mentor. Students participate in seminars designed to develop knowledge about how to conduct research responsibly and ethically. In addition, they receive guidance through both individual tutorials and workshops on how to prepare and present research findings. At the end of the summer, students make a formal presentation of their work to the faculty mentors.

Student responses indicate that combining a research experience with academic support is very successful. Students appreciate the multiple opportunities provided to network with their laboratory members, HST graduate students, faculty, and staff. The Summer Scholars Program is growing both in size and in diversity, and we are actively seeking funding from a number of sources to expand our offerings.

**BioMatrix.** In its seventh year, BioMatrix, the HST-sponsored mentoring community, had an active student membership of 250, including more than 50 freshmen joining at the beginning of their undergraduate careers. This student membership number includes MIT undergraduates, as well as a wide variety of graduate students pursuing PhD and MD degrees from HST, MIT, and Harvard. It also represents our having achieved an optimal balance among undergraduates, graduate students, and mentors.

The monthly dinner programs offered this year included learning about medical practice in a variety of settings; self-care and ways to prevent burnout; a film and discussion on environmental issues; a look at some of the vocational pursuits of mentor members; choosing between careers in academia and industry; and "speed mentoring," a very



popular program in which student members had brief conversations with many potential mentors, plus a follow-up program on “speed interviewing.” We continue to be grateful for the generous individual support from Anthony Williams of the HST Advisory Board, and institutional support from the MIT’s offices of the Deans for Student Life, Graduate Students, and Undergraduate Education.

### **Subjects Added or Significantly Modified in AY2007**

HST.187 Physics of Radiation Oncology – Sharpening the Edge, T. Bortfeld, J. Coderre (one-time special topic)  
 HST.410J Projects in Microscale Engineering for the Life Sciences, *D. Freeman, M. Gray*  
 HST.500 Frontiers in (Bio)Medical Engineering and Physics, *S. Bhatia, M. Poe*  
 HST.543 Cardiac Biophysics, *K. Parker* (Harvard FAS)  
 HST.576J Topics in Neural Signal Processing, E. Brown  
 HST.588 Neurotechnology Ventures, R. Ellis-Behnke (one-time special topic)  
 HST.594 Translational Medicine Seminars, *V. P. Sukhatme*  
 (initially offered as special topic HST.186 in spring 2007)  
 HST.727J The Lexicon and Its Features, *D. Gow, D. Steriade, K. N. Stevens, S. Shattuck-Hufnagel*  
 HST.973J Evaluating a Biomedical Business Concept  
 HST.979J Dynamics of Biomedical Technologies

### **Administration**

HST’s administrative home is located at the Whitaker College of Health Sciences and Technology at MIT. As one of the five medical societies at Harvard Medical School, HST also maintains an office at the medical school’s quadrangle campus in Boston.

After 10 years of leadership as codirector of HST for HMS, Joseph Bonventre, MD (HST ’76), PhD, stepped down in May 2007. David E. Cohen, MD (HST ’87), PhD, succeeds him in this post. Codirector for MIT Martha L. Gray, PhD (HST ’86), and Cohen report to the provost and to the vice president for research and associate provost at MIT, as well as to the HMS dean for basic sciences and graduate studies and the dean of HMS. Richard N. Mitchell, MD, PhD, and Lee Gehrke, PhD, serve as the division’s associate directors.

On October 6, 2006, the lobby of HST’s headquarters building was graced with a new face. A portrait of HST founder Irving M. London, MD, now hangs in the lobby of E25. London pioneered HST’s inter-institutional, collaborative model over 40 years ago and his active presence in HST’s headquarters has been an inspiration for students throughout the years. London’s portrait was presented to the HST community with much fanfare in a celebration that included comments from HST director Gray, former HST director Bonventre, HMS dean Joseph Martin, MIT president emeritus Howard Johnson, newly appointed HST director David Cohen, and Dr. London himself.

### **New Appointments, Promotions, Awards, and Honors**

#### **New Appointments to Faculty**

Kamran Badizadegan, MD, of MGH, an HST alumnus, was appointed to HST’s faculty this year. He also was appointed as principal research scientist in MIT’s George. R.

Harrison Spectroscopy Laboratory. His primary appointment is assistant professor of pathology, HMS, MGH. Dr. Badizadegan's research focus is spectroscopic methods for in vivo diagnosis and imaging, quantitative live cell microscopy, and cellular biology.

Utkan Demirci, PhD, joined the faculty through BWH. He will be part of the HST division at the BWH Landsdowne Street facility in Cambridge, where he will focus on applying micro- and nanoscale technologies to medical problems in global health and tissue engineering initiatives, including developing low-cost diagnostic devices for counting CD4+ T lymphocytes in HIV-infected patients in resource-limited settings; and on applying acoustic wave expertise to create picoliter-sized droplets that encapsulate single cells for cell-by-cell three-dimensional tissue generation.

Jeffrey Karp, PhD, joined the faculty from Robert Langer's laboratory. He too will be based at the HST division at the BWH Landsdowne Street facility, where he will focus on the development of polymeric devices and stem cell-based therapeutics to address key limitations in engineering replacement tissues and organs as well as biomimetic devices for cancer therapy and regenerative medicine.

### **Faculty Awards and Honors**

Elazer R. Edelman, the Thomas D. and Virginia W. Cabot professor of health sciences and technology was elected to the Institute of Medicine of the National Academies.

Farish A. Jenkins, Jr., Alexander Agassiz professor of zoology at Harvard and curator of mammalogy and vertebrate paleontology at Harvard's Museum of Comparative Zoology, discovered the *Tiktaalik rosea*, a discovery ranked fourth in the list of *Science Magazine's* Top Ten Breakthroughs of 2006.

Robert S. Langer, Jr., ScD, professor of health sciences and technology and Institute Professor at MIT, was awarded the National Medal of Science, the nation's highest science honor.

Jeffrey Flier, the George Reisman professor of medicine at HMS and BIDMC, was appointed dean of the HMS Faculty of Medicine.

Shiladitya Sengupta, PhD, assistant professor of medicine and health sciences and technology at HMS has been selected as a recipient of the 2006 MIT Global Indus Technovators Award in the category of biotechnology/medicine/healthcare. This award highlights the contributions of 10 outstanding individuals of Indus origin who are working at the forefront of technology and entrepreneurship.

Sengupta also won the Mary Kay Ash Charitable Foundation grant. Sengupta was selected as the HMS nominee for this award by the HMS Red Book nominating system. The award grants him \$100,000 over two years for his innovative translational research in breast cancer.

Sengupta was also one of three winners of the 2006 Era of Hope Scholar Award from the Department of Defense Breast Cancer Research Program. The award recognizes exceptionally talented, early-career scientists who have demonstrated that they are the best and brightest in their field and have shown a strong potential for leadership in breast cancer research. Sengupta created an anti-cancer drug delivery device, dubbed the nanocell.

William M. Kettle, MD, HST affiliated faculty and medical director and head of the MIT Medical Department, received a \$50,000 grant for research on patient safety from the medical malpractice insurer CRICO/RMF.

George Daley, MD, PhD, associate professor of biological chemistry and molecular pharmacology at HMS, was awarded the American Philosophical Society's 2006 Judson Daland Prize for his work on disease processes and the improvement of therapeutics using stem cell biology.

Lisa E. Freed, MD, PhD '88, principal research scientist at HST and MIT, was selected as one of the 2006 MIT Leader to Leader (L2L) fellows. L2L is a 12-month program that offers both a theoretical leadership framework and hands-on leadership experiences. Working with current senior MIT leaders and faculty, L2L fellows build skills through conversations, workshops, and presentations.

Nancy C. Andrews, MD, PhD, George Richards Minot professor of pediatrics at HMS and CHB and dean for basic sciences and graduate studies at HMS, and a Howard Hughes investigator, was elected vice president of the American Society for Clinical Investigation. She was also elected to the Institute of Medicine of the National Academies.

Raghu Kalluri, PhD, associate professor of medicine at HMS and BIDMC, has been chosen to lead the new Division of Matrix Biology at BIDMC. This division is the first of its kind in the country to reside within a department of medicine, and unique in its combination of matrix research and clinical medicine.

Kalluri also received the Everett Mendelsohn Excellence in Mentoring Award on March 20. This award from Harvard University honors faculty members who go out of their way to mentor graduate students.

Charles N. Serhan, PhD, the Simon Gelman professor of anaesthesia at HMS and BWH, received the DART/NYU Biotechnology Achievement Award for his work on inflammation and the discovery of lipoxins, a series of anti-inflammatory mediators.

Douglas A. Cotanche, PhD, associate professor of otology and laryngology at HMS and CHB, is one of the recipients of the 2007 HMS Faculty Prize for Excellence in Teaching. Cotanche teaches HST 010 Human Functional Anatomy.

Joseph V. Bonventre, Robert H. Ebert professor of medicine and health sciences and technology at HMS and Frederick J. Schoen, MD, PhD, professor of pathology and health sciences and technology at HMS, are directors of the newly established

Technology in Medicine Initiative at BWH's Biomedical Research Institute. They will also serve as liaisons between BWH and the Center for Integration of Medicine and Innovative Technology (CIMIT), a consortium of area teaching hospitals, universities, and research laboratories that develops medical devices.

Bonventre also received the 2007 Bywaters Award from the International Society of Nephrology for outstanding contributions to the understanding of acute renal failure.

Several HST faculty are among the newly elected members of the prestigious American Society for Clinical Investigation: John V. Frangioni, MD, PhD '94, associate professor of medicine at HMS and BIDMC; Matthew L. Meyerson, MD, PhD '93, associate professor of pathology at HMS and Dana-Farber Cancer Institute; and Kenneth D. Mandl, MD, associate professor of pediatrics at HMS and CHB.

The National Academy of Sciences has elected as one of its members Clifford D. Tabin, PhD, professor and head of the Department of Genetics at HMS.

Judah Folkman received the 2006 Jacobson Innovation Award from the American College of Surgeons. He was also awarded the Helen Keller Foundation's Prize for Vision Research. Both awards recognized his pioneering work in angiogenesis.

Folkman also won the Warren Alpert Foundation's 18th annual foundation prize for discovering that tumors require angiogenesis, and for championing the concept of anti-angiogenic therapies. The prize carries a \$150,000 award.

George M. Church, PhD, HST affiliated faculty and professor of genetics at HMS, was named one of *Scientific American* magazine's top 50 science and technology leaders. Church was recognized for his contribution to "off-the-shelf" technology to greatly reduce the cost of DNA sequencing, which will ultimately permit the decoding of a person's genes for routine medical purposes.

Martin L. Yarmush, MD, PhD, Helen Andrus Benedict professor of surgery (biological chemistry and molecular pharmacology) at HMS and MGH, was inducted in 2006 into the New Jersey High-Tech Hall of Fame in the Researcher Category.

Augustus A. White III, MD, PhD, Ellen and Melvin Gordon professor of medical education at HMS and professor of orthopedic surgery at HMS was honored at the annual meeting of the American Academy of Orthopedic Surgeons (AAOS) this spring in Chicago. He received the 2006 Diversity Award for his commitment to culturally competent care, and for promoting diversity in orthopedics.

Subra Suresh, ScD, Ford Professor of engineering at MIT and head of the Department of Materials Science and Engineering, has been named the first Tan Chin Tuan Centennial Professor by the National University of Singapore for his pioneering contributions in materials science and engineering, mechanical engineering, and biological engineering.

Suresh also received the 2007 European Materials Medal from the Federation of European Materials Societies for distinguished contributions to materials science and engineering.

Ali Khademhosseini, PhD, instructor in medicine at HMS and BWH, received funding for his proposal to the CIMIT Science Awards Program. His proposal, "Microencapsulation of cells within shape-controlled microgels as building blocks for tissue engineered organs," was selected for funding from 150 submissions.

Martha Gray, Edward Hood Taplin professor of medical engineering and electrical engineering at MIT, and Deborah Burstein, PhD '86, associate professor of medicine and health sciences and technology at HMS, have been selected for the 2007 Kappa Delta Elizabeth Winston Lanier Award by AAOS for their contributions to the field of orthopedic research, summarized by a paper titled, "Magnetic Resonance Imaging of Cartilage Glycosaminoglycan: Basic Principles, Imaging Technique, and Clinical Applications."

The National Space Biomedical Research Institute Education and Outreach Team received a Stellar Award from the Rotary National Award for Space Achievement Foundation, recognizing the team's "performance as a nationally recognized, top-tier program that is pioneering new models for exemplary teaching, training, and public outreach in support of the Vision for Space Exploration." The team honored with this award includes HST's Bioastronautics Training Program, led by Laurence Young, ScD, Apollo Program professor of astronautics and health sciences and technology at MIT.

Young also won a research award from the Deshpande Center for Technological Innovation for improving the design of safety helmets.

Peter Szolovits, PhD, professor of computer science and engineering and health sciences and technology at MIT, received the Award for Innovation in Personally Controlled Health Record Infrastructure given by the HMS Center for Biomedical Informatics. Presented at the first annual Harvard Medical School Meeting on Personally Controlled Health Records Infrastructure (PCHRI), this award recognizes Szolovits' guiding vision in the creation of the field of PCHRI.

Collin Stultz, MD ('97), PhD, assistant professor of health sciences and technology and electrical engineering and computer science, is the first recipient of the newly established Jonathan Allen Junior Faculty Award, given by the Research Laboratory of Electronics (RLE). The award recognizes innovative junior faculty in RLE and provides resources that will help them advance their academic careers at MIT.

Pervasis Therapeutics, Inc., founded in part by HST faculty members Elazer Edelman and Robert Langer, is a recipient of the Red Herring 100 Spring 2007, an award given to the top 100 North American companies "driving the future of technology."

Christopher Shera, PhD, associate professor of otology and laryngology and health sciences and technology at HMS and Massachusetts Eye and Ear Infirmary, won HST's Irving M. London Teaching Award.

Robert H. Rubin, MD, Gordon & Marjorie Osborne professor of health sciences and technology, HMS, won the 2007 Thomas McMahon Mentoring Award.

### **Student Awards and Achievements**

Kathleen H. Sienko, PhD '07, is the first graduate of the new HST Bioastronautics Training Program. Sienko is now assistant professor of mechanical engineering and bioengineering at the University of Michigan.

The HST Class of 2010 dominated the HMS Olympics, finishing in first place out of the five student societies for the second year running.

HST MD students Joshua Aronson, Irun Bhan, Sanjat Kanjilal, and Ai-ris Yonekura won HHMI Research Training Fellowships for Medical Students, which provide a year of full-time biomedical research training.

Adam Numis, an HST MD student, won the PASTEUR/Doris Duke Charitable Foundation Clinical Research Fellowship, a one-year opportunity in mentored clinical investigation for medical students interested in patient-oriented research as a possible career path.

Nelson Moussazadeh, an HST MD student, received the Sarnoff Cardiovascular Research Foundation Fellowship, which is designed to give medical students the opportunity to spend a year conducting intensive work in a biomedical research laboratory located at an institution other than their own medical school.

Leeland Ekstrom, an HST PhD student in the Radiological Sciences Joint Program, was inaugurated as president of the MIT Graduate Student Council.

Oaz Nir, an HST PhD student in MEMP/Bioinformatics and Integrative Genomics, was inaugurated as secretary of the MIT Graduate Student Council.

Joaquin Blaya, an HST PhD student in the MEMP program, has won a Carroll L. Wilson Award, which will allow him to continue working with Professor Paul Farmer's Partners in Health in Peru.

Blaya also received MIT's prestigious Hugh Hampton Young Memorial Fund Fellowship.

Euiheon Chung, HST PhD student in the MEMP program, received an award from the Optical Society of America, which is funded by the NSF, for his poster "Super-resolution Wide-field Imaging: Objective-launched Standing Wave Total Internal Reflection Fluorescence Microscopy."

HST MD students Suzana M. Zorca and Felipe Jain received first place in their respective sections at the first annual Medical Student, Resident, and Fellow Research Symposium of the Massachusetts Medical Society. Zorca presented her platelet carbohydrate research in the Basic Science section, and Jain won for his clinical research on Parkinson's disease.

HST MD students Fan Liang and Tian Zhang won two of the four Alexandra J. Miliotis Fellowships that were awarded to HMS students. Liang's research focuses on single chromosome amplification. Zhang studies small molecule inhibitors of JAK2 (v617F) in a murine model of polycythemia vera.

Irene Chen, PhD, MD '07, won the prestigious 2006 GE & Science Grand Prize for Young Life Scientists, an award worth \$25,000 from the journal *Science*, for her essay, "The Emergence of Cells During the Origin of Life," which was published in the December 8, 2006, issue.

Irun Bhan was chosen as a recipient of the Aid for Cancer Research Fellowship.

Susie Huang, PhD, a first-year HST MD student, received the Young Investigator Award from the European Society for Magnetic Resonance in Medicine and Biology at its annual conference for the scientific paper she presented on "Designing feedback-based contrast enhancement for in vivo imaging."

Stephanie Piecewicz, an HST PhD student in the MEMP program, was named one of four runners-up in the American Society for Pharmacology and Experimental Therapeutics Division of Cardiovascular Pharmacology's Graduate Student Best Abstract Award competition.

Gaurav Singal, an HST MD student, was named a 2007 Soros fellow by the Paul & Daisy Soros Foundation. The Soros fellows, all of them immigrants or children of immigrants, were selected from over 800 applicants from 257 undergraduate and 150 graduate institutions.

Lisa Treat, an HST PhD student in the MEMP program and a previous winner of the Whitaker Health Sciences Fund Fellowship for doctoral students in the life sciences or engineering, has been awarded a renewal of this award for a second year. Treat works in the Focused Ultrasound Laboratory of Brigham and Women's Hospital, and is developing an image-guided device designed to allow noninvasive, targeted drug delivery to cancerous areas in the brain.

Joey Feingold, an HST PhD student in the SHBT program, has been granted an extension of the Zakhartchenko Fellowship, an award targeted to students doing research in which time figures prominently. Joey's project concerns how the brain creates sequences of internally timed movements, and involves mapping the brain's processing of tasks that require pre-planning, such as speech and music performance.

## **Future**

Technology has transformed medicine to the point that HST today is no longer just a good idea. The collaborative and interdisciplinary work of HST is now prerequisite for medical discovery, advancement, and innovation. HST has spent the previous decade establishing itself as a place at MIT and HMS, and as a conduit between MIT, HMS, Harvard University, and the Harvard teaching hospitals. We have built a strong community of faculty, students, advisors, and alumni, and have created a series of

events that set a precedent for openness and collaboration that have become a part of HST tradition. HST has also expanded its academic repertoire with new programs that will provide more types of students with the tools they need to advance human health.

In the coming year, HST has plans to continue to strengthen its community, educational programs, and research centers.

**Community.** HST has plans to launch an internal community website that will help students, faculty, alumni, and others in the HST community to interact online in a shared dialog about career choices, HST curriculum changes, funding opportunities, collaborative research ideas, and socializing. This site will help build community ties and, by increasing the connections between HST people, we believe it will also increase the probability that interesting ideas will gain traction and turn into compelling advancements.

**Programs.** HST has announced a change in its MEMP doctoral program. Starting in 2008, HST will qualify its own students for doctoral candidacy. This change will eliminate HST's dependency on collaborating departments to qualify its students at MIT, but will not change HST's commitment to educating students with expertise in an engineering or physical science discipline or HST's close relationships with these departments at MIT.

**Infrastructure.** HST will complete its renovation of Building E25 at MIT in 2007 and its renovation of Building 75 in Charlestown in AY2008. The space in Building 75 will allow the Martinos Center to expand its already impressive collection of equipment by adding a 15-Tesla spectrometer and a PET imaging laboratory.

HST serves a vital role for MIT in facilitating the contributions of the Institute to the betterment of human health. Over 35 years it has developed an infrastructure and profile that brings MIT faculty together with Harvard faculty around educational and research programs. HST attracts students who want to be citizens of both universities so that they can take advantage of the strengths of both to develop the diagnostics and therapeutics that will transform how medicine is practiced and reduce the burden of disease.

**Martha L. Gray, PhD**

**Director**

**Edward Hood Taplin Professor of Medical and Electrical Engineering**

**David E. Cohen, MD, PhD**

**Director**

**Associate Professor of Medicine and Health Science and Technology**

*More information about the Harvard-MIT Division of Health Sciences and Technology can be found at <http://hst.mit.edu/>.*