

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, Harvard Medical School (HMS), Harvard University, and the Boston area teaching hospitals in a unique collaboration that integrates science, medicine and engineering to solve problems in human health. HST's administrative home is located at the Whitaker College of Health Sciences and Technology at MIT. HST also maintains an office at the HMS Quadrangle campus in Boston, as one of the five medical societies at Harvard Medical School. The HST director at MIT reports to the provost and to the vice president for research and associate provost at the Institute, and the HST director at Harvard Medical School reports to the HMS dean of medicine and dean for graduate education.

HST trains its students to have a deep understanding of engineering, physical sciences, and the biological sciences, complemented by hands-on clinical experience. HST faculty members are drawn from the Boston-area academic and medical communities and from fields as varied as physics, chemistry, engineering, computer science, and management. This interdisciplinary approach to biomedicine, conceived at HST in 1970, creates a unique inter-institutional experience for our student body.

HST researchers explore the fundamental principles underlying health and disease while also emphasizing the importance of translational research and working to develop new diagnostics and therapeutics. Research currently focuses on biomedical imaging, medical informatics, tissue regeneration, biomedical devices and systems, and micro- and nanoscale technologies.

Graduate Degree Programs

HST is among the largest biomedical engineering and physician scientist training programs in the United States, with 342 students enrolled in its graduate degree programs during AY2012:

- 185 MD and MD/PhD students (does not include seven MD/PhD students enrolled in the Medical Engineering and Medical Physics Program [MEMP])
- 147 PhD students: 112 in MEMP and 35 in Speech and Hearing Bioscience and Technology
- 10 master's students in the Biomedical Enterprise Program

HST graduate students work with faculty and affiliated faculty members from MIT, Harvard, and affiliated teaching hospitals. Whether pursuing careers in medicine, research, industry, or government, HST graduates have made outstanding contributions to advances in human health care.

MEMP trains students as engineers or physical scientists who also possess extensive knowledge of medical sciences. The program provides preclinical and clinical training to students. Typically students complete the program within seven years, and in some cases also pursue an MD.

The MD program is aimed at students interested in a research-based medical career. While eligible to complete the program in four years, students typically complete it in five or more years due to the research component of the curriculum. Students are strongly encouraged to conduct their research under the direction of a single faculty member during the program. Close to 80 percent of MD program alumni have a career path in academics.

Summer Institute

HST offers a specialized Summer Institute Bioinformatics and Integrative Genomics program. Sixteen students participated in summer 2011, and 17 enrolled in summer 2012.

This program offers a unique opportunity for outstanding undergraduate college students considering a career in biomedical engineering and/or medical science. Through hands-on research and in-depth lectures, participants learn about bioinformatics and engage in its application to solve problems in human health. Through individual tutorials and workshops, students learn to communicate their research findings effectively in written and oral formats. Shared living arrangements and a variety of technical and social activities enable Summer Institute participants to develop a network of peers and build strong, enduring connections with faculty working in the field.

Faculty Honors and Promotions

Professor Sangeeta Bhatia was elected to the Class of 2011 Fellows of the Biomedical Engineering Society.

Professor Emery Brown received the 2011 Jerome Sacks Award for Outstanding Cross-Disciplinary Research from the National Institute of Statistical Sciences.

Affiliated faculty member professor George Q. Daley was elected to the Institute of Medicine.

Professor Elazer Edelman received the 2011 Katz Prize in Cardiovascular Research and was elected to the National Academy of Engineering.

Associate Professor Ali Khademhosseini received the 2011 Pioneers of Miniaturization Prize from the Royal Society of Chemistry's *Lab on a Chip* journal and Corning Incorporated.

HST associate director Richard Mitchell was promoted to professor of pathology and health sciences and technology at HMS.

Professor Frederick J. Schoen received a 2011 Distinguished Alumni Award from Cornell University College of Engineering, Materials Science and Engineering.

Faculty Mentoring and Teaching Awards

Julie Greenberg, PhD, and Bruce Rosen, MD, PhD, received the Thomas A. McMahon Mentoring Award. Dr. Greenberg, HST's director of education and academic affairs, was noted for her daily long-term commitment to students and for her generous mentoring, as well as her unwavering advocacy of students in the context of institutional change in HST. Dr. Rosen was noted for his steady commitment to friendly mentoring and support, and his insightful research advice, all of which allow and encourage his students to perform the research they are passionate about.

Assistant professor Rachael A. Clark, MD, PhD, received the Seidman Prize for MD Research Mentorship for her active student advocacy and for serving as an exceptional role model for women physician-scientists.

Clinical instructor Anastasia Herta Koniaris, MD, received the Irving M. London Teaching Award for her inspiring teaching and outstanding, committed direction of HST 070 Human Reproductive Biology.

Professor R. Rox Anderson, MD, received the Biomedical Enterprise Program (BEP) Teaching Award for everything he's done for BEP and its students, both inside and outside the classroom—and for his generosity and enthusiasm that have allowed BEP students to explore new areas of clinical medicine.

Student Honors and Awards

The Office of the Dean for Graduate Education awarded the Hugh Hampton Young Memorial Fund Fellowship to James Ankrum, a PhD candidate in the MEMP program, for the second year in a row.

Carlos Pardo, PhD candidate in the MEMP program, received the second year of funding from the Howard Hughes Medical Institute International Student Research Fellowship for 2012–2013.

The following PhD candidates received National Science Foundation graduate research fellowships: Vyas Ramanan, Jacob Sargent, and Andrew Warren—all in the MEMP program—and Jonathon Sellon in the Speech and Hearing Bioscience Technology (SHBT) program.

The Hertz Foundation awarded fellowships to MD/PhD-MEMP student Allen Chen and MEMP student Vyas Ramanan. Allen Chen also received a National Defense Science and Engineering Graduate Fellowship.

MEMP student Justin Lee received the Department of Energy Computational Science Graduate Fellowship.

MEMP student Dustin Kendrick received a NASA Space Technology Fellowship.

SHBT student Jonathon Whitton was awarded the 2012–2013 Amelia Peabody Scholarship.

MEMP candidate Meghan Shan received the Poitras Pre-doctoral Fellowship.

Two PhD candidates in the MEMP program—Stephanie Yaung and George Xu—received a Legatum Seed Grant to support development of medical testing for newborns in China.

A team of PhD candidates in the MEMP program—Justin Lee, Adam Pan, Vyas Ramanan, Nikhil Vadhavkar and Andrew Warren—received a project award from the Bill & Melinda Gates Foundation for their proposal to develop unmanned aerial vehicles for developing-world countries that can be deployed by health care workers via cell phones to swiftly deliver vaccines to hard-to-reach locations.

MEMP Bioastronautics student Rachel Ellman received the Orville and Wilbur Wright Graduate Award from the American Institute of Aeronautics and Astronautics.

MEMP student Jean-Philippe Coutu received a fellowship from the Fonds de recherche en santé du Québec.

MEMP student Nuria Oliva Jorge received a La Caixa Foundation Fellowship.

MD student Ashley Stein received a fellowship from the American Heart Association.

SHBT student Shanqing Cai won two awards—the Acoustical Society of America's Raymond H. Stetson Fellowship and MIT's RLE Helen C. Peake Research Award.

SHBT student Naomi Bramhall won a scholarship from the American Speech-Language-Hearing Foundation.

MD student Alexander Bick (along with alumna and affiliated faculty member Dr. Priscilla Slanetz) received the 2011 Massachusetts Medical Society Information Technology Award.

MEMP student Uri Laserson was a finalist in this year's Lemelson Prize competition.

MD candidate Salil Garg won this year's Seidman Thesis Prize.

Research Program

Highlights

Professor Robert Langer received numerous honors this year including the 2012 American Chemical Society's Priestley Medal, the 2012 Terumo Global Science Prize (conferred by the Terumo Life Science Foundation), the Chemical Heritage Foundation's 2012 Perkin Medal, and the 2012 Wilhelm Exner Medal, given annually in Austria by the Oesterreichischer Gewerbeverein. Langer's research is at the interface of medicine and materials science and chemical engineering. Professor Langer and his team are developing new nanoparticles for treating cancer and other diseases.

Dr. Emery Neal Brown, professor of brain and cognitive sciences and health sciences and technology, also received numerous honors this year including the National Institutes of Health Director's Transformative Research Award. In April 2012 Dr. Brown was elected to the American Academy of Arts and Sciences for contributions in neuroscience.

In August 2012, MIT researchers led by Professor Sangeeta Bhatia developed RNA-delivering nanoparticles that allow for rapid screening of new drug targets in mice. By sequencing cancer-cell genomes, scientists discovered vast numbers of genes that are mutated, deleted, or copied in cancer cells. This treasure trove is a boon for researchers seeking new drug targets, but it has been nearly impossible to test them all in a timely fashion.

In February 2012, Elazer R. Edelman, Thomas D. and Virginia W. Cabot professor of health sciences and technology, was among 66 new members and 10 foreign associates elected to the National Academy of Engineering for contributions to the design, development, and regulation of local cardiovascular drug-delivery and drug-eluting stents.

MIT researchers led by Professor Edelman have shown that implanted cells' therapeutic properties depend on their shape, which is determined by the type of scaffold on which they are grown. The work could allow scientists to develop even more effective implants and also target many other diseases, including cancer.

Events

HST Faculty Poster Session

Approximately 50 faculty members and 100 students attended the eighth annual HST Faculty Poster Session, held on October 6 at the Tosteson Medical Education Center at HMS. Forty-five faculty posters were on exhibit, representing all HST programs. Some posters represented broad research programs, while others presented specific research projects; some included student co-authors. This annual event familiarizes faculty members with their colleagues' research and allows them to recruit students to their laboratories. It also assists students in beginning the process of selecting laboratories and mentors for their research.

HST Forum

The 25th HST Forum was held on April 19 at the Tosteson Medical Education Center. At this event showcasing student research, the exciting depth and breadth of HST science and accomplishment are highlighted for MD and PhD candidates, faculty, staff, and other members of the HST, HMS, and MIT communities.

This year approximately 140 people attended the forum, including 38 students who presented posters on their research. The poster session was followed by a keynote address given jointly by MIT Institute Professor Phillip Sharp and his advisee HST MD/PhD student Arvind Ravi, through which they treated the audience to a unique view of a dynamic mentor/mentee relationship. The joint address was a fitting way to celebrate the 25th anniversary of the forum and was well received by current and prospective members of the HST community.

In the context of an impressive array of articulately presented student research, the following students received the Martha Gray Prize for Excellence in Research in the categories named:

Jesse Engreitz (MEMP program), Bioinformatics and Integrative Genomics
 Alexandra German (MEMP program), Physiology and Systems Biology
 Jessica Lacy (MD program), Imaging, Acoustics, and Optics
 Nathan Reticker-Flynn (MEMP program), Biomedical Devices
 William Hwang (MD/PhD program), Cell and Molecular Biology
 Daniel Macaya (MEMP program), Regenerative and Rehabilitative Biomedical Engineering

Priorities

The senior administration of both MIT and HMS continued their concerted effort toward refocusing HST's educational priorities on its core academic mission: the PhD and MD programs. Following the Ad-Hoc Committee to Explore Options for the Structure of the Harvard-MIT Health Sciences and Technology Effort at MIT recommendations in May 2011, provost L. Rafael Reif and vice president for research Claude Canizares announced the establishment of an [Institute for Medical Engineering and Science \(IMES\)](#) at MIT in February 2012. With support from HMS, the Engineering Council, the Academic Council, and the Corporation Visiting Committee for HST, IMES will have ongoing responsibility for the HST Program.

Launched on July 1, 2012, IMES aims to pioneer novel research and graduate education paradigms to advance health and educate the next generation of leaders working at the convergence of engineering, science, and clinical medicine. IMES has three important immediate goals:

- To serve as an integrative force across MIT and create an intellectual hub of research and education at the convergence of engineering, science, and translational and clinical medicine
- To create strategic partnerships with collaborating hospitals and industry that could be transformative for health care and medicine
- To provide a robust home for the HST program

Achieving these goals is expected to benefit all units at MIT and collaborating institutions in the Boston area. In support of these ambitions, IMES draws on HST's 40-plus years of providing world-class training to leaders in medicine and healthcare. HST's MD and PhD educational programs and partnership with the Harvard Medical School form a significant historical, structural, and administrative underpinning that is important for IMES potential and growth. IMES anticipates significant growth in educational and research programs as partnerships with the hospitals are put in place and new faculty members are recruited in partnership with MIT departments. In partnership with HMS, IMES will also play a significant role in educating physician-scientists and physician-engineers who can integrate approaches from the physical sciences and engineering with the practice and science of medicine.

Arup K. Chakraborty
Director

Robert T. Haslam
Professor of Chemical Engineering, Chemistry, Physics, and Biological Engineering