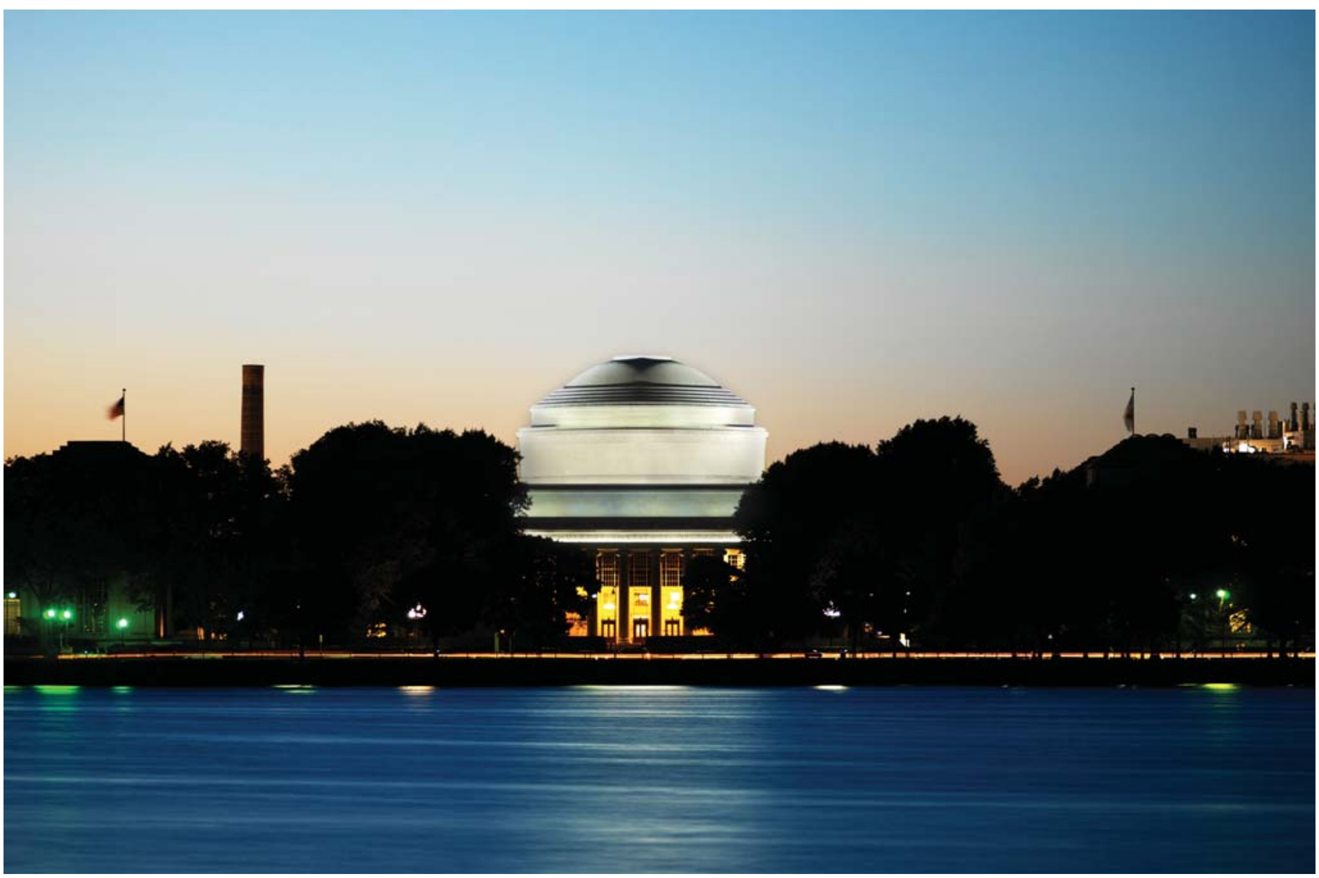
MIT Briefing Book

2011 Massachusetts Institute of Technology



Briefing Book

Massachusetts Institute of Technology
2011 edition

Researched and written by a variety of MIT faculty and staff, in particular the members of the Office of the Provost/Institutional Research, Office of the President, Office of Sponsored Research, Student Financial Services, and the MIT Washington Office.

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MIT Washington Office

The MIT Washington Office was established in 1991 as part of the President's Office. The mission of the MIT Washington Office is to represent the Institute in Washington as one of the nation's premier academic institutions. The role of the Washington Office has also evolved over time to include a role in educating MIT's students in the science and technology policy-making process.

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1 MIT Facts and History

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MIT Facts and History

The Massachusetts Institute of Technology is one of the world's preeminent research universities, dedicated to advancing knowledge and educating students in science, technology, and other areas of scholarship that will best serve the nation and the world. It is known for rigorous academic programs, cutting-edge research, a diverse campus community, and its longstanding commitment to working with the public and private sectors to bring new knowledge to bear on the world's great challenges.

William Barton Rogers, the Institute's founding president, believed that education should be both broad and useful, enabling students to participate in "the humane culture of the community," and to discover and apply knowledge for the benefit of society. His emphasis on "learning by doing," on combining liberal and professional education, and on the value of useful knowledge continues to be at the heart of MIT's educational mission.

MIT's commitment to innovation has led to a host of scientific breakthroughs and technological advances. Achievements of the Institute's faculty and graduates have included the first chemical synthesis of penicillin and vitamin A, the development of inertial guidance systems, modern technologies for artificial limbs, and the magnetic core memory that enabled the development of digital computers. Exciting areas of research and education today include neuroscience and the study of the brain and mind, bioengineering, energy, the environment and sustainable development, information sciences and technology, new media, financial technology, and entrepreneurship.

University research is one of the mainsprings of growth in an economy that is increasingly defined by technology. A study released in February 2009 by the Kauffman Foundation revealed that MIT graduates had founded 25,800 active companies. These firms employed about 3.3 million people, and generated annual world sales of $2 trillion, or the equivalent of the eleventh-largest economy in the world.

MIT has forged educational and research collaborations with universities, governments, and companies throughout the nation and world, and draws its faculty and students from every corner of the globe. The result is a vigorous mix of people, ideas, and programs dedicated to enhancing the world's well-being.

In the spring of 2011, MIT observed the 150th anniversary of the signing of its charter in 1861. To mark the historic event, MIT launched MIT150, a 150-day-long celebration of MIT's innovative past and continued role in the development of technology. In her welcome to the celebration the sixteenth president of MIT, Susan Hockfield, wrote, "In the current era, I believe MIT is called once again to an important role. We can demonstrate that progress is possible against the great global problems of today and tomorrow— energy, climate, water, poverty, megacities, disease—through science and technology deeply informed by wise policy and pursued headlong with the can-do culture of MIT. Building on our entrepreneurial spirit, we can deliver innovators and innovations that will drive the next wave of economic growth. We can set a path toward a new future for American manufacturing, through innovative systems, processes, and materials. And MIT can inspire the next generation of young people, from every background, to understand that engineering, math and science can give them the exhilarating power to participate—as the active explorers, entrepreneurs, and inventors who will design the future. MIT has made revolutionary contributions over the course of our first 150 years, and equally important work lies ahead."

People

Total MIT-affiliated people in Massachusetts	50,000+
Employees	13,800
Cambridge Campus	10,485
Lincoln Laboratory	3,195
Students	10,566
Alumni in Masssachusetts	Approximately 20,000

Economic Information

Total MIT Expenditures in FY 2010	$2.4 billion

Federal Research Expenditures

Cambridge campus (MIT FY 2010)	$627 million
Lincoln Laboratory* (MIT FY 2010)	$753 million
SMART* (MIT FY 2010)	$21 million
Total (MIT FY 2010)	**$1.401 billion**

*Totals do not include research performed by Campus Laboratories for Lincoln Lab and Singapore-MIT Alliance for Research and Technology ("SMART")

Payroll, including Lincoln Laboratory (FY 2010)	$967 million

Technology Licensing Office

The Technology Licensing Office (TLO) manages the patenting and licensing process for MIT, Lincoln Laboratory, and the Whitehead Institute. The TLO aims to benefit the public by moving results of MIT research into societal use via technology licensing.

Statistics for FY 2010

Total number of inventions disclosures	530
Number of U.S. new utility patent applications filed	184
Number of U.S. patents issued	166
Number of licenses and options granted (not including trademarks and end-use software)	57
Number of options granted (not including options as part of research agreements)	34
Number of software end-use licenses granted	13
Number of companies started (venture capitalized and/or with a minimum of $500K of other funding)	16

Students

The Institute's student body of 10,566 is highly diverse. Students come from all 50 states, the District of Columbia, three territories and dependencies, and 118 foreign countries. U.S. minority groups constitute 48 percent of undergraduates and 19 percent of graduate students. The Institute's 2,966 international students make up 9.5 percent of the undergraduate population and 38 percent of the graduate population. For more information about international students at MIT, see pages 86-88.

Student Profile 2010-2011

Undergraduate	4,299
Graduate	6,267
Total	10,566

Undergraduate
45 percent female 55 percent male
Graduate
31 percent female 69 percent male

In Fall 2010, 46 percent of MIT's first-year students (who submitted their class standing) were first in their high school class; 93 percent ranked in the top 5 percent.

Members of U.S. minority groups: 3,286

	Undergraduate*	Graduate*
African American	332	131
Asian American	1,030	710
Hispanic American	578	270
Native American	37	24
Native Hawaiian or other Pacific Islander	1	0
Two or more races	100	73
Total	**2,078 (48%)**	**1,208 (19%)**

*These figures may not precisely reflect the population because they are self-reported, and not all students choose to identify an ethnicity or race. 228 undergraduates and 589 graduate students chose not to identify an ethnicity or race.

Degrees

In 2009-2010, MIT awarded 3,296 degrees:

Doctoral degrees	583
Master's degrees	1,580
Professional Engineer degrees	17
Bachelor of Science degrees	1,116

45 percent of MIT Ph.D. graduates remain in Massachusetts.

Nearly half of 2009-2010 graduates from MIT Ph.D. programs planned to stay in Massachusetts after completing their studies, according to the annual Doctoral Student Exit Survey. Conducted by the Office of the Provost/Institutional Research, the survey found that 49 percent of respondents intended to remain in the Bay State. This compares to roughly 9 percent of those earning degrees who indicated they attended high school in Massachusetts — a rough gauge of who among degree recipients were native to the state.

Faculty, Staff, and Trustees

Faculty/Staff 2010-2011

Faculty	1,017
Other academic and instructional staff	861
Research staff and research scientists (includes postdoctoral positions)	2,882
Administrative staff	2,267
Support staff	1,476
Service staff	789
Medical clinical staff	103
Affiliated faculty, scientists, and scholars	1,090
Total campus faculty and staff	**10,485**

In addition, approximately 590 graduate students serve as teaching assistants or instructors, and 2,390 graduate students serve as research assistants.

MIT Lincoln Laboratory employs about 3,200 people, primarily at Hanscom Air Force Base in Lexington, Massachusetts.

Faculty Profile

63 percent hold the rank of Full Professor
21 percent hold the rank of Associate Professor
16 percent hold the rank of Assistant Professor
76 percent of faculty are tenured

Professors	643
Associate professors	214
Assistant professors	160
Faculty with dual appointments	39
Total	**1,017**

64 percent of the faculty are in Science and Engineering fields.

School	Faculty
Architecture and Planning	77
Engineering	370
Humanities, Arts, and Social Sciences	166
Science	276
Sloan School of Management	108
Whitaker College	8
All others	12

Gender	Faculty	Percent
Male	801	79
Female	216	21

Minority Group Representation

20 percent of faculty are members of a minority group; 7.2 percent are members of an underrepresented minority.*

American Indian or Alaskan Native
1 female 2 males

Black or African American
11 females 26 males

Hispanic
4 females 31 males

Asian
32 females 99 males

*Some faculty members identify as part of multiple groups.

Alumni

MIT's 122,000 alumni are connected to the Institute through graduating-class events, departmental organizations, and over 48 clubs in the United States and 41 abroad. More than 9,500 volunteers offer their time, financial support, and service on committees and on the MIT Corporation, the Institute's Board of Trustees. MIT graduates hold leadership positions in industries and organizations around the world. An estimated 20,000 alumni reside in Massachusetts, and about 85 percent of MIT's alumni live in the United States.

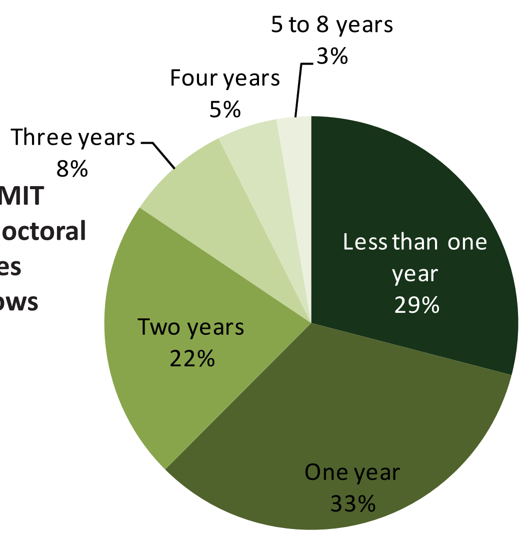
Postdoctoral Appointments

In 2010, MIT hosted more than 1,000 postdoctoral associates and fellows. These individuals work with faculty in academic departments, laboratories, and centers.

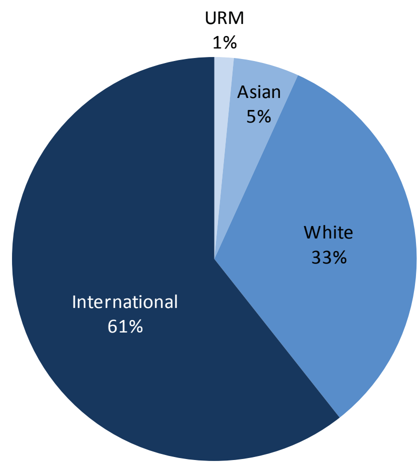
As of October 31, 2010	
American Indian or Alaskan Native	2
Black or African American	4
Hispanic or Latino	14
Total URM	**20**
Asian	68
White	423
International	787
Total	**1,278**
Female	361
Male	937

Country of Citizenship	Count	Percent of Total
China	149	19
Rep. of Korea	76	10
India	68	9
Germany	57	7
Canada	49	6
Italy	32	4
Spain	32	4
France	31	4
Japan	27	4
Israel	26	3
All Others	240	30
Total	**787**	

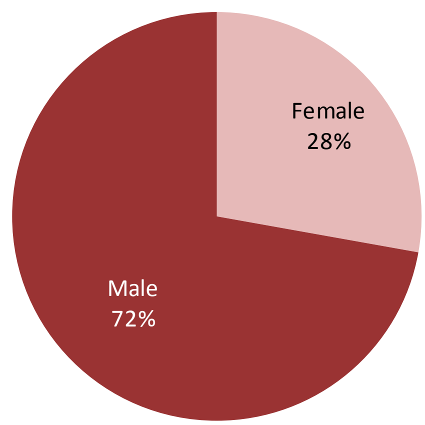
Years at MIT All Postdoctoral Associates and Fellows



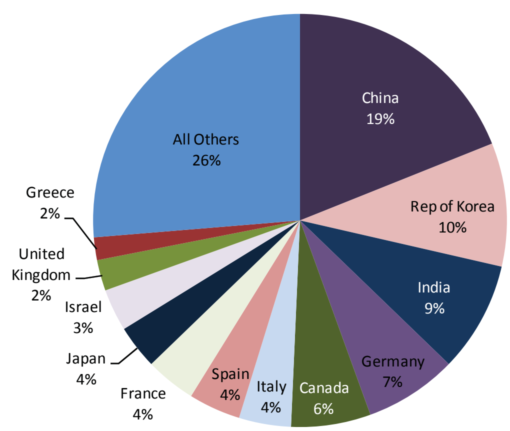
Ethnicity of Postdoctoral Associates and Fellows



Gender of Postdoctoral Associates and Fellows



Country of Citizenship of International Postdoctoral Associates and Fellows



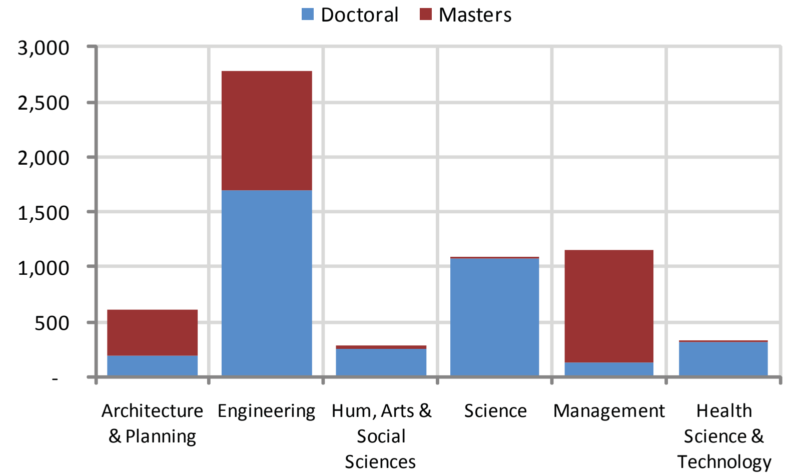
Graduate Students

As of October 31, 2010 there were 6,267 graduate students at MIT—2,611 masters students and 3,656 doctoral students.

Citizenship	Count
U.S. Citizen	3,621
U.S. Permanent Resident	290
International	2,356
Total	**6,267**

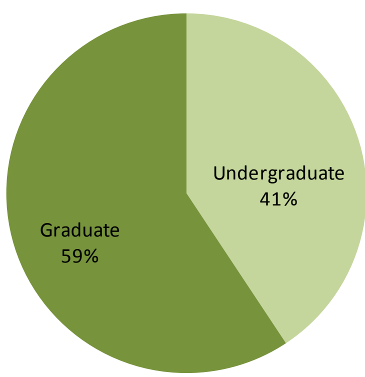
Graduate Level	Count
Doctoral	3,656
Masters	2,611

Graduate Students by School and Degree Level

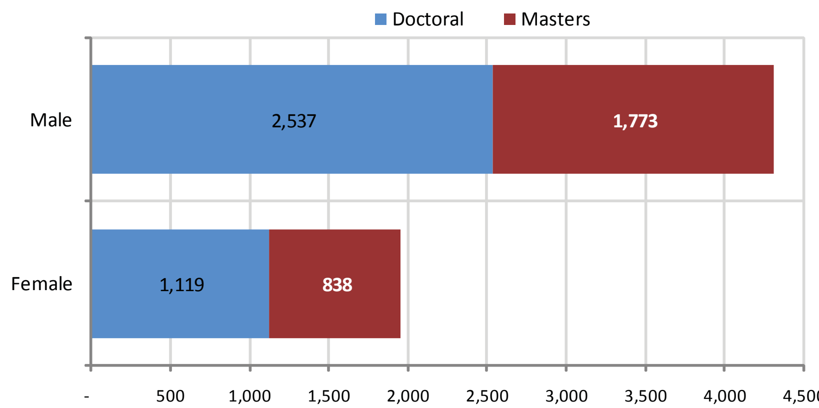


	Graduate Level		
School Name	Doctoral	Masters	Grand Total
Architecture & Planning	189	417	606
Engineering	1,690	1,095	2,785
Hum, Arts & Social Sciences	264	18	282
Science	1,071	28	1,099
Management	128	1,033	1,161
Health Science & Technology	314	20	334
Grand Total	3,656	2,611	6,267

Graduate Students as a Percentage of the Total Student Population



Graduate Students by Gender and Degree Level



Awards and Honors of Current Faculty and Staff

1 **Nobel Prize in Chemistry**
2 **Nobel Prizes in Economic Sciences**
3 **Nobel Prizes in Medicine/Physiology**
3 **Nobel Prizes in Physics**

The following awards are listed by number of current faculty and staff who have received the award, award name, and awarding agency.

3 **A. M. Turing Award**
Association for Computer Machinery

2 **Alan T. Waterman Award**
National Science Foundation

139 **American Academy of Arts and Sciences Member**
American Academy of Arts and Sciences

99 **American Association for the Advancement of Science Fellow**
American Association for the Advancement of Science

15 **American Philosophical Society Member**
American Philosophical Society

74 **American Physical Society Fellow**
American Physical Society

5 **Dirac Medal**
Abdus Salam International Exchange of Scholars

6 **Fulbright Scholars Program**
Council for International Exchange of Scholars

7 **Gairdner International Award**
Gairdner Foundation

74 **Guggenheim Fellow**
John Simon Guggenheim Memorial Foundation

2 **HHMI Alumni Investigator**
3 **HHMI Early Career Scientist**
16 **HHMI Investigator**
2 **HHMI Professor**
Howard Hughes Medical Institute (HHMI)

32 **Institute of Medicine Member**
National Academies

1 **International Cosmos Prize**
Expo '90 Foundation

3 **John Bates Clark Medal**
American Economic Association

3 **John von Neumann Medal**
Institute of Electrical and Electronics Engineers (IEEE)

21 **MacArthur Fellow**
John D. and Catherine T. MacArthur Foundation

1 **MRS Medal**
Materials Research Society

62 **National Academy of Engineering Member**
78 **National Academy of Sciences Member**
National Academies

8 **National Medal of Science**
1 **National Medal of Technology and Innovation**
National Science and Technology Medals Foundation

26 **Presidential Early Career Awards for Scientists and Engineers (PECASE)**
Executive Office of the President, Office of Science and Technology Policy

3 **Pulitzer Prize**
Pulitzer Board

2 **Rolf Nevanlinna Prize**
International Mathematical Union (IMU)

Peter Diamond
2010 Nobel Prize in Economic Sciences

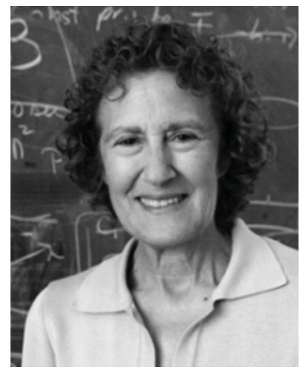
Diamond received the award along with two co-winners, Dale T. Mortensen of Northwestern University and Christopher A. Pissarides of the London School of Economics and Political Science. Diamond received the award for his analysis of the foundations of search markets. His model helps explain the ways in which unemployment, job vacancies, and wages are affected by regulation and economic policy.

http://nobelprize.org/nobel_prizes/economics/laureates/2010/press.html

Barbara Liskov
2008 A. M. Turing Award

Liskov received the award for her pioneering "contributions to practical and theoretical foundations of programming language and system design, especially related to data abstraction, fault tolerance, and distributed computing." Liskov is the second woman ever to receive the award, which is often described as the "Nobel Prize in Computing."

http://awards.acm.org/citation.cfm?id=1108679&srt=year&year=2008&aw=140&ao=AMTURING&yr=2008



Susan Lindquist
2010 National Medal of Science

Lindquist received the award, the nation's highest science honor, "For her studies of protein folding, demonstrating that alternative protein conformations and aggregations can have profound and unexpected biological influences, facilitating insights in fields as wide-ranging as human disease, evolution, and biomaterials."

http://www.nsf.gov/od/nms/recip_details.cfm?recip_id=5300000000465

Presidential Early Career Awards for Scientists and Engineers (PECASE)

In 2010, seven MIT researchers received this presidential award, the nation's highest honor for scientists at the beginning of their professional careers. They are Martin Zwierlein, Amy Finkelstein, Manolis Kellis, Scott Aaronson, Michael Laub, Laura Schultz, and Katrin Wehrheim. The awards—established in 1996—honor and support scientists and engineers whose work shows promise in advancing the nation's goals, tackling grand challenges, and contributing to the American economy. Currently, 24 MIT faculty members and 2 MIT staff members have received the PECASE award, including the 2010 recipients.

Fields of Study

MIT supports a large variety of fields of study, from science and engineering to the arts. MIT's five academic schools are organized into departments and other degree-granting programs. In addition, several programs, laboratories, and centers cross traditional boundaries and encourage creative thought and research.

School of Architecture and Planning

Architecture
Program in Media Arts and Sciences
Center for Real Estate
Urban Studies and Planning

School of Engineering

Aeronautics and Astronautics
Biological Engineering
Chemical Engineering
Civil and Environmental Engineering
Electrical Engineering and Computer Science
Engineering Systems Division
Materials Science and Engineering
Mechanical Engineering
Nuclear Science and Engineering

School of Humanities, Arts, and Social Sciences

Anthropology
Comparative Media Studies
Economics
Foreign Languages and Literatures
History
Linguistics and Philosophy
Literature
Music and Theatre Arts
Political Science
Science, Technology, and Society
Writing and Humanistic Studies

Sloan School of Management

Management Science
- Finance
- Information Technology
- Marketing Science
- Operations Research

School of Science

Biology
Brain and Cognitive Sciences
Chemistry
Earth, Atmospheric, and Planetary Sciences
Mathematics
Physics

Interdisciplinary Educational Programs

Computational and Systems Biology
Computation for Design and Optimization
Energy Studies, Minor
Harvard-MIT Division of Health Sciences and Technology
Leaders for Global Operations
Microbiology
Operations Research
Program in Polymer Science and Technology
MIT-Woods Hole Joint Program in Oceanography and Applied Ocean Science and Engineering
Women's Studies

Major Research Laboratories, Centers, and Programs

In addition to teaching and conducting research within their departments, MIT faculty, students, and staff work in MIT's interdisciplinary laboratories.

These include the following:

Center for Advanced Visual Studies
http://cavs.mit.edu/

Center for Biomedical Engineering
http://web.mit.edu/cbe/www/

Center for Biomedical Innovation
http://web.mit.edu/cbi/

Center for Collective Intelligence
http://cci.mit.edu/

Center for Computational Research in Economics and Management Science
http://mitsloan.mit.edu/research/computational.php

Center for Digital Business
http://ebusiness.mit.edu/

Center for Educational Computing Initiatives
http://ceci.mit.edu/

Center for Energy and Environmental Policy Research
http://web.mit.edu/ceepr/www/

Center for Environmental Health Sciences
http://cehs.mit.edu/

Center for Future Civic Media
http://civic.mit.edu/

Center for Global Change Science
http://web.mit.edu/cgcs/www/

Center for Gynepathology Research
http://web.mit.edu/cgr/

Center for Innovation in Product Design
http://dspace.mit.edu/handle/1721.1/3764

Center for International Studies
http://web.mit.edu/cis

Center for Materials Research in Archaeology and Ethnology
http://http://web.mit.edu/cmrae/index.html

Center for Materials Science and Engineering
http://web.mit.edu/cmse/

Center for Real Estate
http://web.mit.edu/cre/

Center for Technology, Policy, and Industrial Development
http://engineering.mit.edu/research/labs_centers_programs/ctpid.php

Center for Transportation and Logistics
http://engineering.mit.edu/research/labs_centers_programs/ctl.php

Clinical Research Center
http://web.mit.edu/crc/www/

Computer Science and Artificial Intelligence Laboratory
http://csail.mit.edu/

The Dalai Lama Center for Ethics and Transformative Values
http://thecenter.mit.edu/

Deshpande Center for Technological Innovation
http://web.mit.edu/deshpandecenter/

Division of Comparative Medicine
http://web.mit.edu/comp-med/

Francis Bitter Magnet Laboratory
http://web.mit.edu/fbml/

Haystack Observatory
http://www.haystack.mit.edu

Institute for Soldier Nanotechnologies
http://web.mit.edu/isn/

Joint Program on the Science and Policy of Global Change
http://globalchange.mit.edu/

David H. Koch Institute for Integrative Cancer Research
http://web.mit.edu/ki/

Knight Science Journalism Fellows Program
http://web.mit.edu/knight-science/

Laboratory for Financial Engineering
http://lfe.mit.edu/

Laboratory for Information and Decision Systems
http://lids.mit.edu/

Laboratory for Manufacturing and Productivity
http://web.mit.edu/lmp/

Major Research Laboratories, Centers, and Programs (continued)

Laboratory for Nuclear Science
http://web.lns.mit.edu

Lean Advancement Initiative
http://lean.mit.edu/

Legatum Center for Development and Entrepreneurship
http://legatum.mit.edu/

Lemelson-MIT Program
http://web.mit.edu/invent

Materials Processing Center
http://mpc-web.mit.edu/

McGovern Institute for Brain Research
http://mit.edu/mcgovern/

Media Laboratory
http://www.media.mit.edu

Microsystems Technology Laboratory
http://mtlweb.mit.edu

MIT Center for Digital Business
http://digital.mit.edu/

MIT Energy Initiative
http://web.mit.edu/mitei

MIT Entrepreneurship Center
http://entrepreneurship.mit.edu

MIT Kavli Institute for Astrophysics and Space Research
http://space.mit.edu/

MIT Mind Machine Project
http://mmp.cba.mit.edu

MIT-Portugal Program
http://mitportugal.org/

Nuclear Reactor Laboratory
http://web.mit.edu/nrl/www/

Office of Professional Education Programs
http://web.mit.edu/professional/

Operations Research Center
http://web.mit.edu/orc/www/

Picower Institute for Learning and Memory
http://web.mit.edu/picower/

Plasma Science and Fusion Center
http://www.psfc.mit.edu/

Productivity from Information Technology Initiative
http://mitsloan.mit.edu/research/profit/

Research Laboratory of Electronics
http://rle.mit.edu/

Sea Grant College Program
http://seagrant.mit.edu/

Singapore-MIT Alliance
http://web.mit.edu/sma/

Singapore-MIT Alliance for Research and Technology (SMART) Centre
http://web.mit.edu/SMART/

Spectroscopy Laboratory
http://web.mit.edu/spectroscopy/

System Design and Management Program
http://sdm.mit.edu/

Technology and Development Program
http://web.mit.edu/mit-tdp/www/

Whitaker College of Health Sciences and Technology
http://hst.mit.ed/index.jsp

Women's Studies and Gender Studies Program
http://web.mit.edu/wgs/index.html

MIT Lincoln Laboratory
MIT operates Lincoln Laboratory in Lexington, Massachusetts as an off-campus Federally Funded Research and Development Center focused on technologies for national security.

Academic and Research Affiliations

Alliance for Global Sustainability

Established in 1995, the Alliance for Global Sustainability (AGS) is an international partnership among MIT, the Swiss Federal Institute of Technology, the University of Tokyo, and the Chalmers University of Technology in Sweden. See page 81 for more information.

The Broad Institute of MIT and Harvard

The Broad Institute is founded on two principles – that this generation has a historic opportunity and responsibility to transform medicine, and that to fulfill this mission, we need new kinds of research institutions, with a deeply collaborative spirit across disciplines and organizations. Operating under these principles, the Broad Institute is committed to meeting the most critical challenges in biology and medicine. Broad scientists pursue a wide variety of projects that cut across scientific disciplines and institutions. Collectively, these projects aim to: Assemble a complete picture of the molecular components of life; Define the biological circuits that underlie cellular responses; Uncover the molecular basis of major inherited diseases; Unearth all the mutations that underlie different cancer types; Discover the molecular basis of major infectious diseases; and Transform the process of therapeutic discovery and development. http://www.broadinstitute.org/

Cambridge MIT Institute

The Cambridge-MIT Institute (CMI) is a collaboration between the University of Cambridge and MIT. Funded by British government and industry, CMI's mission is to enhance competitiveness, productivity, and entrepreneurship in the United Kingdom. See page 93 for more information.

Cross-Registration at Other Institutions

MIT has cross-registration arrangements with several area schools, enabling qualified MIT students to take courses at Harvard University, Boston University's African Studies Program, Brandeis University's Florence Heller Graduate School for Advanced Studies in Social Welfare, Massachusetts College of Art, The School of the Museum of Fine Arts, and Tufts University's School of Dental Medicine. MIT also has junior year abroad and domestic year away programs where students may study at another institution in the U.S. or abroad.

Charles Stark Draper Laboratory

Founded as MIT's Instrumentation Laboratory, Draper Laboratory became an independently operated, nonprofit research and educational organization in 1973. MIT and Draper Laboratory still collaborate in areas such as guidance, navigation, and control; computer and computational sciences; data and signal processing; material sciences; integrated circuitry; information systems; and underwater vehicle technologies.

Global Enterprise for Micro-Mechanics and Molecular Medicine (GEM4)

GEM4 bringstogether engineers and life scientists from around the world to apply the advances of engineering, science, and nanotechnology to global medical challenges.

Howard Hughes Medical Institute

Howard Hughes Medical Institute (HHMI) is a scientific and philanthropic organization that conducts biomedical research in collaboration with universities, academic medical centers, hospitals, and other research institutions throughout the country. Sixteen HHMI investigators hold MIT Faculty appointments.

Academic and Research Affiliations
(continued)

Idaho National Laboratory

Created in 2005 by the U.S. Department of Energy, the Idaho National Laboratory (INL) includes the visionary proposal for the National University Consortium (NUC) – five leading research universities from around the nation whose nuclear research and engineering expertise are of critical importance to the future of the nation's nuclear industry. MIT will initially lead the NUC team, whose goal is collaborative, coordinated nuclear research and education, accomplished in conjunction with the Center for Advanced Energy Studies (CAES). The NUC partners will establish the university-based Academic Centers of Excellence (ACE) to collaborate with CAES research programs and the collocated research centers of CAES. The NUC consists of MIT, Oregon State University, North Carolina State University, Ohio State University, and University of New Mexico.

Magellan Project

The Magellan Project is a five-university partnership to construct and operate two 6.5 meter optical telescopes at the Las Campanas Observatory in Chile. The telescopes allow researchers to observe planets orbiting stars in solar systems beyond our own and to explore the first galaxies that formed near the edge of the observable universe. Collaborating with MIT in the Magellan Project are the Carnegie Institute of Washington, Harvard University, the University of Arizona, and the University of Michigan.

Massachusetts Green High Performance Computing Center (MGHPCC)

In October, 2010 construction began in Holyoke, Mass., on a world-class, green, high performance computing center. The MGHPCC facility will provide state-of-the-art computational infrastructure in support of breakthroughs in science, thereby supporting the research missions of the participating institutions, strengthening partnerships with industry, and allowing Massachusetts to attract and retain the very best scientists to fuel the state's innovation economy. The participating institutions include MIT, the University of Massachusetts, Boston University, EMC, Cisco, and Accenture.

MIT-Portugal Program

MIT and the Portuguese Ministry of Science, Technology and Higher Education have announced plans to enter into a long-term collaboration to significantly expand research and education in engineering and management across many of Portugal's top universities. The wide-ranging initiative will be the broadest of its kind ever undertaken by the government of Portugal, and will include the participation of more than 40 MIT faculty from all five schools at the Institute. The MIT-Portugal Program will undertake research and education in several focus areas, and will give MIT an opportunity to gain insight into the planning, design, and implementation of transportation, energy, manufacturing, and bioengineering systems in Portugal.

MIT-Woods Hole Oceanographic Institution Joint Program in Oceanography and Applied Ocean Science and Engineering

MIT and the Woods Hole Oceanographic Institution jointly offer Doctor of Science and Doctor of Philosophy degrees in chemical oceanography, marine geology, marine geophysics, physical oceanography, applied ocean science and engineering, and biological oceanography. They also offer Master's and professional degrees in some disciplines.

Naval Construction and Engineering (Course 2N)

The graduate program in Naval Construction and Engineering at MIT is intended for active duty officers in the U.S. Navy, U.S. Coast Guard, and foreign navies that have been designated for specialization in the design, construction, and repair of naval ships. The curriculum prepares Navy, Coast Guard, and foreign officers for careers in ship design and construction, and is sponsored by Commander, Naval Sea Systems Command.

The Ragon Institute

The Ragon Institute, officially established in February 2009 and supported by the Phillip T. and Susan M. Ragon Foundation, seeks to establish a model of scientific collaboration that links the clinical, translational and basic science expertise at MGH, MIT, Harvard, and the Broad Institute to tackle the greatest global health challenges related to infectious disease research. See http://www.ragoninstitute.org/index.html

ROTC (Reserve Officer Training Corps) Programs

Military training has existed at MIT since students first arrived in 1865. In 1917, MIT established the nation's first Army ROTC unit. Today, MIT's Air Force, Army, and Navy ROTC programs also serve students from Harvard and Tufts Universities; the Air Force and Army programs also include Wellesley College students. These programs enable students to become commissioned military officers upon graduation and may provide scholarships. More than 12,000 officers have been commissioned from MIT, and more than 150 have achieved the rank of general or admiral.

Singapore-MIT Alliance

The Singapore-MIT Alliance (SMA) is an innovative engineering education and research collaboration of three premier academic institutions: MIT, National University of Singapore, and the Nanyang Technological University. SMA promotes global education and research in engineering and the life sciences through distance education. Offering graduate degrees in five engineering disciplines and one life science discipline, SMA is the largest interactive distance education collaboration in the world. More than 50 MIT faculty members and 50 from Singapore universities participate in SMA's programs.

Singapore-MIT Alliance for Research and Technology (SMART) Centre

Established in 2007, the SMART Centre is MIT's first research centre outside of Cambridge, MA and its largest international research endeavor. The Centre is also the first entity in the Campus for Research Excellence and Technological Enterprise (CREATE) currently being developed by Singapore's National Research Foundation.

The SMART Centre will: identify and carry out research on critical problems of societal significance and develop innovative solutions through its interdisciplinary research groups (IRGs); become a magnet for attracting and anchoring global research talent to Singapore; develop robust partnerships with local universities and institutions in Singapore; engage in graduate education by co-advising local doctoral students and post-doctoral associates; and help instill a culture of translational research, entrepreneurship and technology transfer through the SMART Innovation Centre.

Synthetic Biology Engineering Research Center

Five MIT researchers are among the pioneers behind a new research center in synthetic biology. The Synthetic Biology Engineering Research Center (SynBERC) was established in 2006, and is managed via the California Institute for Qualitative Biomedical Research. In addition to MIT, participating universities are the University of California at Berkeley, Harvard University, the University of California at San Francisco, and Prairie View A&M University. SynBERC's foundational research will be motivated by pressing biotechnology applications.

Wellesley-MIT Exchange Program

Through this cross-registration program, students may enroll in any courses at the other school, expanding the educational opportunities for participating students. Students also earn Massachusetts certificates to teach at the elementary and secondary level, through the Wellesley College Education Department.

Whitehead Institute for Biomedical Research

An independent basic research and teaching institution affiliated with MIT, the Whitehead Institute conducts research in developmental biology and the emerging field of molecular medicine. Faculty at the Whitehead Institute teach at MIT, and MIT graduate students conduct research and receive training in Whitehead Institute Laboratories.

Education Highlights

MIT has long maintained that professional competence is best fostered by coupling teaching with research and by focusing education on practical problems. This hands-on approach has made MIT a consistent leader in outside surveys of the nation's best colleges. MIT was the first university in the country to offer curriculums in architecture (1865), electrical engineering (1882), sanitary engineering (1889), naval architecture and marine engineering (1895), aeronautical engineering (1914), meteorology (1928), nuclear physics (1935), and artificial intelligence (1960s). More than 4,000 MIT graduates are professors at colleges and universities around the world. MIT faculty have written some of the best-selling textbooks of all time, such as *Economics* by Paul A. Samuelson and *Calculus and Analytic Geometry* by George Thomas. The following are some notable MIT teaching milestones since 1969, when humans, including MIT alumnus Buzz Aldrin, first landed on the moon.

1969 MIT launches the Undergraduate Research Opportunities Program (UROP), the first of its kind. The program, which enables undergraduates to work directly with faculty on professional research, subsequently is copied in universities throughout the world. About 2,800 MIT students participate in UROP annually.

1970 The Harvard-MIT Program in Health Sciences and Technology is established to focus advances in science and technology on human health and to train physicians with a strong base in engineering and science.

1971 MIT holds its first Independent Activities Period (IAP), a January program that emphasizes creativity and flexibility in teaching and learning. Almost 800 activities are offered annually, including design contests, laboratory projects, workshops, field trips, and courses in practical skills.

1977 MIT organizes the Program in Science, Technology, and Society to explore and teach courses on the social context and consequences of science and technology – one of the first programs of its kind in the U.S.

1981 MIT launches Project Athena, a $70 million program to explore the use of computers in education. Digital Equipment Corporation and IBM each contribute $25 million in computer equipment.

1981 The MIT Sloan School of Management launches its Management of Technology program, the world's first Master's program to focus on the strategic management of technology and innovation.

1983-1990 MIT language and computer science faculty join in the Athena Language Learning Project to develop interactive videos that immerse students in the language and character of other cultures. The work pioneers a new generation of language learning tools.

1984 MIT establishes the Media Laboratory, bringing together pioneering educational programs in computer music, film, graphics, holography, lasers, and other media technologies.

1991 MIT establishes the MacVicar Faculty Fellows Program, named in honor of the late Margaret A. MacVicar, to recognize outstanding contributions to teaching. MacVicar, a professor of physics, had conceived of, designed, and launched UROP (see 1969, above).

1992 MIT launches the Laboratory for Advanced Technology in the Humanities to extend its pioneering work in computer- and video-assisted language learning to other disciplines. Its first venture was a text and performance multi-media archive for studies of Shakespeare's plays.

1993 In recognition of the increasing importance of molecular and cell biology, MIT becomes the first college in the nation to add biology to its undergraduate requirement.

1995 MIT's Political Science Department establishes the Washington Summer Internship Program to provide undergraduates the opportunity to apply their scientific and technical training to public policy issues.

1998 MIT teams up with Singapore's two leading research universities to create a global model for long-distance engineering education and research. The first truly global collaboration in graduate engineering education and research, this large-scale experiment today is a model for distance education.

1999 The University of Cambridge and MIT establish the Cambridge-MIT Institute, whose programs include student and faculty exchanges, an integrated research program, professional practice education, and a national competitiveness network in Britain.

1999 MIT establishes the Society of Presidential Fellows to honor the most outstanding students worldwide entering the Institute's graduate programs. With gifts provided by lead donors, presidential fellows are awarded fellowships that fund first year tuition and living expenses.

2000 MIT Faculty approve the Communication Requirement (CR), which went into effect for the Class of 2005. The CR integrates substantial instruction and practice in writing and speaking into all four years and across all parts of MIT's undergraduate program. Students participate regularly in activities designed to develop both general and technical communication skills.

2001 Studio Physics is introduced to teach freshman physics. Incorporating a highly collaborative, hands-on environment that uses networked laptops and desktop experiments, the new curriculum lets students work directly with complicated and unfamiliar concepts as their professors introduce them.

2001 To provide a model for sharing of knowledge to benefit all humankind, MIT launches OpenCourseWare, a program that makes materials for nearly all of its courses freely available on the web.

2001 MIT establishes WebLab, a microelectronics teaching laboratory that allows students to interact remotely on the Web with transistors and other microelectronics devices anywhere and at any time.

2001 MIT's Earth System Initiative launches Terrascope, a freshman course where students work in teams to solve complex problems in earth sciences. Bringing together physics, mathematics, chemistry, biology, management, and communications, the course has enabled students to devise strategies for preserving tropical rainforests, understand the costs and the benefits of oil drilling in the Arctic National Wildlife Refuge, and plan a mission to Mars.

2002 To give engineering students the opportunity to develop the skills they'll need to be leaders in the workplace, MIT introduces the Undergraduate Practice Opportunities Program (UPOP). The program involves a corporate training workshop, job seminars taught by alumni, and a 10-week summer internship.

2003 MIT Libraries introduce DSpace, a digital repository that gathers, stores, and preserves the intellectual output of MIT's faculty and research staff, and makes it freely available to research institutions worldwide. Within a year of its launch, DSpace material had been downloaded more than 8,000 times, and more than 100 organizations had adopted the system for their own use.

2003 MIT's Computational and Systems Biology program (CSBi), an Institute-wide program linking biology, engineering, and computer science in a systems biology approach to the study of cell-to-cell signaling, tissue formation, and cancer, begins accepting students for a new Ph.D. program that will give them the tools for treating biological entities as complex living systems.

Education Highlights
(continued)

2005 Combining courses from engineering, mathematics, and management, MIT launches its Master's program in Computation for Design and Optimization, one of the first curriculums in the country to focus on the computational modeling and design of complex engineered systems. The program prepares engineers for the challenges of making systems ranging from computational biology to airline scheduling to telecommunications design and operations run with maximum effectiveness and efficiency.

2006 MIT creates the Campaign for Students, a fundraising effort dedicated to enhancing the educational experience at MIT through creating scholarships and fellowships, and supporting multidisciplinary education and student life.

2007 MIT makes material from virtually all MIT courses available online for free on OpenCourseWare (OCW). The publication marks the beginning of a worldwide movement toward open education that now involves more than 160 universities and 5,000 courses.

2009 MIT launches the Bernard M. Gordon-MIT Engineering Leadership Program. Through interaction with industry leaders, faculty, and fellow students, the program aims to help undergraduate engineering students develop the skills, tools and character they will need as future engineering leaders.

2009 MIT introduces a minor in Energy Studies, open to all undergraduates. The new minor, unlike most energy concentrations available at other institutions, and unlike any other concentration at MIT, is designed to be inherently cross-disciplinary, encompassing all of MIT's five schools. It can be combined with any major subject. The minor aims to allow the student to develop expertise and depth in their major discipline, but then complement that with the breadth of understanding offered by the energy minor.

2010 MIT introduces the flexible engineering degree for undergraduates. The degree, the first of its kind, allows students to complement a deep disciplinary core with an additional subject concentration. The additional concentrations can be broad and interdisciplinary in nature (energy, transportation, or the environment), or focused on areas that can be applied to multiple fields (robotics and controls, computational engineering, or engineering management).

Research Highlights

The following are selected research achievements of MIT faculty over the last four decades.

1969 Ioannis V. Yannas begins work on developing artificial skin – a material used successfully to treat burn victims.

1970 David Baltimore reports the discovery of reverse transcriptase, an enzyme that catalyzes the conversion of RNA to DNA. The advance, which led to a Nobel Prize for Baltimore in 1975, provided a new means for studying the structure and function of genes.

1973 Jerome Friedman and Henry Kendall, with Stanford colleague Richard Taylor, complete a series of experiments confirming the theory that protons and neutrons are made up of minute particles called quarks. The three received the 1990 Nobel Prize in Physics for their work.

1974 Samuel C.C. Ting, Ulrich Becker, and Min Chen discover the "J" particle. The discovery, which earned Ting the 1976 Nobel Prize in Physics, points to the existence of one of the six postulated types of quarks.

1975-1977 Barbara Liskov and her students design the CLU programming language, an object-oriented language that helped form the underpinnings for languages like Java and C++. As a result of this work and other accomplishments, Liskov later wins the Turing Award, considered the Nobel Prize in computing.

1975-1982 Joel Moses develops the first extensive computerized program (MACSYMA) able to manipulate algebraic quantities and perform symbolic integration and differentiation.

1976 Har Gobind Khorana and his research team complete chemical synthesis of the first human-manufactured gene fully functional in a living cell. The culmination of 12 years' work, it establishes the foundation for the biotechnology industry. Khorana won the 1968 Nobel Prize in Physiology/Medicine for other genetics work.

1977 Phillip Sharp discovers the split gene structure of higher organisms, changing the view of how genes arose during evolution. For this work, Sharp shared the 1993 Nobel Prize in Physiology/Medicine.

1977 Ronald Rivest, Adi Shamir, and Leonard Adleman invent the first workable public key cryptographic system. The new code, which is based on the use of very large prime numbers, allows secret communication between any pair of users. Still unbroken, the code is in widespread use today.

1979 Robert Weinberg reports isolating and identifying the first human oncogene – an altered gene that causes the uncontrolled cell growth that leads to cancer.

1981 Alan Guth publishes the first satisfactory model of the universe's development in the first 10-32 seconds after the Big Bang.

1982 Alan Davison discovers a new class of technetium compounds that leads to the development of the first diagnostic technetium drug for imaging the human heart.

1985 Susumu Tonegawa describes the structure of the gene for the receptors – "anchor molecules" – on the white blood cells called T lymphocytes, the immune system's master cells. In 1987, Tonegawa receives the Nobel Prize in Physiology/Medicine for similar work on the immune system's B cells.

Research Highlights
(continued)

1986 H. Robert Horvitz identifies the first two genes found to be responsible for the process of cell death, which is critical both for normal body development and for protection against autoimmune diseases, cancer, and other disorders. Going on to make many more pioneering discoveries about the genetics of cell death, Horvitz shares the 2002 Nobel Prize in Physiology/Medicine for his work.

1988 Sallie Chisholm and associates report the discovery of a form of ocean plankton that may be the most abundant single species on earth.

1990 Julius Rebek, Jr. and associates create the first self-replicating synthetic molecule.

1990 Building on the discovery of the metathesis – the process of cutting carbon-carbon double bonds in half and constructing new ones – Richard Schrock devises a catalyst that greatly speeds up the reaction, consumes less energy, and produces less waste. A process based on his discovery is now in widespread use for efficient and more environmentally friendly production of important pharmaceuticals, fuels, synthetic fibers, and many other products. Schrock shares the 2005 Nobel Prize in Chemistry for his breakthrough.

1991 Cleveland heart doctors begin clinical trials of a laser catheter system for microsurgery on the arteries that is largely the work of Michael Feld and his MIT associates.

1993 H. Robert Horvitz, together with scientists at Massachusetts General Hospital, discover an association between a gene mutation and the inherited form of amyotrophic lateral sclerosis (Lou Gehrig's disease).

1993 David Housman joins colleagues at other institutions in announcing a successful end to the long search for the genetic defect linked with Huntington's disease.

1993 Alexander Rich and post-doctoral fellow Shuguang Zhang report the discovery of a small protein fragment that spontaneously forms into membranes. This research will lead to advances in drug development, biomedical research, and the understanding of Alzheimer's and other diseases.

1994 MIT engineers develop a robot that can "learn" exercises from a physical therapist, guide a patient through them, and – for the first time – record biomedical data on the patient's condition and progress.

1995 Scientists at the Whitehead Institute for Biomedical Research and MIT create a map of the human genome and begin the final phase of the Human Genome Project. This powerful map contains more than 15,000 distinct markers and covers virtually all of the human genome.

1996 A group of scientists at MIT's Center for Learning and Memory, headed by Matthew Wilson and Nobel laureate Susumu Tonegawa, demonstrate with new genetic and multiple-cell monitoring technologies how animals form memory about new environments.

1997 MIT physicists create the first atom laser, a device which is analogous to an optical laser but emits atoms instead of light. The resulting beam can be focused to a pinpoint or made to travel long distances with minimal spreading.

1998 MIT biologists led by Leonard Guarente identify a mechanism of aging in yeast cells that suggests researchers may one day be able to intervene in, and possibly inhibit, the aging process in certain human cells.

1998 An interdisciplinary team of MIT researchers, led by Yoel Fink and Edwin L. Thomas, invent the "perfect mirror," which offers radical new ways of directing and manipulating light. Potential applications range from a flexible light guide that can illuminate specific internal organs during surgery to new devices for optical communications.

1999 Michael Cima, Robert Langer, and graduate student John Santini report the first microchip that can store and release chemicals on demand. Among its potential applications is a "pharmacy" that could be swallowed or implanted under the skin and programmed to deliver precise drug dosages at specific times.

1999 Alexander Rich leads a team of researchers in the discovery that left-handed DNA (also known as Z-DNA) is critical for the creation of important brain chemicals. Having first produced Z-DNA synthetically in 1979, Rich succeeded in identifying it in nature in 1981. He also discovered its first biological role and received the National Medal of Science for this pioneering work in 1995.

2000 Scientists at the Whitehead/MIT Center for Genome Research and their collaborators announce the completion of the Human Genome Project. Providing about a third of all the sequences assembled, the Center was the single largest contributor to this international enterprise.

2000 Researchers develop a device that uses ultrasound to extract a number of important molecules noninvasively and painlessly through the skin. They expect that the first application will be a portable device for noninvasive glucose monitoring for diabetics.

2000 Researchers from the MIT Sloan School of Management launch the Social and Economic Explorations of Information Technology (SeeIT) Project, the first empirical study of the effects of Information Technology (IT) on organizational and work practices. Examining IT's relationship to changes in these models, SeeIT is providing practical data for understanding and evaluating IT's business and economic effects, which will enable us taking full advantage of its opportunities and better control its risks.

2001 In a step toward creating energy from sunlight as plants do, Daniel Nocera and a team of researchers invent a compound that, with the help of a catalyst and energy from light, produces hydrogen.

2002 MIT researchers create the first acrobatic robotic bird – a small, highly agile helicopter for military use in mountain and urban combat.

2002-2005 Scientists at MIT, the Whitehead Institute for Biomedical Research, and the Broad Institute complete the genomes of the mouse, the dog, and four strains of phytoplankton, photosynthetic organisms that are critical for the regulation of atmospheric carbon dioxide. They also identify the genes required to create a zebrafish embryo. In collaboration with scientists from other institutions, they map the genomes of chimpanzees, humans' closest genetic relative, and the smallest known vertebrate, the puffer fish.

2003 MIT scientists cool a sodium gas to the lowest temperature ever recorded – a half-a-billionth of a degree above absolute zero. Studying these ultra-low temperature gases will provide valuable insights into the basic physics of matter; and by facilitating the development of better atomic clocks and sensors for gravity and rotation, they also could lead to vast improvements in precision measurements.

Research Highlights
(continued)

2004 MIT's Levitated Dipole Experiment (LDX), a collaboration among scientists at MIT and Columbia, generates a strong dipole magnetic field that enables them to experiment with plasma fusion, the source of energy that powers the sun and stars, with the goal of producing it on Earth. Because the hydrogen that fuels plasma fusion is practically limitless and the energy it produces is clean and doesn't contribute to global warming, fusion power will be of enormous benefit to humankind and to earth systems in general.

2004 A team led by neuroscientist Mark Bear illuminates the molecular mechanisms underlying Fragile X Syndrome, and shows that it might be possible to develop drugs that treat the symptoms of this leading known inherited cause of mental retardation, whose effects range from mild learning disabilities to severe autism.

2004 Shuguang Zhang of MIT's Center for Biomedical Engineering, Marc A. Baldo, assistant professor of electric engineering and computer science, and recent graduate Patrick Kiley, first figure out how to stabilize spinach proteins – which, like all plants, produce energy when exposed to light – so they can survive without water and salt. Then, they devise a way to attach them to a piece of glass coated with a thin layer of gold. The resulting spinach-based solar cell, the world's first solid-state photosynthetic solar cell, has the potential to power laptops and cell phones with sunlight.

2005 MIT physicists, led by Nobel laureate Wolfgang Ketterle, create a new type of matter, a gas of atoms that shows high-temperature superfluidity.

2005 Vladimir Bulovic, professor of electrical engineering and computer science, and Tim Swager, professor of chemistry, develop lasing sensors based on a semiconducting polymer that is able to detect the presence of TNT vapor subparts per billion concentrations.

2006 MIT launches the MIT Energy Initiative (MITei) to address world energy problems. Led by Ernest J. Moniz and Robert C. Armstrong, MITei coordinates energy research, education, campus energy management, and outreach activities across the Institute.

2007 Rudolf Jaenisch, of the Whitehead Institute for Biomedical Research, conducts the first proof-of-principle experiment of the therapeutic potential of induced pluripotent stem cells (iPS cells), using iPS cells reprogrammed from mouse skin cells to cure a mouse model of human sickle-cell anemia. Jaenisch would then use a similar approach to treat a model of Parkinson's disease in rats.

2007 Marin Soljacic and his colleagues develop a new form of wireless power transmission they call WITricity. It is based on a strongly coupled magnetic resonance and can be used to transfer power over distances of a few meters with high efficiency. The technique could be used commercially to wirelessly power laptops, cell phones, and other devices.

2007 David H. Koch '62, SM '63 gives MIT $100 million to create the David H. Koch Institute for Integrative Cancer Research. The Institute, scheduled to open in 2010, will bring together molecular geneticists, cell biologists, and engineers in a unique multidisciplinary approach toward cancer research.

2007 Tim Jamison, Professor of Chemistry, discovers that cascades of epoxide-opening reactions that were long thought to be impossible can very rapidly assemble the Red Tide marine toxins when they are induced by water. Such processes may be emulating how these toxins are made in nature and may lead to a better understanding of what causes devastating Red Tide phenomena. These methods also open up an environmentally green synthesis of new classes of complex highly biologically active compounds.

2007 MIT mathematicians form part of a group of 18 mathematicians from the U.S. and Europe that maps one of the the most complicated structures ever studied: the exceptional Lie group E8. The "answer" to the calculation, if written, would cover an area the size of Manhattan. The resulting atlas has applications in the fields of string theory and geometry.

2008 Mriganka Sur's laboratory discovers that astrocytes, star-shaped cells in the brain that are as numerous as neurons, form the basis for functioning brain imaging. Using ultra high-resolution imaging in the intact brain, they demonstrate that astrocytes regulate blood flow to active brain regions by linking neurons to brain capillaries.

2008 A team led by Marc A. Baldo designs a solar concentrator that focuses light at the edges of a solar power cell. The technology can increase the efficiency of solar panels by up to 50 percent, substantially reducing the cost of generating solar electricity.

2008 Daniel Nocera creates a chemical catalyst that hurdles one of the obstacles to widespread use of solar power — the difficulty of storing energy from the sun. The catalyst, which is cheap and easy to make, uses the energy from sunlight to separate the hydrogen and oxygen molecules in water. The hydrogen can then be burned, or used to power an electric fuel cell.

2009 A team of MIT researchers led by Angela Belcher reports that it was able to genetically engineer viruses to produce both the positively and negatively charged ends of a lithium ion battery. The battery has the same energy capacity as those being considered for use in hybrid cars, but is produced using a cheaper, less environmentally hazardous process. MIT President Susan Hockfield presents a prototype battery to President Barack Obama at a press briefing at the White House.

2009 Researchers at MIT's Picower Institute for Learning and Memory show for the first time that multiple, interacting genetic risk factors may influence the severity of autism symptoms. The finding could lead to therapies and diagnostic tools that target the interacting genes.

2009 Professor Gerbrand Ceder and graduate student Byoungwoo Kang develop a new way to manufacture the material used in lithium ion batteries that allows ultrafast charging and discharging. The new method creates a surface structure that allows lithium ions to move rapidly around the outside of the battery. Batteries built using the new method could take seconds, rather than the now standard hours, to charge.

2009 As neuroscience progresses rapidly toward an understanding of basic mechanisms of neural and synapse function, MIT neuroscientists are discovering the mechanisms underlying brain disorders and diseases. Li-Huei Tsai's laboratory describes mechanisms that underlie Alzheimer's disease, and propose that inhibition of histone deacetylases is therapeutic for degenerative discorders of learning and memory. Her laboratory also discovers the mechanisms of action of the gene Disrupted-in-Schizophrenia 1 (DISC1), and demonstrates why drugs such as lithium are effective in certain instances of schizophrenia. This research opens up pathways to discovering novel classes of drugs for devastating neuropsychiatric conditions.

2 Campus Research

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MIT has historically viewed teaching and research as inseparable parts of its academic mission. Therefore, the Institute recognizes its obligation to encourage faculty to pursue research activities that hold the greatest promise for intellectual advancement. MIT maintains one of the most vigorous programs of research of any university, and conducts basic and applied research principally at two Massachusetts locations, the MIT campus in Cambridge and MIT Lincoln Laboratory, a Federally-Funded Research and Development Center (FFRDC) in Lexington.

MIT pioneered the federal/university research relationship, starting in World War II. Initially called upon by the federal government to serve the national war effort, that relationship has continued into the present day, helping MIT fulfill its original mission of serving the nation and the world.

All federal research on campus is awarded competitively, based on the scientific and technical merit of the proposals. In FY 2010, there were 3,520 active awards and 647 members of research consortiums.

Research activities range from individual projects to large-scale, collaborative, and sometimes international endeavors. Peer-reviewed research accomplishments form a basis for reviewing the qualifications of prospective faculty appointees and for evaluations related to promotion and tenure decisions.

Although proud of its existing safeguards, MIT has recommitted itself to examine issues of integrity of research protocol with added vigilance. In recent years, the complexity of the research enterprise has increased, particularly in the areas involving commercial sponsorship, technology transfer, and international engagement. Given this evolution, MIT has initiated a number of comprehensive reviews of its principles, policies, and procedures with the goal of preserving the highest standards of conduct among all those in its community.

In 2008, the provost, in consultation with the chair of the faculty, appointed an ad hoc faculty Committee on Managing Potential Conflicts of Interest in Research. The role of the committee is threefold: (1) to review the types of individual and institutional relationships that have the potential to give rise to actual or perceived conflicts of interest; (2) to assess applicable laws and regulations; and (3) to examine the Institute's written and practiced policies and procedures related to conflicts of interest and compare them to those of other higher educational institutions.

In a related move, the provost, in consultation with the chair of the faculty, appointed another ad hoc faculty committee, the Committee on Technology Transfer in the 21st Century. This group is exploring ways in which MIT's policies, procedures, and practices can enhance and accelerate technology transfer to contribute to the economy and welfare of the nation and the world. In addition to reviewing industrial partnerships and the principles on which they rest, the group will learn from practices at peer institutions. Then it will recommend appropriate changes to MIT's policies and procedures to enable the formation of beneficial, strategic partnerships with industry while preserving MIT's fundamental values and principles.

In recognition of the connection between the two studies, the Committee on Managing Potential Conflicts of Interest and the Committee on Technology Transfer in the 21st Century are coordinating with each other. More information can be found at http://web.mit.edu/provost/committees.html.

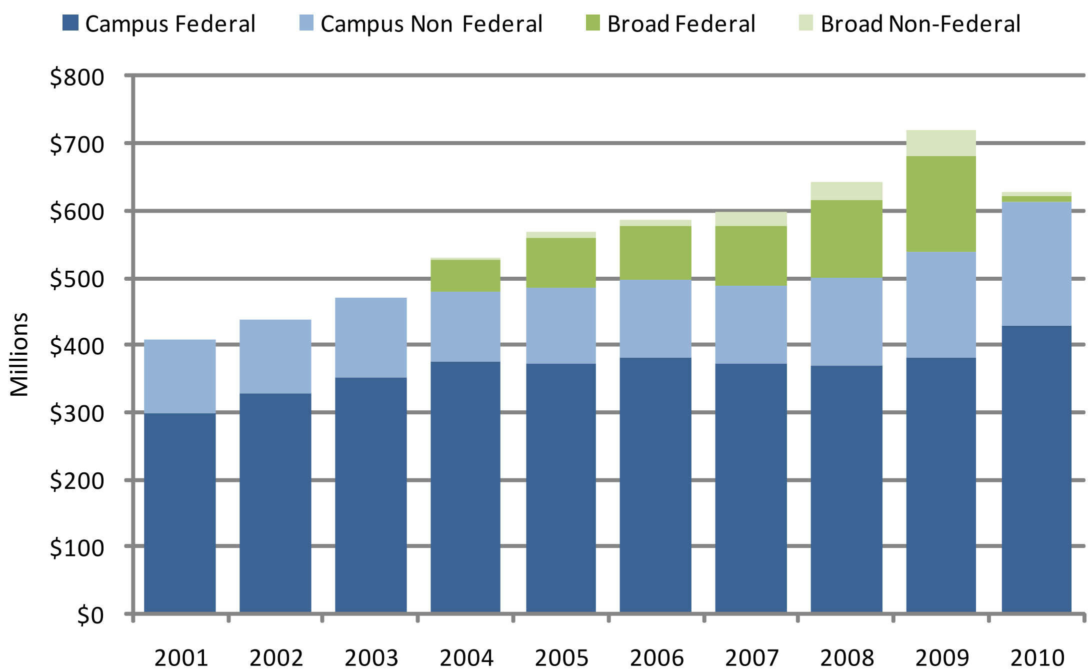
MIT Research Expenditures Fiscal Years 2001-2010

	2001	2002	2003	2004	2005
Campus Federal	$299,780,717	$328,430,122	$350,897,272	$376,476,261	$374,103,793
Campus Non-Federal	$107,642,499	$110,753,174	$120,857,180	$103,157,988	$110,675,892
Broad Federal				$47,682,557	$73,494,543
Broad Non-Federal				$2,137,355	$9,149,352

	2006	2007	2008	2009	2010
Campus Federal	$382,784,774	$373,603,371	$369,008,780	$381,459,466	$430,154,479
Campus Non -Federal	$114,361,780	$114,389,201	$132,487,316	$158,595,887	$184,216,417
Broad Federal	$81,566,398	$90,800,231	$114,900,168	$141,039,966	$7,716,616
Broad Non-Federal	$8,782,952	$19,475,269	$26,647,183	$37,107,980	$4,473,007

The bar graphs for campus research expenditures below show the amount MIT expended by fiscal years (July 1 — June 30).

The Broad Institute separated from MIT on July 1, 2009. The chart below displays both campus research expenditures and Broad Institute research expenditures.

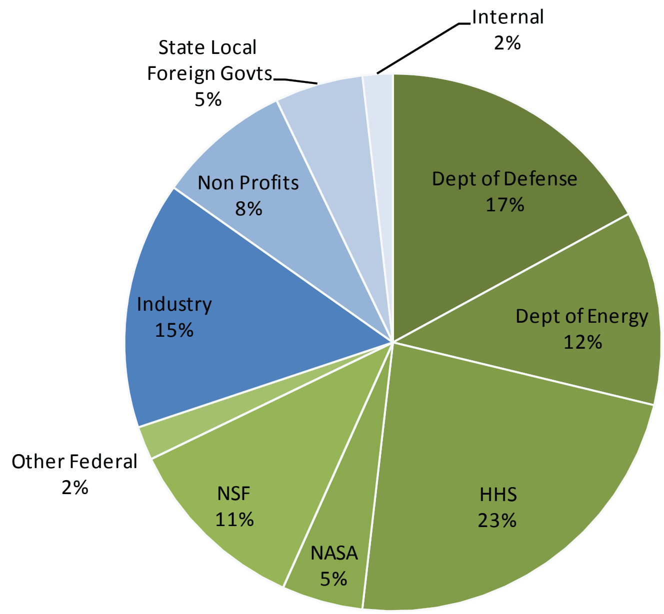


These figures do not include expenditures for MIT Lincoln Laboratory. Information for Lincoln Laboratory begins on page 55.

Federal research expenditures include all primary contracts and grants, including sub-awards from other organizations where the federal government is the original funding source.

Federal Research Support

Research Expenditures by Primary Sponsor (Including the Broad Institute) FY 2010



Units with Research Greater than $10 Million in Research Expenditures

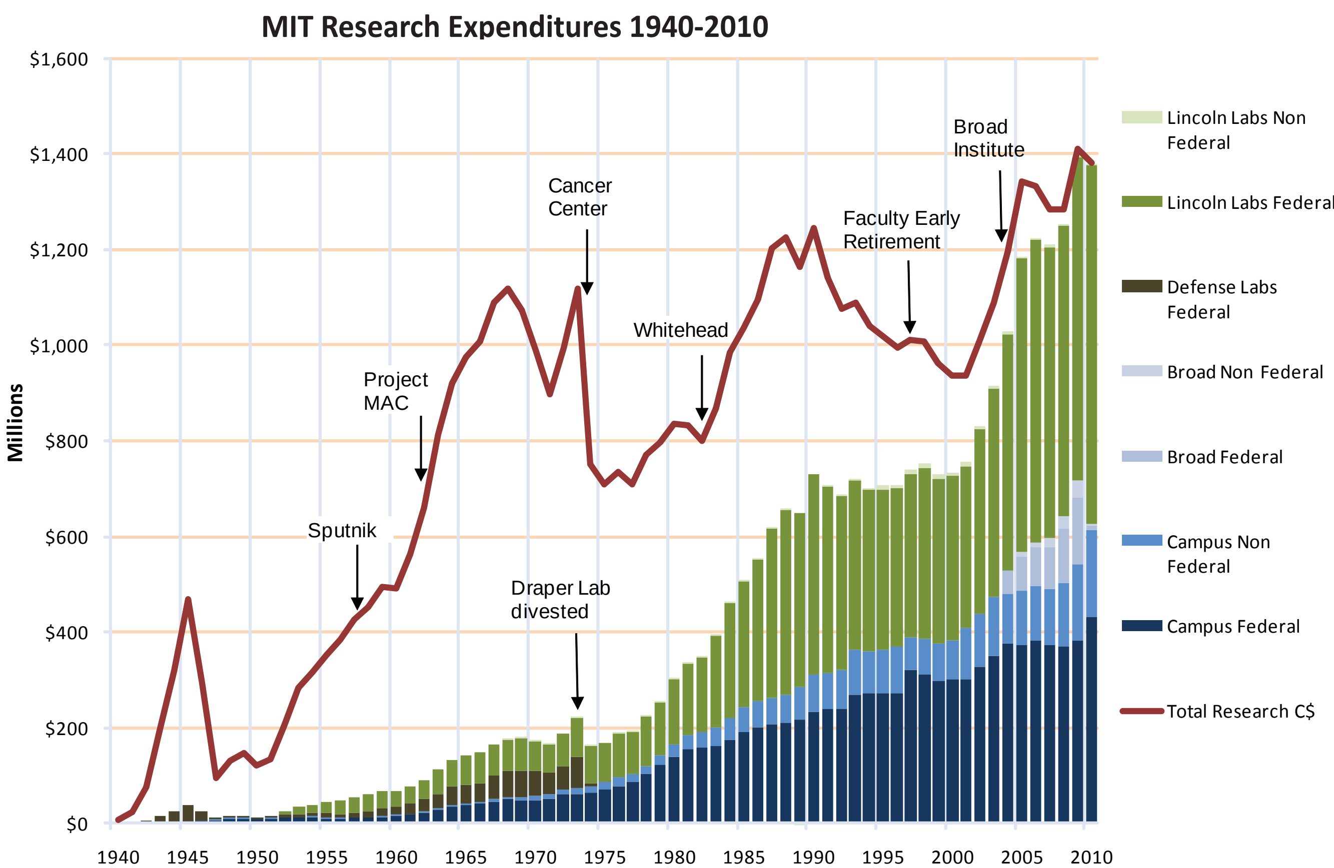
Computer Science and Artificial Intelligence Laboratory
Research Laboratory of Electronics
Plasma Science and Fusion Center
Mechanical Engineering
Koch Institute for Integrative Cancer Research
Chemical Engineering
MIT Energy Initiative
Laboratory for Nuclear Science
Chemistry
Biology
Picower Institute for Learning and Memory
Aeronautics and Astronautics
Kavli Institute for Astrophysics and Space Research
Media Laboratory
Earth, Atmospheric, and Planetary Sciences
McGovern Institute for Brain Research
Materials Science and Engineering
Materials Processing Center
Institute for Soldier Nanotechnologies
Microsystems Technology Laboratories
Harvard/MIT Division of Health Science and Technology
Biological Engineering
The Broad Institute
Haystack Observatory
Earth System Initiative

Primary Sponsor	2010	% of Total
DOD	$106,890,338	17%
DOE	$73,273,733	12%
HHS	$144,560,910	23%
NASA	$30,629,006	5%
NSF	$69,800,598	11%
Other Federal	$12,716,510	2%
Industry	$93,329,833	15%
Non-Profits	$50,638,981	8%
State, Local, and Foreign Govts.	$33,338,890	5%
Internal	$11,381,720	2%
Grand Total	$626,560,519	
Federal	70%	
Non-Federal	30%	
Constant $	$626,560,519	

The Institute provides the faculty with the infrastructure and support necessary to conduct research, much of it through contracts, grants, and other arrangements with government, industry, and foundations. The Office of Sponsored Programs provides central support related to the administration of sponsored research programs, and it assists faculty, other principal investigators, and their local administrators in managing and identifying resources for individual sponsored projects. In addition, a Research Council — which is chaired by the vice president for research and associate provost and composed of the heads of all major research laboratories and centers — addresses research policy and administration issues. The Resource Development Office also works with faculty to generate proposals for foundation or other private support.

The Institute sees profound merit in a policy of open research and free interchange of information among scholars. At the same time, MIT is committed to acting responsibly and ethically in all its research activities. As a result, MIT has policies related to the suitability of research projects, research conduct, sources of support, use of human subjects, sponsored programs, relations with intelligence agencies, the acquisition of art and artifacts, the disposition of equipment, and collaborations with research-oriented industrial organizations. These policies are spelled out on the Policies and Procedures website and on the Office of Sponsored Programs website.
http://web.mit.edu/policies/
http://web.mit.edu/osp/www/

The red line represents an adjustment for inflation, using the Consumer Price Index for all Urban Consumers (CPI-U) as the deflator with the most recent fiscal year as the base.



MIT and the American Recovery and Reinvestment Act (ARRA)

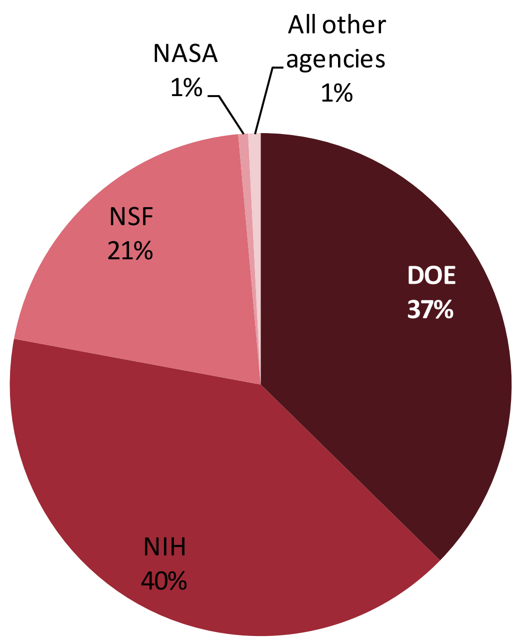
The 2009 economic stimulus package, the American Recovery and Reinvestment Act (ARRA), signed into law on February 17, 2009, provided a significant support for science funding at a time when universities nationwide were facing funding cutbacks and financial concerns due to the recession. Overall, ARRA provided $22 billion in one-time research and development (R&D) funding for fiscal years 2009 (FY09) and 2010 (FY10), in addition to regularly appropriated funds. This funding was included in the legislation to help fulfill its purpose of "reinvestment"; since R&D support is directly related to the nation's innovation capacity and therefore its longer term economic strength, the Congress allocated approximately 2 percent of the total funding in the legislation to R&D. More specifically, ARRA included $10 billion for the NIH, $5.5 billion for the DOE, and $3 billion for the NSF, as well as significant funding increases for NASA ($400 million for Science and $150 million for Aeronautics) and NIST ($580 million).

In most cases, ARRA R&D funding was applied toward existing research proposals that had received high ratings within agencies but had not been awarded due to funding limitations. In some cases, however, ARRA funding was applied toward new initiatives. For example at DOE, ARRA included the initial funding ($400 million) for the new Advanced Research Projects Agency—Energy (ARPA-E) and full five-year funding for additional Energy Frontier Research Centers (EFRCs). MIT has received several ARPA-E awards to date, and houses two EFRCs, one of which is funded through ARRA.

MIT's ARRA expenditures through December 31, 2010 total $50,791,161.

For the quarter 10/1/2010 to 12/31/2010 MIT reported that 468.23 jobs were created with ARRA funding.

Source of ARRA Awards at MIT	Number of Awards	Obligated Total Amount
DOE	23	$52,115,838
NIH	87	$56,692,582
NSF	57	$28,833,406
NASA	3	$885,603
All other agencies	4	$1,116,849



The following are a selection of some of the various research projects at MIT supported by ARRA:

Protein linked to memory and learning may lead to novel Alzheimer's treatments

Findings from the Picower Institute for Learning and Memory may lead to new drugs for Alzheimer's disease and other debilitating neurological diseases. Sirtuin1, an enzyme associated with Resveratrol, a compound found in red wine, is known to slow the aging process. In the brain, it does this by shielding neurons from damage. A team of researchers lead by Prof. Li-Huei Tsai found that it also increases synaptic plasticity, the ability to strengthen or weaken neural connections in response to new information. This means that, in addition to preventing damage, Sirtuin1 actually promotes new learning and memory. Researchers hope to use this finding to create Sirtuin1-based treatments for neurodegenerative diseases. The research is supported by the National Institutes of Health, as well as the Simons Foundation, the Swiss National Science Foundation, and the Howard Hughes Medical Institute. http://web.mit.edu/newsoffice/2010/sirtuins-0714.html

ARPA-E: Energy Storage for the Nation's Energy Grid

With a nearly $7 million five-year grant from the newly formed ARPA-E (Advanced Research Projects Agency-Energy), a group led by Prof. Donald Sadoway is developing an innovative solution to the problem of storing huge amounts of energy as part of the nation's energy grid—a liquid metal battery. The first of its kind, the all-liquid battery is designed to use low-cost, abundant molten metals. ARPA-E predicts the liquid battery technology "could revolutionize the way electricity is used and produced on the grid, enabling round-the-clock power from America's wind and solar power resources, increasing the stability of the grid, and making blackouts a thing of the past." http://web.mit.edu/newsoffice/2009/liquid-battery.html

Neutrino Physics at MIT

New findings from physicists at MIT may force scientists to rethink the Standard Model, the theory that serves as the foundation of particle physics. Scientists led by Prof. Janet Conrad at MIT's Neutrino and Dark Matter Group have observed unexpected behavior in neutrinos, tiny particles generated by nuclear reactions in the sun. These unexpected behaviors suggest there are more types of neutrinos than the three specified in the Standard Model. To investigate these observations, the group is designing a state-of-the-art 100-ton liquid argon chamber detection device in collaboration with the Fermi National Acceleration Laboratory. The detector is scheduled to begin operating in 2013. A second collaboration investigating the phenomenon, the Double Chooz experiment, is already collecting data from the Chooz nuclear power plant in the French Ardennes. http://www2.lns.mit.edu/neutrino/mixing.html

Department of Defense
Selected Current Projects

Cyborg Moths

Scientists from Microsystems Technology Laboratories and the Research Laboratory of Electronics are developing the technology to guide the flight of the giant hawkmoth, *Manduca sexta*. A neurostimulator implanted in the moth's abdomen simulates the moth's abdominal nerve cord, altering the direction of its flight. In addition to creating the first guided live insect, the project aims to also create technologies that will impact human health, robotic devices, and military intervention. Led by professors Joel Voldman, Anantha Chandrakasan, Jeffrey Lang, and Martin Schmidt, the project is funded by the Defense Advanced Research Projects Agency.

Improving the Detection of Explosives

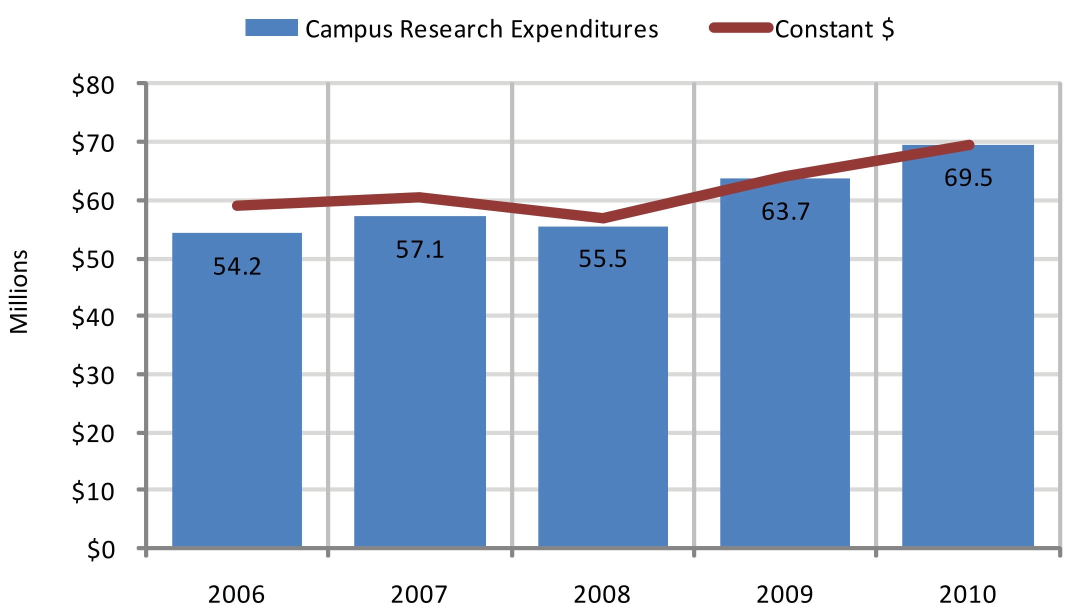
MIT scientists have developed a new semiconducting polymer that is able to detect the presence of TNT vapor even at the concentration of parts per billion. The polymer's molecules emit light when exposed to ultraviolet light. If TNT vapor is present, however, it binds to the molecules and extinguishes the emission. In comparison with most commercially-available systems which can sense only TNT particles, this new technology offers a much more powerful defense against threats like improvised explosive devises or explosives hidden in cargo. The new polymer is the work of Timothy Swager of the Department of Chemistry, Vladimir Bulovic of Electrical Engineering and Computer Science, and their team of researchers at MIT's Institute for Soldier Nanotechnologies (ISN). They are working now on similar molecules that can sense other explosives, minute amounts of nerve agents, or nitrous oxide levels in human breath, an indicator of physiological condition. ISN is a university-affiliated research center funded by the US Army Research Office.

Nature Gives a Lesson in Armor Design

Sea shells provide extraordinary protection – stiff, strong and yet lightweight – for the small soft-bodied creatures like sea snails that live in perilous environments. Now teams of Institute for Soldier Nanotechnologies researchers, directed by Christine Ortiz of the Department of Materials Sciences and Engineering and by Mary Boyce of Mechanical Engineering, are unraveling the source of nacre – the shell's mother-of-pearl inner lining. Composed of ceramic calcium carbonate and a flexible biopolymer — two relatively weak materials — nacre gets its strength as millions of ceramic plates, each a few nanometers in size, are stacked and then glued together with thin biopolymer layers. The teams are studying the nanoscale behavior of the adhesion forces that bind these elements together with such resilience. Understanding nature's nanoscale structural principles will help engineers design better body armor for soldiers, police officers, rescue workers, and other people in dangerous situations. It will also shed light on the problem of creating durable composites that can withstand high forces in water. The work is supported by the US Army Research Office.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

Department of Defense	2006	2007	2008	2009	2010
Campus Research Expenditures	$54,195,586	$57,113,631	$55,525,708	$63,650,161	$69,478,056
Constant $	$59,028,024	$60,638,086	$56,845,753	$64,266,130	$69,478,056



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers
Receiving Support in the Most Current Year

Computer Science & Artificial Intelligence Laboratory
Research Laboratory of Electronics
Institute for Soldier Nanotechnologies
Microsystems Technology Laboratories
Mechanical Engineering
Media Laboratory
Haystack Observatory
Center for Technology, Policy, & Industrial Development
Materials Processing Center
Laboratory for Information and Decision Systems

In the 2008-2009 Academic Year, 336 graduate students held research assistantships and 93 held fellowships funded at least in part by the Department of Defense: of these, 292 research assistantships and 3 fellowships were fully funded by DOD.

Department of Health and Human Services

Selected Current Projects

Convergence: A new era of cancer research

On October 9, 2007, MIT announced the launch of a major new initiative in cancer research, supported by a $100 million gift from MIT alumnus David H. Koch. The David H. Koch Institute for Integrative Cancer Research, which opened officially in March 2011, will address one of the most pressing challenges to human health: the ultimate eradication of cancer, starting with real improvements in detection, treatment and prevention.

The Koch Center strives to foster a new era of cancer research based on convergence, which is the principle of merging distinct technologies, devices, and disciplines into a unified whole that creates a host of new pathways and opportunities. The promise of the convergence approach is outlined in an MIT White Paper released in January 2011 by 12 members of the MIT faculty. The Third Revolution: The Convergence of Life Science, Physical Science, and Engineering outlines this new approach to life sciences that will enable advances in translational medicine and the future of personalized medicine.

The Koch Institute brings together more than 40 laboratories and more than 500 researchers from the fields of engineering, physical, and life sciences, including cancer biologists, genome scientists, chemists, engineers, and computer scientists. These scientists will press the front line of cancer research. Areas of research include: developing nanotechnology-based cancer drugs; improving detection and monitoring; exploring the molecular and cellular basis of metastasis; advancing personalized medicine through analysis of cancer pathway and drug resistance; and engineering the immune system to fight cancer. http://ki.mit.edu/approach

Nanotechnology Comes to Cancer Research

Nanotechnology demonstrates great promise in cancer research and treatment, from the fabrication of nanoparticles to delivering drugs and imaging agents to the implantation of tiny sensors for early detection and monitoring. With a National Cancer Institute grant establishing the MIT-Harvard Center of Cancer Nanotechnology Excellence, an interdisciplinary team of MIT and Harvard researchers has launched a number of projects to rapidly advance the application of these technologies. One project, led by MIT chemical and biomedical engineer Robert Langer and Omid Farokhzad of Harvard Medical School, focuses on using nanoparticle "homing devices" that will transport time-released anti-cancer drugs directly to prostate cancer cells. The technology also has the advantage of avoiding the toxic side effects of current cancer therapies, which attack healthy as well as diseased cells. Another project, led by biologist and Nobel laureate Phillip Sharp, is exploring the use of nanomaterials to deliver short interfering RNAs (siRNAs) to the genes associated with lethal cancers. siRNAs are tiny sequences for RNA that, when introduced into a cell, silence the targeted gene. Although potentially very powerful cancer-fighting tools, siRNAs remain difficult to dispatch to tumor cells. With its goal of mastering the technology of siRNA delivery, this project has the potential to open up a broad range of new cancer therapies.

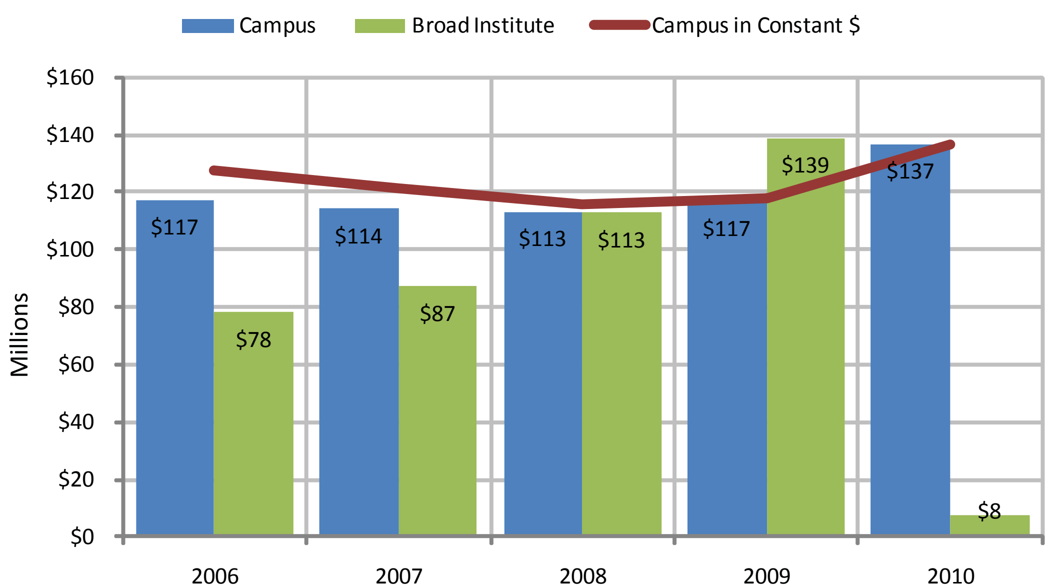
Restoring Sight

Researchers at MIT are working on a retinal implant that could one day help blind people regain a useful level of vision. A team led by John Wyatt, a professor of electrical engineering, and comprised of scientists, engineers, and ophthalmologists from Massachusetts Eye and Ear Infirmary, the Boston VA Medical Center, Cornell University, and MIT, is designing an implant for people who have lost their sight from retinitis pigmentosa or age-related macular degeneration. The retinal prosthesis would take over the function of lost retinal cells by electrically stimulating nerve cells that normally carry visual input from the retina to the brain. The team hopes to start testing a prototype in blind patients within the next three years. The research is funded by the National Institutes of Health, the VA Center for Innovative Visual Rehabilitation, the National Science Foundation, the Catalyst Foundation and the MOSIS microship fabrication service. See http://web.mit.edu/newsoffice/2009/microchip-blind-092309.html

MIT Campus and Broad Institute Research Expenditures*
Fiscal Years 2006-2010

*The Broad Institute separated from MIT on July 1, 2009. The chart below displays both campus research expenditures and Broad Institute research expenditures.

Research Expenditures	2006	2007	2008	2009	2010
Campus	$117,334,394	$114,242,082	$113,348,419	$116,960,155	$136,923,238
Broad Institute	$78,238,123	$87,315,284	$112,958,244	$138,935,579	$7,637,672
Campus in Constant $	$127,796,706	$121,291,907	$116,043,116	$118,092,027	$136,923,238
Broad Constant $	$85,214,352	$92,703,469	$115,643,665	$140,280,117	$7,637,672
Constant $	$213,011,059	$213,995,376	$231,686,780	$258,372,144	$144,560,910



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers Receiving Support in the Most Current Year

The Koch Institute for Integrative Cancer Research
Biology
Chemistry
Harvard/MIT Division of Health Sciences and Technology
Picower Institute for Learning & Memory
Biological Engineering
McGovern Institute for Brain Research
The Broad Institute
Chemical Engineering
Center for Environmental Health Sciences

The following MIT faculty and alumni have received the NIH Pioneer Award:

Current Faculty: Leona Sampson, 2009; Aviv Regev, 2008; Alice Ting, 2008; Alex von Oudenaarden, 2008; Emery Brown, 2007; Arup Chakrabarty, 2006.

Former Faculty: James Sherley, 2006

Alumni: Joshua M. Epstein, 2008; Krishna V. Shenoy, 2009

Department of Energy

Selected Current Projects

Improved Nuclear Energy

MIT is a primary partner in the DOE Energy Innovation Hub on Modeling and Simulation for Nuclear Reactors. The Consortium for Advanced Simulation of Light Water Reactors (CASL), led by Oak Ridge National Laboratory (ORNL), includes 4 national labs, 3 universities, and 3 industry organizations. That is a rare collaboration among the long-term researchers and the technology application groups to achieve improved energy sources, in this case putting the power of modern computing into a multi-scale representation of the nuclear plants. MIT has a team of 7 faculty members working with the Hub, aided by two research scientists, 3 postdocs, and 9 graduate students.

CASL aims at providing state of the art models in integrated simulation tools of the important physics that govern the behavior of nuclear power reactors during their operation. In particular, CASL aims to improve the reliability of the operation of the nuclear plants by enabling better prediction of the materials failures limits and safety margins in the plants. The simulation tools will enable the plants to avoid some of the limiting factors in the operation of the plants. This includes materials phenomena such as corrosion in the radiation environment, and thermal hydraulic phenomena such as deposition of crud on fuel elements, thereby limiting heat transfer conditions from the fuel to the coolant under realistic conditions of plant chemistry. Such improved models will aid the design of future reactors with enhanced safety and economics.

The Second Wireless Revolution

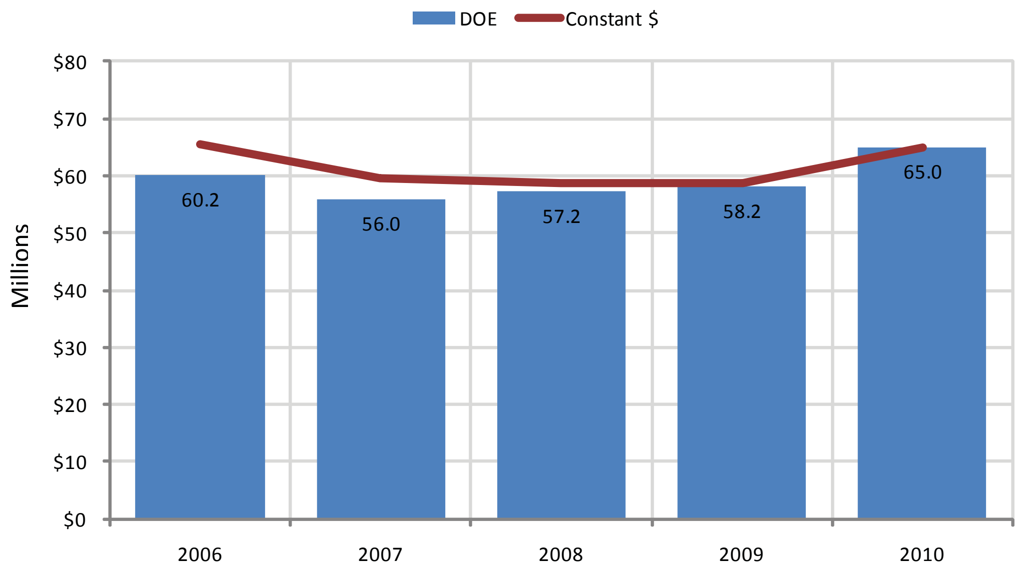
The solid state amplifiers that the nation's roughly 200,000 wireless base stations now use to communicate with cell phones and other electronic devices are costly. Generating excessive heat, they require bulky cooling equipment and also need large backup batteries. Chiping Chen and a team of researchers in MIT's Plasma Science and Fusion Center are developing an alternative – the first radio frequency (RF) power amplifier, which combines vacuum tube technology with an elliptical or "ribbon," electron beam, another recent MIT breakthrough. Much more efficient for RF amplification than the one-dimensional electron beam that conventional vacuum electron devices emit, the device requires less energy than both the vacuum tubes and the solid-state transistors which replaced them in many applications. These amplifiers are smaller, generate less heat, require smaller backup batteries, and cost thousands of dollars less than solid-state amplifiers. With the potential to reduce the cost of delivering voice and data from the current 50 cents to 5 cents per megabyte, they could save consumers hundreds of billions of dollars over the next 20 years. The technology has a range of applications, extending from communications (telephone, broadband, and satellite) to defense and scientific research. The work is funded by the Department of Energy, the Air Force Office of Scientific Research, and the MIT Deshpande Center for Technological Innovation.

Looking for the Stuff of the Universe

Although physicists understand a lot about the protons, neurons, and electrons that make up conventional atomic matter, these particles in fact constitute only about 4 percent of the universe's total mass and energy. The composition of the other 96 percent is a mystery: 73 percent is the "dark energy" that accounts for the accelerated expansion of the universe, and 23 percent is "dark matter," measured from its gravitation pull on ordinary matter. Now, researchers from MIT's Department of Physics and Laboratory of Nuclear Science and the Department of Physics are helping to solve part of this mystery by designing an experiment that will enable them to observe dark matter particles as they interact with ordinary matter. They are constructing a chamber filled with a dilute gas whose atoms will act as targets for dark matter particles. When one hits a gas atom, the atom recoils and bumps into another one, causing them to lose electrons. The chamber will convert these electrons into visible light detectable by a video camera, which then will provide an actual image of the dark matter interaction. The project is supported by the Department of Energy and the Kavli Institute for Astrophysics and Space Research.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

Department of Energy	2006	2007	2008	2009	2010
Campus Research Expenditures	$60,179,039	$55,990,324	$57,238,752	$58,183,287	$65,034,647
Constant $	$65,545,001	$59,445,461	$58,599,522	$58,746,351	$65,034,647



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers Receiving Support in the Most Current Year

Plasma Science and Fusion Center
Laboratory for Nuclear Science
Materials Processing Center
Research Laboratory of Electronics
Nuclear Science and Engineering
Materials Science and Engineering
Earth, Atmospheric & Planetary Sciences
Chemistry
Center for Global Change Science
Laboratory for Manufacturing and Productivity

In the 2008-2009 Academic Year, 157 graduate students held research assistantships and 14 held fellowships funded at least in part by the Department of Energy; of these, 151 research assistantships and 12 fellowships were fully funded by DOE.

National Science Foundation
Selected Current Projects

Solar-Power Breakthrough

Professor Daniel G. Nocera, The Henry Dreyfus Professor of Energy at the Massachusetts Institute of Technology, has duplicated the solar fuels process of photosynthesis with the creation of a new catalyst that is structurally and functionally the same as that found in a leaf. In doing so he provides a cheap and highly manufacturable method to store solar energy so that it may be used 24 hours a day, 7 days a week by the individual. Biochemistry pioneer James Barber of London's Imperial College, who determined the structure of the photosynthetic membrane in 2004, stated "this is a major discovery with enormous implications for the future prosperity of mankind." The discovery provides a carbon-neutral source by enabling the large scale deployment of solar energy at the personal level.

Nocera's cobalt-oxygen evolving catalyst (Co-OEC) can use solar light as an input (via a photovoltaic cell or directly) to split water into hydrogen and oxygen. The Co-OEC is unique because it operates safely with high activity under benign conditions (room temperature and pH 7); is comprised of inexpensive, earth-abundant materials and is easy to manufacture and engineer; is self-healing; is functional in natural, waste, and sea waters; can form on diverse conducting surfaces of varying geometry and can be easily interfaced with a variety of light-absorbing and charge-separating materials, and; may be activated by solar-derived electricity or directly by sunlight mediated by a semiconductor. In addition, because Co-OEC is fully functional in waste and natural water streams, Nocera's discovery also sets a path to providing clean drinking water to poor populations worldwide.

Developing the Next Generation of Batteries

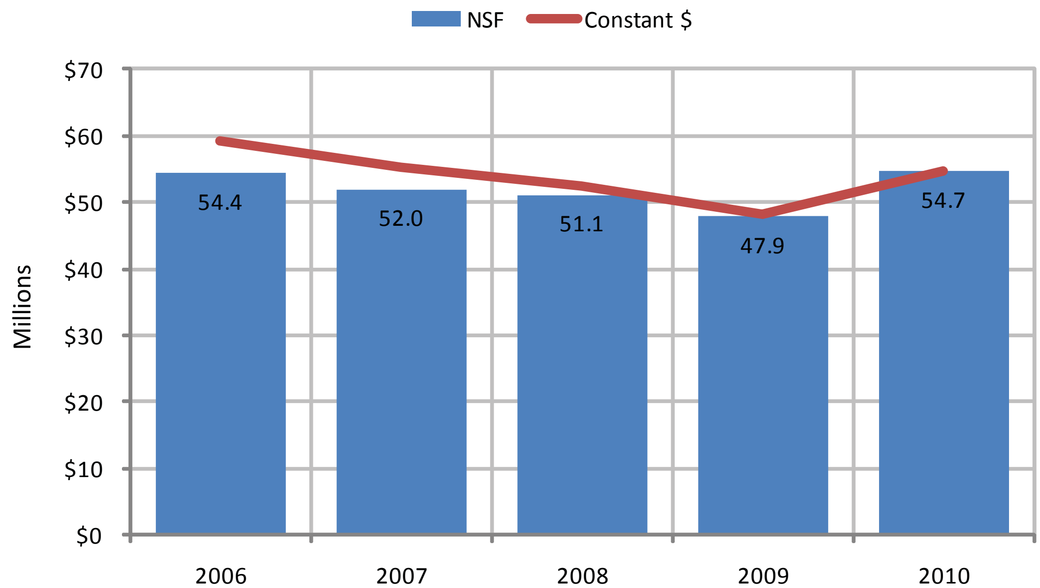
MIT researchers are researching innovative approaches to battery construction. A team of MIT researchers led by Angela Belcher was able to genetically engineer viruses to produce both the positively and negatively charged ends of a lithium ion battery. The battery has the same energy capacity as those being considered for use in hybrid cars, but is produced using a cheaper, less environmentally hazardous process. MIT President Susan Hockfield presented a prototype battery to President Barack Obama at a press briefing at the White House. Professor Gerbrand Ceder and graduate student Byoungwoo Kang have developed a new way to manufacture the material used in lithium ion batteries that allows ultrafast charging and discharging. The new method creates a surface structure that allows lithium ions to move rapidly around the outside of the battery. Batteries built using the new method could take seconds, rather than the now standard hours, to charge. Belcher's research is funded by the National Science Foundation through the Materials Research Science and Engineering Centers program, as well as the Army Research Office Institute of Collaborative Technologies. Ceder's research is funded by the National Science Foundation through the Materials Research Science and Engineering Centers program, and by the Department of Energy through the Batteries for Advanced Transportation Program.

Using Computer Science to Detect and Treat Autism

MIT Media Lab researchers Rosalind Picard, Matthew Goodwin, and Rana el Kaliouby, along with collaborators at five other institutions, recently received a joint $10 million, five-year National Science Foundation Expectations award to develop new technologies for measuring and analyzing behavior during face-to-face interactions. This collaboration will be the first large-scale effort of computer scientists and behavior scientists to jointly address diagnosing and intervening early in the lives of those with Autism Spectrum Disorders (ASD). ASD, which refers to a group of complex neurodevelopmental disorders that cause social communication and behavioral impairments in children and adults, currently affects 1 in 110 children in the United States. The collaboration aims to combine computer science and behavioral science to create an entirely new field of inquiry: computational behavior science.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

National Science Foundation	2006	2007	2008	2009	2010
Campus Research Expenditures	$54,412,356	$52,006,145	$51,119,892	$47,864,487	$54,678,389
Constant $	$59,264,122	$55,215,419	$52,335,195	$48,327,692	$54,678,389



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers
Receiving Support in the Most Current Year

Computer Science & Artificial Intelligence Laboratory
Kavli Institute for Astrophysics and Space Research
Earth, Atmospheric and Planetary Science
Haystack Observatory
Research Laboratory of Electronics
Chemistry
Mathematics
Center for Materials Science and Engineering
Earth System Initiative
Mechanical Engineering

In the 2008-2009 Academic Year, 278 graduate students held research assistantships, 168 held fellowships and 13 held traineeships funded at least in part by the National Science Foundation; of these, 256 research assistantships, 167 fellowships, and 13 traineeships were fully funded by NSF.

The National Science Foundation has awarded the Faculty Early Career Development (CAREER) Award to 106 current MIT faculty and staff members.

NASA

Selected Current Projects

Mapping the Moon

NASA's Lunar Reconnaissance Orbiter made its way to the moon following a flawless liftoff in June 2009 from Cape Canaveral Air Force Station aboard an Atlas V rocket. The mission will perform high-resolution mapping of the moon with seven sensors in preparation for future robotic and human exploration. MIT has ties to three of the instruments on the craft. Professor Maria Zuber, head of the Department of Earth, Atmospheric and Planetary Sciences, is the co-leader of investigations to perform high-resolution topographic mapping and the first operational optical tracking of a planetary spacecraft. Members of MIT Kavli Institute for Astrophysics and Space Research are also participating in an experiment to characterize the lunar radiation environment. See http://web.mit.edu/newsoffice/2009/launch-0619.html for the original MIT news article about the launch.

Probing the Violent Universe

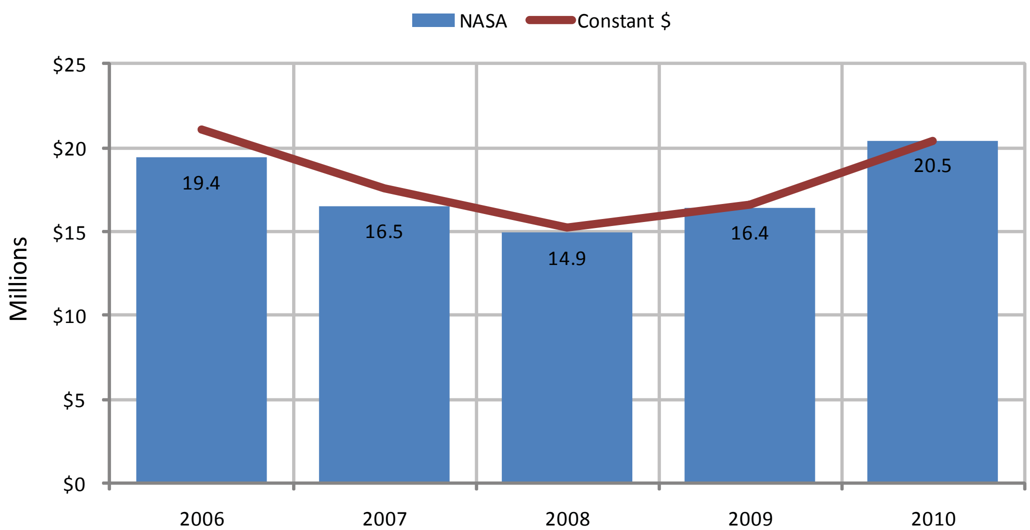
The Chandra X-ray observatory, launched in July 1999, is one of NASA's major astronomical satellites. X-rays mark the most energetic phenomena in the universe including black holes, highly active stars, supernovae and their remnants, quasars, and the ten million degree gas that permeates clusters of galaxies. Chandra carries by far the best X-ray telescope ever built, one capable of making images at X-ray wavelengths that are comparable to those made by the best ground-based optical telescopes in visible light. MIT's Kavli Institute for Astrophysics and Space Research (formerly the Center for Space Research) built two of the four scientific instruments that record the radiation focused by the telescope. A great majority of the observations performed with Chandra use one or both of these instruments, which were developed over more than a decade using technological advances made both on campus and at MIT Lincoln Laboratory. The specialized, X-ray sensitive Charge Coupled Devices (CCDs) and the periodic, submicron structures at the cores of these instruments remain unique in the world. They provide astronomers with orders of magnitude improvements in imaging and spectroscopic sensitivity. MIT's own researchers continue to use Chandra to probe the violent universe and also participate in the Chandra X-ray Center, which operates the observatory from Cambridge, Massachusetts.

Weather, Climate Change, and Searching for Life on Mars

Currently operating in Mars' orbit on the Mars Global Surveyor spacecraft is a joint MIT-NASA instrument that is mapping changes in the seasonal frost cap of Mars. On the Mars Reconnaissance Orbiter spacecraft an MIT-led investigation is collecting data to study the internal structure, CO_2 cycle, and atmospheric density of Mars. A joint study by MIT and Harvard Medical School is designing a prototype of a device to attempt to detect Earth-like life on Mars or other space environments. The device is being designed to fly on a future planetary lander or rover.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

NASA	2006	2007	2008	2009	2010
Research Expenditures	$19,405,127	$16,535,646	$14,923,271	$16,433,254	$20,463,995
Constant $	$21,135,417	$17,556,053	$15,278,050	$16,592,286	$20,463,995



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers Receiving Support in the Most Current Year

Kavli Institute for Astrophysics and Space Research
Earth, Atmospheric and Planetary Sciences
Aeronautics and Astronautics
Haystack Observatory
Earth System Initiative
Center for Global Change Science
Harvard/MIT Division of Health Science and Technology
Research Laboratory of Electronics
Mechanical Engineering
Microsystems Technology Laboratories

In the 2008-2009 Academic Year, 61 graduate students held research assistantships and 3 held fellowships funded at least in part by NASA; of these, 54 research assistantships and 3 fellowships were fully funded by NASA.

Other Federal Agencies
Selected Current Projects

Keeping the Noise Down

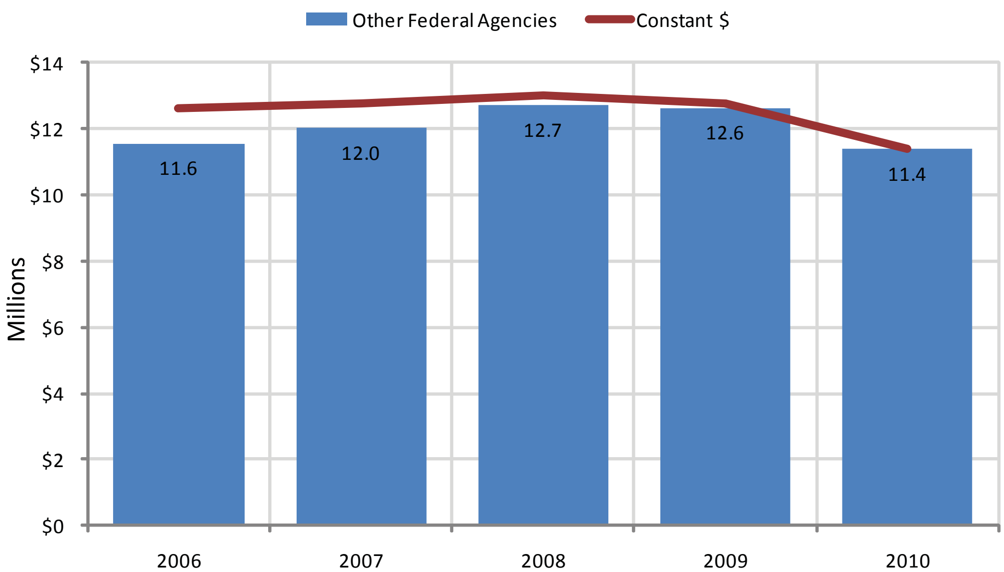
The demand for air travel is predicted to double over the next 20 years. Yet, with key airports operating at full capacity, aircraft noise in these mostly urban areas is a major barrier to service growth. Is there any way to design an airplane whose noise is imperceptible outside the boundaries of the airport and no longer so detrimental to people living, working, or going to school close to the flight paths? This is the challenge researchers from MIT, the University of Cambridge, and many parts of the civil aerospace and aviation industry are addressing in the Silent Aircraft Initiative, launched in 2003 by the Cambridge-MIT Institute (CMI). Exploring the design of the three major aircraft noise sources – the engines, the undercarriage, and the airframe – researchers are exploring such options as putting the engines above the aircraft, so the body itself shields the ground from noise; embedding them in long, muffled ducts; and designing an advanced engine located inside the airframe. They also are addressing technologies that will improve the integration of the airframe and the propulsion system. In addition, the team is assessing the economic implications of silent aircraft for both airlines and regional economics. The work is funded by the NASA Langley Research Center and CMI.

…While Keeping Down the Pollution and the Cost

Under the leadership of Aeronautics and Astronautics Professor John-Paul Clarke, a team of researchers has developed a new landing procedure that reduces noise, cuts pollution, and shortens flight time. In traditional approaches, planes begin their descent many miles from the runway, spending substantial time at relatively low altitudes. Furthermore, the planes move down in steps, which require noisy engine thrusts every time they level out. The new system, which uses sophisticated avionics that enable pilots on their final approach to guide their planes directly to the correct radio beam, keeps a plane at cruise altitude until it is relatively close to the airport. At this point, the plane makes an even, continuous descent to the runway, appreciably reducing noise, burning less fuel and emitting fewer fumes. Because the aircraft maintains higher speeds and takes a more direct path to the runway, the system also reduced flight time. The team demonstrated the approach's effectiveness in a two-week test at Louisville Regional Airport; and it now is conducting research to adapt and test the procedure for airports with heavier traffic volume and greater aircraft diversity. The Louisville test was funded by Congress, with additional support from UPS, Boeing, regional traffic control centers, MIT, the Federal Aviation Administration, and NASA. In 2003, MIT was designated an Air Transportation Center of Excellence for Aircraft Noise and Aviation Emission Mitigation, created by the FAA. Clarke is the center's director.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

Other Federal Agencies	2006	2007	2008	2009	2010
Research Expenditures	$11,569,359	$12,025,115	$12,715,545	$12,643,762	$11,376,292
Constant $	$12,600,959	$12,767,179	$13,017,839	$12,766,121	$11,376,292



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Other Federal Agencies include: Department of Transportation, Department of Commerce, Department of the Interior, Department of Education, Department of Agriculture, Nuclear Reactor Commission, Environmental Protection Agency, etc.

Leading Departments, Laboratories and Centers Receiving Support in the Most Current Year

Aeronautics and Astronautics
Sea Grant College Program
Center for Transportation and Logistics
The Broad Institute
Computer Science and Artificial Intelligence Laboratory
Laboratory for Nuclear Science

In the 2008-2009 Academic Year, 35 graduate students held research assistantships and 20 held fellowships funded at least in part by the Other Federal Agencies; of these, 34 research assistantships and 12 fellowships were fully funded.

Non-Profit Organizations
Selected Current Projects

Treating Parkinson's Disease with Stem Cells

A team including MIT researchers has demonstrated for the first time that artificially created stem cells can be used to treat symptoms of Parkinson's disease in rats. Researchers at the Whitehead Institute for Biomedical Research found that nerve cells derived from skin cells reprogrammed to behave like embryonic stem cells can be successfully integrated in animal brains and improve symptoms of a neurodegenerative condition similar to Parkinson's. The work could lead to successful treatments for human patients of Parkinson's, the degenerative neurological disorder. However, the researchers pointed out that hurdles associated with reprogramming cells must first be cleared. The research was supported by the Ellison Medical Foundation and the National Institutes of Health. http://web.mit.edu/newsoffice/2008/parkinson-0407.html

Marine Microbiology Initiative

Marine microbes are extraordinarily sensitive biosensors; they rapidly alter their protein expression in response to minute changes in environmental conditions such as light, temperature, chemicals, or pressure. The same sensitivity that makes them valuable environmental indicators also renders them difficult to study in their natural state. Researchers in MIT's departments of civil and environmental engineering, and biological engineering are using a new method to study these marine microbe communities by examining small RNA (sRNA), the snippets of genetic material that control gene expression. The discovery of sRNA in a natural setting may make it possible to study on a broad scale how microbial communities living in different ocean environments respond to environmental stimuli. The research is being led by professors Edward DeLong and Sallie Chisholm, and is funded by the Gordon and Betty Moore Foundation Marine Microbiology Initiative. The research is also supported by the National Science Foundation and the Department of Energy. http://web.mit.edu/newsoffice/2009/small-RNA-0514.html

Simons Initiative on Autism and the Brain

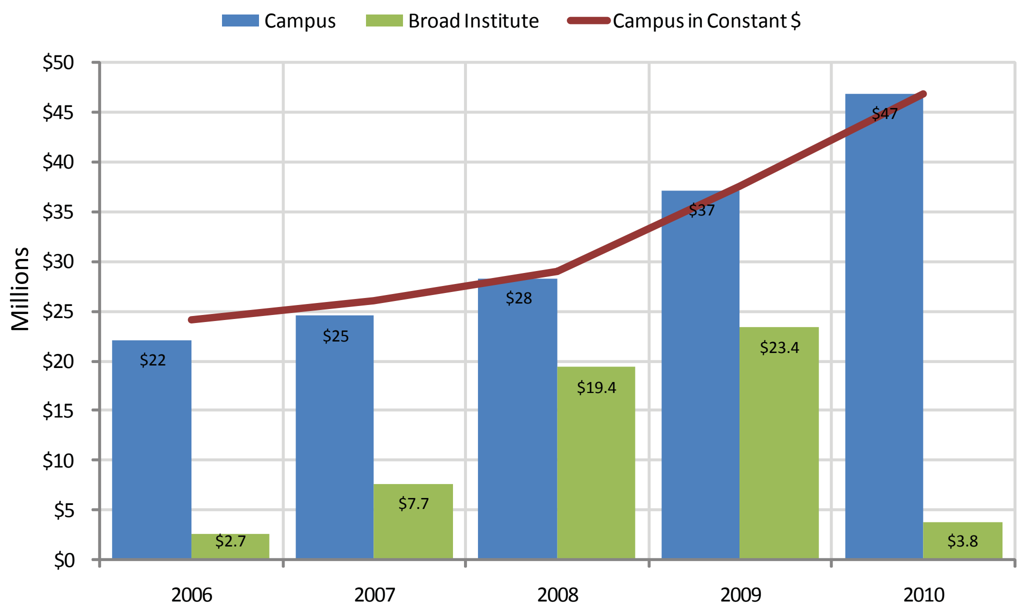
Disorders of learning and development affect up to 5 in 100 individuals in the United States. A subset affected by Autism Spectrum Disorders (ASD) includes approximately one in every 150 children. Recent advances in neuroscience, including neurogenetics, systems neuroscience, and cognitive neuroscience, have the promise of significantly advancing our understanding of the causes of ASD and other pervasive developmental disorders, and help in their treatment. To be effective, however, a research effort requires close interaction between neuroscientists, cognitive scientists, and clinicians.
In 2005, the Simons Foundation awarded a 5-year grant to fund autism research in 6 BCS labs at MIT under the Simons Autism Project. The projects aim to use advanced research tools and methods to develop accurate diagnosis and treatment for children with ASD and related developmental disorders, and for developing animal models of ASD. In 2009, the Simons Foundation established a three-year grant to improve the infrastructure for autism research at MIT. This gift promotes innovative, collaborative, and interdisciplinary research that bridges labs and methods and that is targeted toward a deeper understanding of autism. This grant includes several components: funding for postdoctoral fellows and seed research grants, and funds for a colloquium series.

With the help of the SFARI, MIT's autism research effort has grown into the Simons Initiative on Autism and the Brain. Many MIT researchers are members of the Autism Consortium, a collaboration of 75 clinicians and researchers across 13 Boston-area institutions to seek the causes and develop therapies for autism. http://autism.mit.edu/

MIT Campus and Broad Institute Research Expenditures*
Fiscal Years 2006-2010

*The Broad Institute separated from MIT on July 1, 2009. The chart below displays both campus research expenditures and Broad Institute research expenditures.

Research Expenditures	2006	2007	2008	2009	2010
Campus	$22,138,254	$24,515,221	$28,324,003	$37,161,950	$46,846,106
Broad Institute	$2,694,886	$7,683,458	$19,370,397	$23,376,207	$3,792,875
Campus in Constant $	$24,112,247	$26,028,044	$28,997,366	$37,521,582	$46,846,106
Broad Constant $	$2,935,180	$8,157,601	$19,830,900	$23,602,428	$3,792,875



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories and Centers Receiving Support in the Most Current Year

Technology and Development Program
Mechanical Engineering
MIT Energy Initiative
Brain & Cognitive Sciences
Earth Systems Initiative
McGovern Institute for Brain Research
Chemical Engineering
Research Laboratory of Electronics
Materials Science and Engineering
The Koch Institute for Integrative Cancer Research

3 Lincoln Laboratory

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Lincoln Laboratory

MIT Lincoln Laboratory is a Federally Funded Research and Development Center (FFRDC) operated by the Massachusetts Institute of Technology under contract with the Department of Defense (DOD). The Laboratory's core competencies are in sensors, information extraction (signal processing and embedded computing), communications, integrated sensing, and decision support, all supported by a strong program in advanced electronics technology.

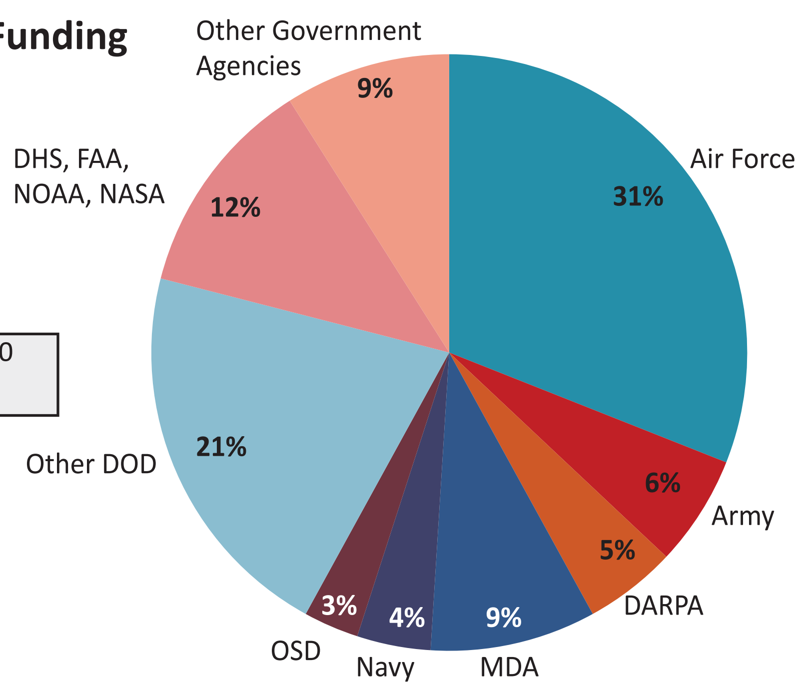
Since its establishment in 1951, MIT Lincoln Laboratory's mission has been to apply technology to problems of national security. The Laboratory's technology development is focused on its primary mission areas—space control; air and missile defense technology; communication systems and cyber security; intelligence, surveillance, and reconnaissance systems and technology; advanced electronics; tactical systems; and homeland protection. In addition, Lincoln Laboratory undertakes government-sponsored, nondefense projects in areas such as air traffic control and weather surveillance.

Two of the Laboratory's principal technical objectives are (1) the development of components and systems for experiments, engineering measurements, and tests under field operating conditions and (2) the dissemination of information to the government, academia, and industry. Program activities extend from fundamental investigations through the design process, and finally to field demonstrations of prototype systems. Emphasis is placed on transitioning systems and technology to industry.

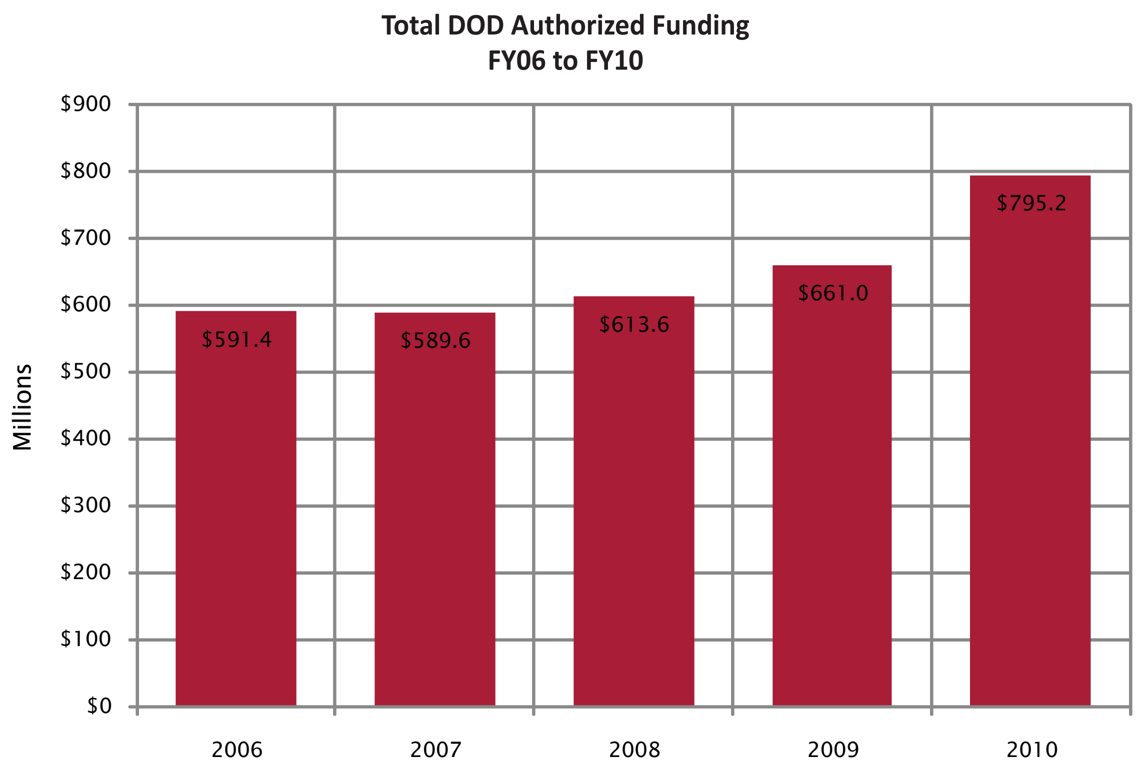
MIT Lincoln Laboratory also emphasizes meeting the government's FFRDC goals of maintaining long-term competency, retaining high-quality staff, providing independent perspective on critical issues, sustaining strategic sponsor relationships, and developing technology for both long-term interests and short-term, high-priority needs.

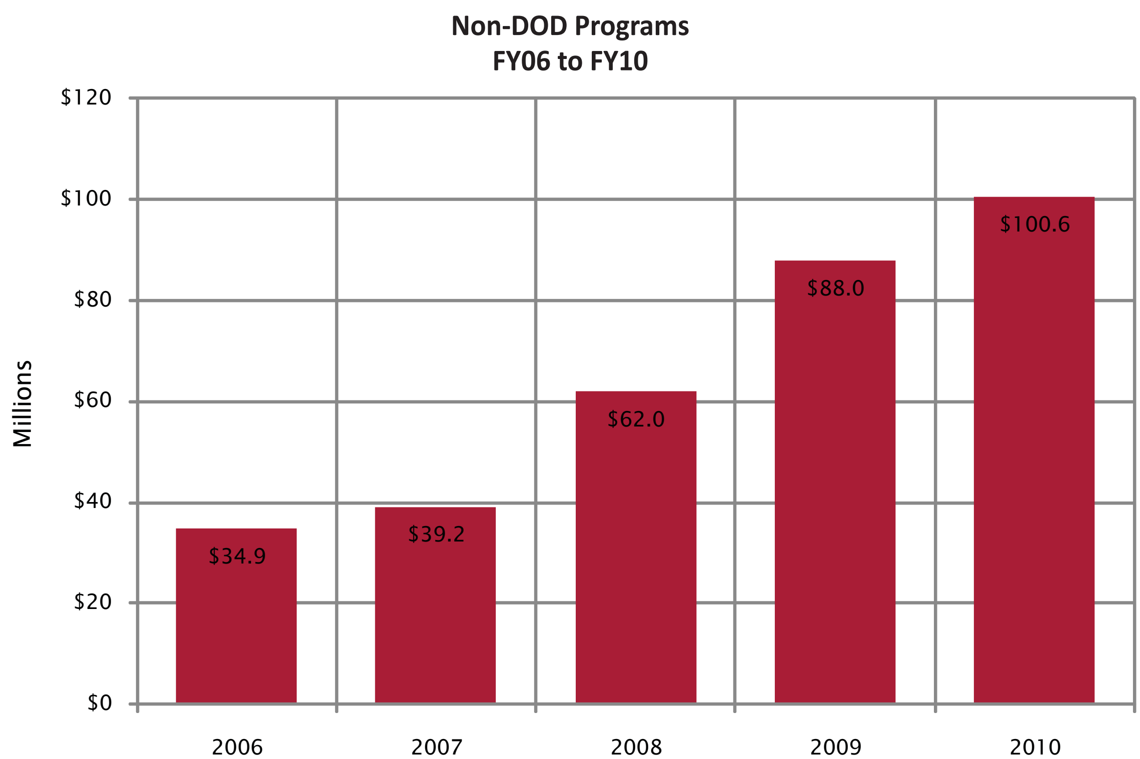
FY 2010 Authorized Funding By Sponsor

Total Authorized FY 2010 Funding = $895.8 M



All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.



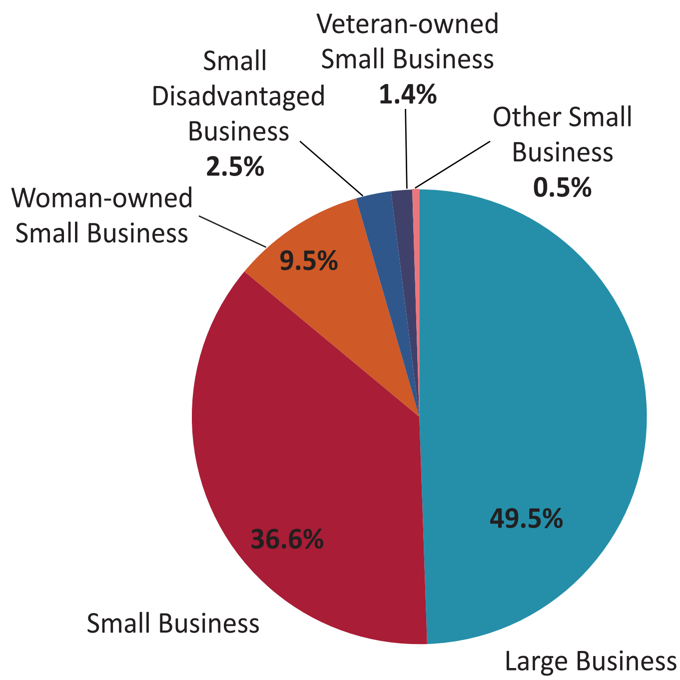


All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

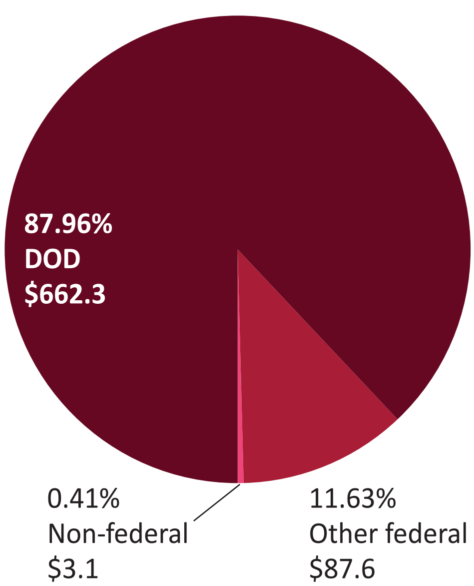
Lincoln Laboratory's Economic Impact

Goods and Services (including subcontracts) Expenditures Fiscal Year 2010 (In $millions)	
Type	**Amount**
Large Business	170.6
Small Business (SB)	126.2
Woman-owned SB	32.6
Small Disadvantaged Business	8.6
Veteran-owned SB	4.8
Other SB	1.7
Total	344.5
Top Seven States	
Massachusetts	133.3
California	51.5
New Jersey	36.7
Virginia	21.8
Texas	17.3
New Hampshire	12.6
Ohio	12.0
Other New England States	
Rhode Island	4.2
Connecticut	3.0
Maine	0.3
Vermont	0.1

The Laboratory has generated and supported a range of national business and industrial activities. The charts that follow show the Laboratory's economic impact by business category and state.



All of the above data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.



Lincoln Laboratory's Research Expenditures

Lincoln Lab employs approximately 3,000 people and has research expenditures of $753.0 million

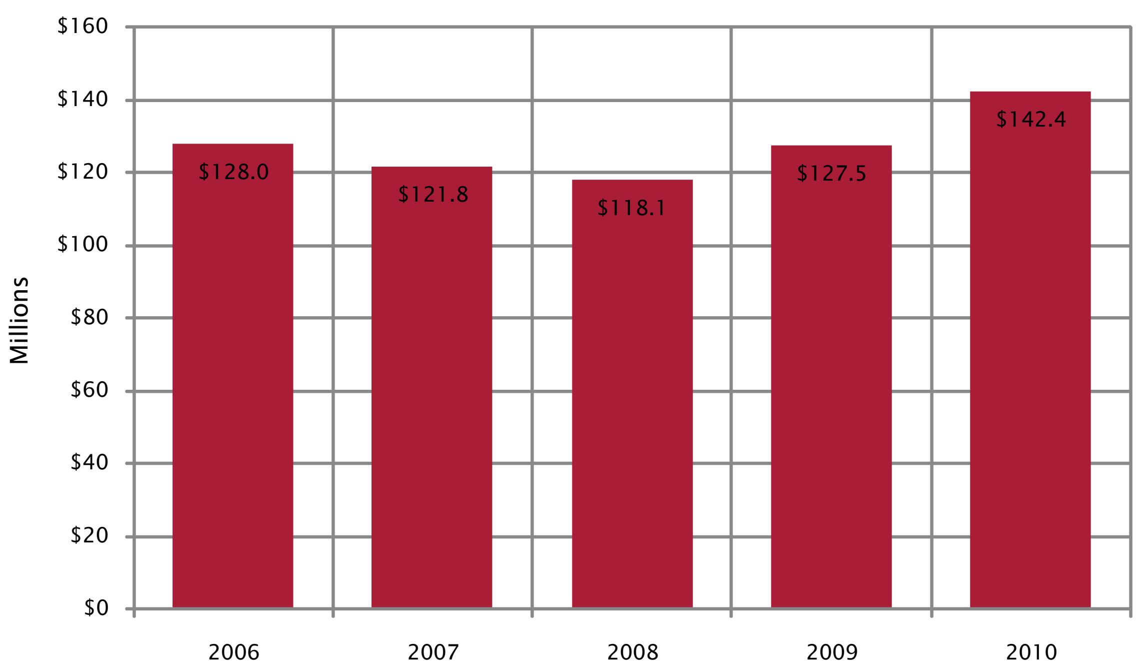
Research Expenditures (in millions)
Fiscal Year 2010*
Total: $753.0 million

**This graph shows research expenditures for the MIT fiscal year, which runs from July 1 to June 30. The data reported in this section reflect the period concurrent with the U.S. Government fiscal year, which runs from October 1 to September 30.*

Air and Missile Defense Technology

In the Air and Missile Defense Technology mission, Lincoln Laboratory works with government, industry, and other laboratories to develop integrated systems for defense against ballistic missiles, cruise missiles, and air vehicles in tactical, strategic, and homeland defense applications. Activities include the investigation of system architectures, development of advanced sensor and decision support technologies, development of flight-test hardware, extensive field measurements and data analysis, and the verification and assessment of deployed system capabilities. The program includes a focused evaluation of the survivability of U.S. air vehicles against air defense systems. A strong emphasis is placed on the rapid prototyping of sensor and system concepts and algorithms, and the transfer of the resulting technologies to government contractors responsible for the development of operational systems. Lincoln Laboratory continues to have a significant role in characterizing the capabilities and limitations of deployed ballistic missile defense components and in helping to develop, refine, and verify tactics, techniques, and procedures to optimize performance. The Laboratory is also actively engaged in the analysis, development, testing, and implementation of new capabilities. Areas of particular focus are system-wide tracking and discrimination, system-level testing, and advanced countermeasures techniques.

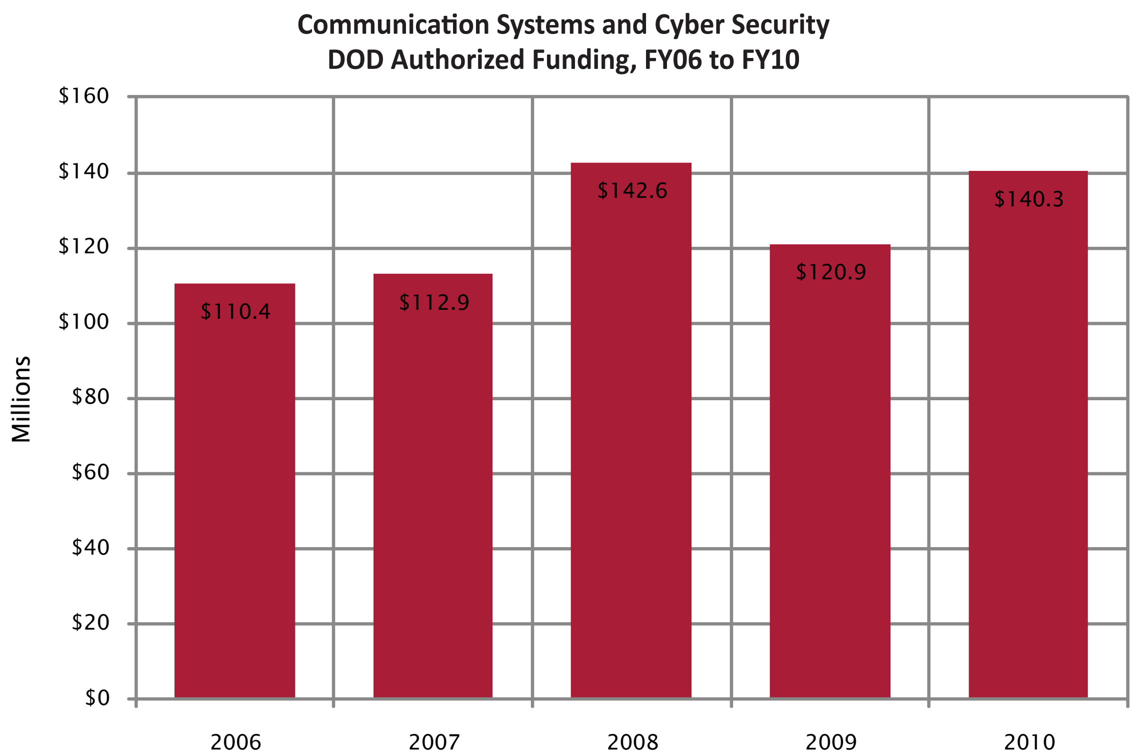
Air and Missile Defense Technology
DOD Authorized Funding, FY06 to FY10



All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Communication Systems and Cyber Security

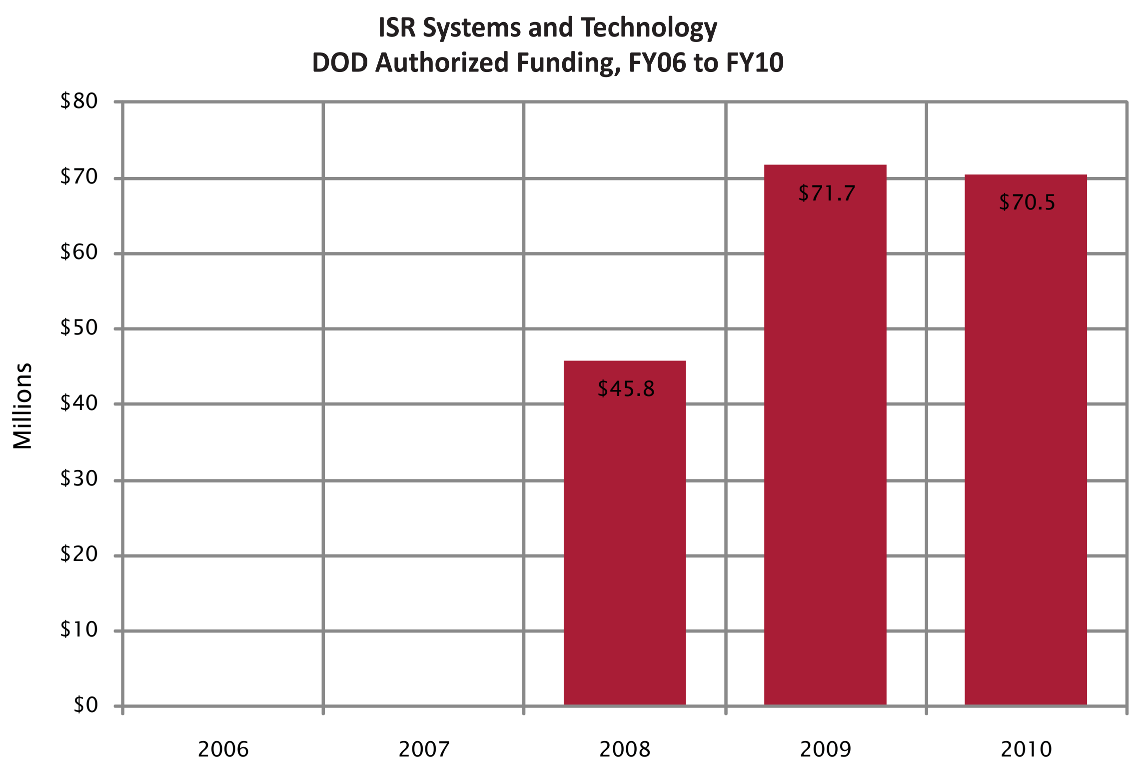
In the Communication Systems and Cyber Security missions, Lincoln Laboratory develops and demonstrates new technology to enable worldwide networked operations for the military and other government agencies. This work draws on a core expertise in RF, fiber and free-space optics, network protocols and services, information operations, communications processing, and speech and language technologies to address the needs of next-generation satellite, airborne, and terrestrial networks. The approach spans the network domain from physical layer to applications, with significant attention given to the interplay among layers and the need to provide security. Future directions include evolving core programmatic thrusts, such as satellite communications and on-the-move communications, and expanding the focus on net-centric operations and cyber security.



All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Intelligence, Surveillance, and Reconnaissance Systems and Technology

The Intelligence, Surveillance, and Reconnaissance (ISR) Systems and Technology mission conducts research and development into advanced sensing concepts, signal and image processing, high-performance computing, networked sensor architectures, and decision sciences. This work is focused on providing improved surface and undersea surveillance capabilities for problems of national interest. The Laboratory's ISR program encompasses airborne imaging and moving target detection radar, RF geolocation systems, electro-optic imaging, and laser radar. Successful concepts often develop into experimental prototype ISR systems, sometimes on surrogate platforms, that demonstrate new capability in operationally relevant environments. Future directions are expanded efforts in signals intelligence and multi-intelligence data exploitation, as well as laser-based sensing for explosives and chemical signatures. Future goals are to strengthen tracking and exploitation expertise and programs, and to develop an end-to-end ISR test bed.

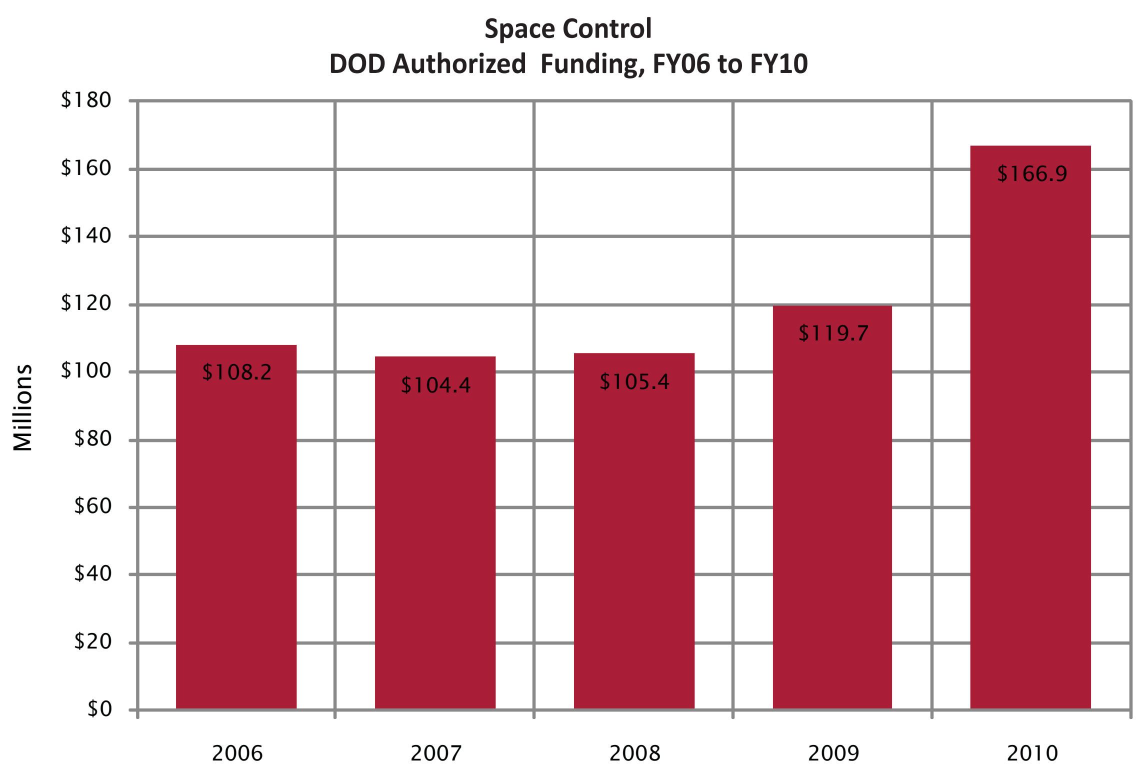


The ISR Systems and Technology mission area was instituted in 2008.

All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Space Control

The Space Control mission develops technology that enables the nation's space surveillance system to meet the challenges of space situational awareness. Lincoln Laboratory works with systems to detect, track, and identify man-made satellites; performs satellite mission and payload assessment; and investigates technology to improve monitoring of the space environment, including space weather and atmospheric and ionospheric effects. The technology emphasis is the application of new components and algorithms to enable sensors with greatly enhanced capabilities and to support the development of net-centric processing systems for the nation's Space Surveillance Network. Long-range objectives are the development of technology for systems that support the nation's space control needs, that enable environmental monitoring, and that provide special-purpose surveillance. Work on programs that support homeland security systems and that provide specialized sensing, data exploitation, and decision support for intelligence efforts is anticipated.

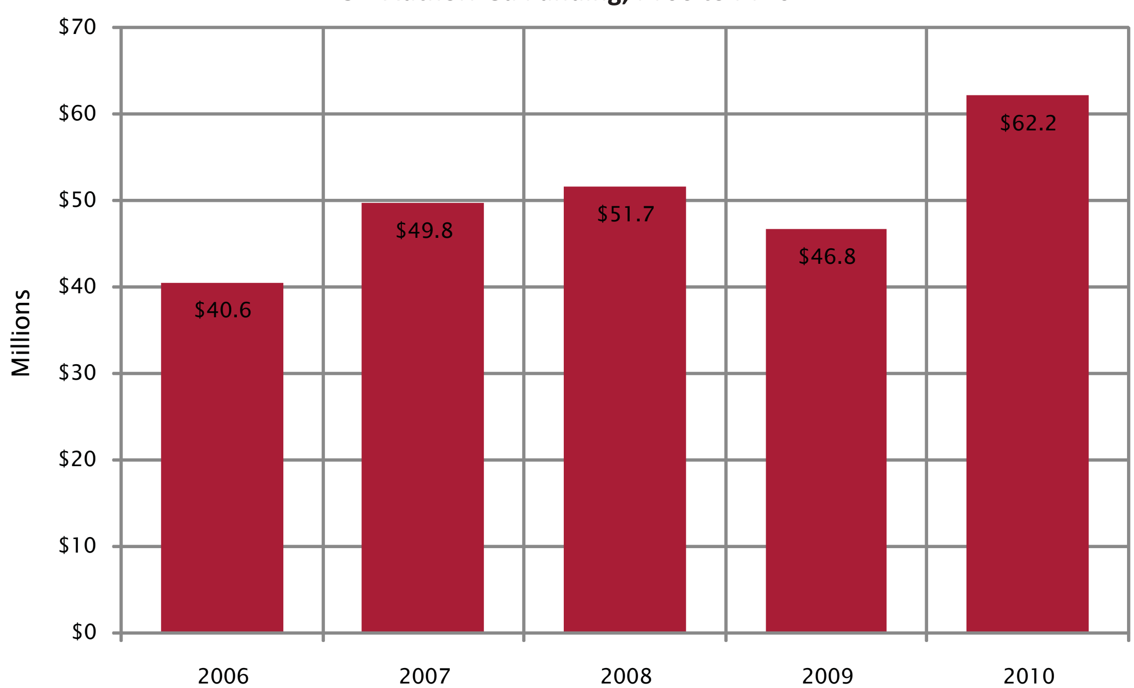


All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Advanced Technology

Research and development in Advanced Technology focus on the invention of new devices, the practical realization of those devices, and their integration into subsystems. Although many of these devices continue to be based on solid-state electronic or electro-optical technologies, recent work is highly multidisciplinary, and current devices increasingly exploit biotechnology and innovative chemistry. The broad scope of this work includes the development of unique high-performance detectors and focal planes, 3-D integrated circuits, biological and chemical agent sensors, diode lasers and photonic devices using compound semiconductors and silicon-based technologies, microelectromechanical devices, RF components, and unique lasers including high-power fiber and cryogenic lasers. Work will continue in the integration of advanced electronic devices into Department of Defense systems; a growing emphasis will be on microsystems assembly and packaging.

Advanced Technology
DOD Authorized Funding, FY06 to FY10

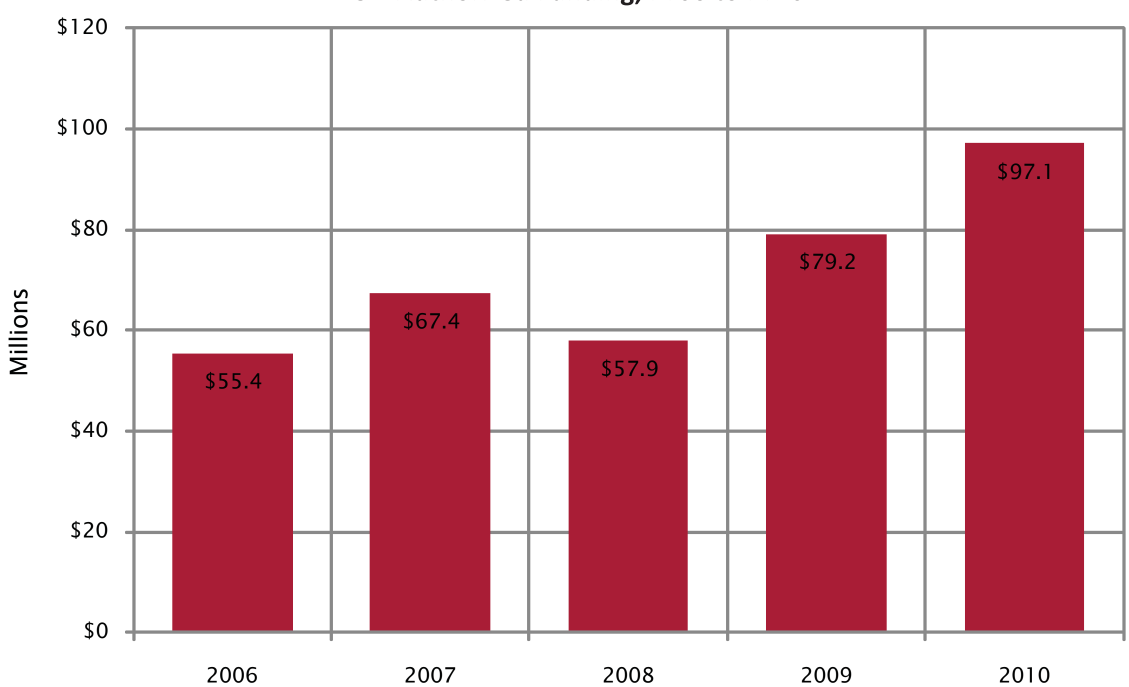


All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Tactical Systems

In the Tactical Systems mission, Lincoln Laboratory focuses on helping the U.S. military understand the operational utility and limitations of advanced technologies. Activities focus on a combination of systems analysis to assess technology impact in operationally relevant scenarios, rapid development and instrumentation of prototype U.S. and threat systems, and detailed, realistic instrumented testing. The Tactical Systems area is characterized by a very tight coupling between the Laboratory's efforts and the DOD sponsors involved in these efforts. This tight coupling ensures that the analysis which is done and the systems which are developed are relevant and beneficial to the military. Future goals are enhancing capabilities for countermeasure systems, evaluating upgrades for surveillance and target acquisition radars, and expanding the test bed that supports counterterrorism applications.

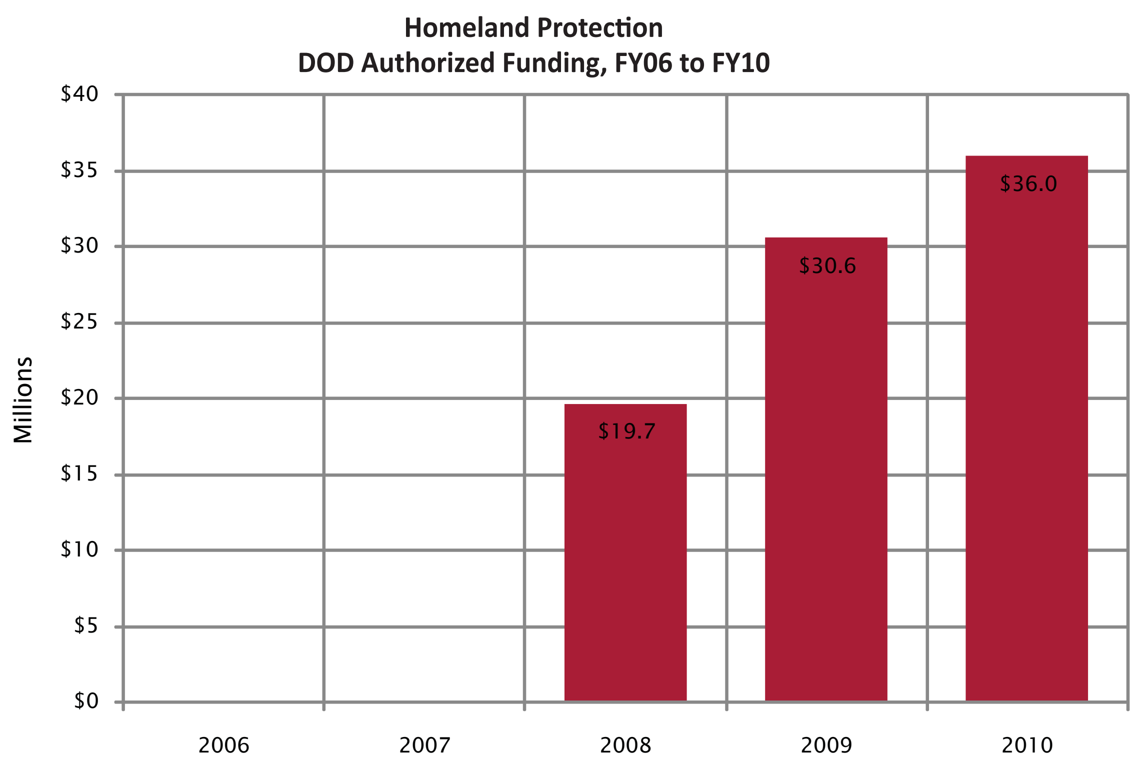
Tactical Systems
DOD Authorized Funding, FY06 to FY10



All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Homeland Protection

The Homeland Protection mission is supporting the nation's homeland security by developing technology and systems to help prevent terrorist attacks within the United States, to reduce the vulnerability of the United States to terrorism, and to minimize the damage and assist in the recovery from terrorist attacks. Current sponsors for this mission area include the Department of Homeland Security, Department of Defense, and other federal, state, and local entities. Efforts include architecture studies for the defense of civilians and facilities against potential biological attacks, development of the Enhanced Regional Situation Awareness system for air defense of the National Capital Region, development of cyber security technology for critical homeland infrastructure protection, and the evaluation of technologies for border and maritime security. Future focuses will be on air security for the homeland; an integrated air, land, and maritime surveillance architecture; continued investigations into sensors for detecting and identifying biological and chemical agents; and the use of sensors for border security.



The Homeland Protection mission area was instituted in 2008.

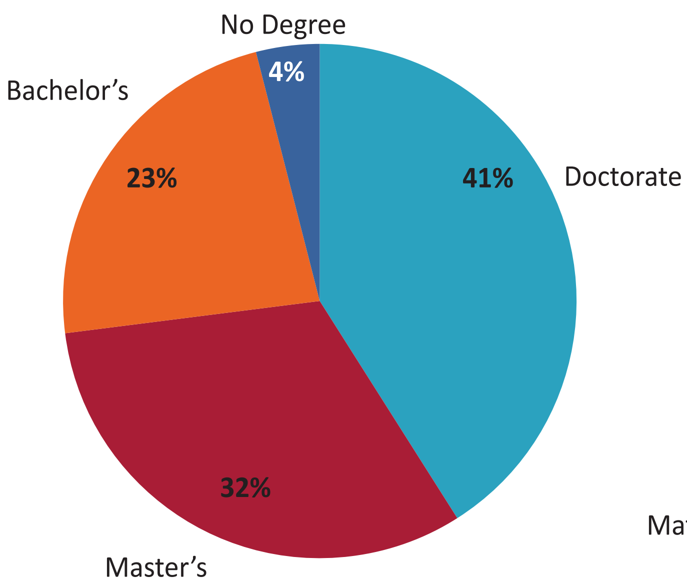
All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Lincoln Laboratory Staff

Approximately 1,550 professional technical staff are involved in research programs. Almost three-quarters of the technical staff have advanced degrees, with 41% holding doctorates. Professional development opportunities and challenging cross-disciplinary projects are responsible for the Laboratory's ability to retain highly qualified, creative staff.

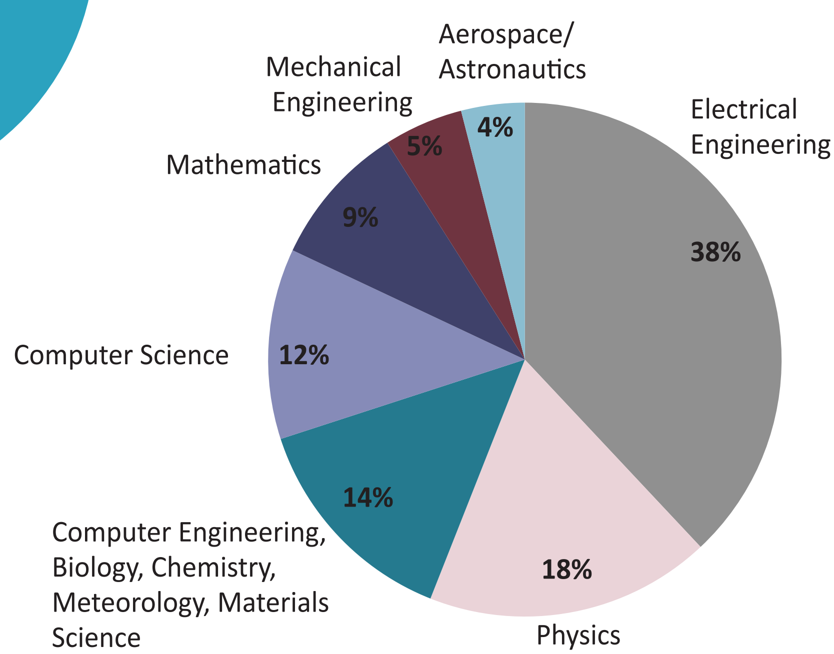
Lincoln Laboratory recruits at more than 60 of the nation's top technical universities, with 65-75 percent of new hires coming directly from universities. Lincoln Laboratory augments its campus recruiting by developing long-term relationships with research faculty and promoting fellowship and summer internship programs.

Technical Staff Profile



Degrees Held by Lincoln Laboratory Technical Staff

Academic Disciplines of Lincoln Laboratory Technical Staff



All data are for the period concurrent with the U.S. Government fiscal year, Oct. 1 to Sept. 30.

Test Facilities and Field Sites

Hanscom Field Flight and Antenna Test Facility
The Laboratory operates the main hangar on the Hanscom Air Force Base flight line. This 93,000-sq-ft building accommodates the Laboratory Flight Test Facility and complex of state-of-the-art antenna test chambers. The Flight Facility houses several Lincoln Laboratory-operated aircraft used for rapid prototyping of airborne sensors and communications.

Hanscom Field Flight and Antenna Test Facility

Millstone Hill Field Site, Westford, MA
MIT operates radio astronomy and atmospheric research facilities at Millstone Hill, an MIT-owned, 1,100-acre research facility in Westford, Massachusetts. Lincoln Laboratory occupies a subset of the facilities whose primary activities involve tracking and identification of space objects.

Millstone Hill Field Site, Westford, Massachusetts

Reagan Test Site, Kwajalein, Marshall Islands
Lincoln Laboratory serves as the scientific advisor to the Reagan Test Site at the U.S. Army Kwajalein Atoll installation located about 2,500 miles WSW of Hawaii. Twenty staff members work at this site, serving two- to three-year tours of duty. The site's radars and optical and telemetry sensors support ballistic missile defense testing and space surveillance. The radar systems provide test facilities for radar technology development and for the development of ballistic missile defense techniques.

Reagan Test Site, Kwajalein Atoll, Marshall Islands

Other Sites
Pacific Missile Range Facility, Kauai, Hawaii
Experimental Test Site, Socorro, New Mexico

4 MIT and Industry

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MIT and Industry

Innovation Ecosystem

MIT is built on a foundation of innovation and entrepreneurship. Since its creation in 1861 by the Massachusetts State Legislature, MIT has been charged with the "development and practical application of science in connection with arts, agriculture, manufactures, and commerce." The Institute's motto, mens et manus – mind and hand – codifies its continuing commitment to serving society through the practical application of university research.

An institutional culture with a dynamic relationship to industrial innovation has grown on top of this foundation. The components of this ecosystem of innovation encompass education, business connections, and the commercialization of university research. MIT's innovation model encourages members of its research community – its students, researchers, faculty, staff, and alumni – to reach beyond MIT's campus. The success of this model is outlined in a 2009 Kauffman Foundation report on the Entrepreneurial Impact of MIT.[1] The report estimates that living MIT graduates have founded about 25,800 active companies, employing 3.3 million people and generating estimated annual world revenues of $2 trillion.

MIT's Innovation Ecosystem is sustained by the deep understanding of science and engineering instilled in its students, and is enhanced by several Institute initiatives. A sampling of these initiatives are described below.

The Technology Licensing Office

For decades, MIT's Technology Licensing Office has helped MIT faculty and researchers with patenting, licensing, and starting firms that build upon technology developed at MIT. In FY2010, MIT received 166 U.S. patents (second in the U.S. after the combined total of the ten universities in the University of California system) and filed 184 new U.S. patent applications. (See page 11 for more detailed TLO statistics.)

Industrial Liaison Program/Office of Corporate Relations

MIT has long held that breakthrough research hinges on open, consultative dialogue. The Office of Corporate Relations' Industrial Liaison Program (ILP) was established in 1948, making MIT the first academic institution with a formal program designed to nurture university/industry collaboration. For six decades, the ILP has connected member companies with the latest research developments at MIT and enabled industry to support the Institute's research and educational activities. Industry-sponsored research at MIT totaled $110 million in FY10, or 15% of all MIT research funding.

The Deshpande Center for Technological Innovation

Established in 2002, the Deshpande Center is a Proof of Concept Center (POCC) that trains university faculty and researchers in forming companies and commercializing technologies. The center helps bridge the gap between basic research and a valid proof of concept. This training reduces technology risks and market risks so investors feel comfortable committing the resources to develop the technology outside of the university. Since 2002, The Center has funded more than 80 projects with over $10 million in grants. Twenty projects have spun out of the center into commercial ventures, collectively raising more than $180 million in outside financing and employing more than 200 people.

Innovation Prizes

A number of prizes at MIT spur students and faculty to explore difficult problems. One example is the MIT $100K Entrepreneurship Competition, a year-long educational experience designed to encourage MIT students to act on their talent, ideas, and energy to produce tomorrow's leading firms. Since the $100K competition was founded in 1989, it has served as the launch pad for more than 120 companies, which have generated over $16 billion in market value and created over 4,000 jobs.

[1] Roberts, E. and Eesley, C; Entrepreneurial Impact: The Role of MIT; The Kauffman Foundation, February 2009 (http://www.kauffman.org/research-and-policy/mit-entrepreneurs.aspx)

MIT Entrepreneurship Center

Proposed in 1990 by the then Dean of the MIT Sloan School of Management as a center to support entrepreneurship across the five Schools at MIT, the Entrepreneurship-Center (E-Center) creates great value for its stakeholders by connecting technologists and business people and fostering an environment that helps them accelerate the creation of new companies together. The E-Center's educational and networking programs help instill in students the skills and attitudes it takes to succeed as entrepreneurs. The E-Center also builds alliances between MIT entrepreneurs and local corporate and venture capital leaders, building a community of academic, government, and industry leaders focused on entrepreneurial ventures.

Venture Mentoring Service

The MIT Venture Mentoring Service (VMS) connects members of the MIT community with advisory resources to increase successful outcomes and accelerate the commercialization of university innovations. The MIT VMS harnesses the knowledge and experience of volunteer alumni and other business leaders to help prospective entrepreneurs in the university community bring their ideas and inventions to market. Since its launch in 2000, more than 1,400 entrepreneurs involved in nearly 800 ventures have enrolled in VMS mentoring. Of these, more than 130 have advanced to become operating businesses.

Benefits to the National Economy

In 2009, the Kauffman Foundation of Entrepreneurship released a study on MIT's Entrepreneurial impact on the nation's economy. The study found that the five states benefiting most from MIT-related jobs were Massachusetts, with just under 1,000,000 jobs; California, with 526,000 jobs; New York, with 231,000 jobs; Texas, with 184,00 jobs; and Virginia, with 136,000 jobs.

Nearly 60 percent of companies founded by MIT alumni are located outside the Northeast. These companies have a large presence in the San Francisco Bay area (Silicon Valley), Southern California, the Washington-Baltimore-Philadelphia belt, the Pacific Northwest, the Chicago area, southern Florida, Dallas and Houston, and the industrial cities of Ohio, Michigan, and PennsylvaThe study also noted that "an important subset of the MIT alumni companies is in software, electronics (including instruments, semiconductors, and computers), and biotech. These firms are the cutting edge of what we think of as high technology and, correspondingly, are more likely to be planning future expansion than companies in other industries. They export a higher percentage of their products, hold more patents, and spend more of their revenues on research and development."

The study also found that MIT acts as a magnet for foreign entrepreneurs. It reported that 30 percent of foreign students who attend MIT found companies at some point in their lives. It stated that "half of those companies created by 'imported' entrepreneurs, 2,340 firms, are headquartered in the United States, generating their principal revenue ($16 billion) and employment (101,500 people) benefits here."

Industry

Selected Current Projects

Micro-Ants

Researchers at MIT, in collaboration with researchers at Boston University and in Germany, have created a new system that uses microscopic magnetic beads suspended in liquid to move objects inside microfluidic chips. The beads, which are made of polymers with specks of magnetic material suspended in them, have been dubbed "micro-ants" for their ability to transport objects much larger than themselves. When they are placed in a rotating magnetic field the beads spontaneously form short chains and spin, creating a current that can transport surrounding particles as much as 100 times larger than the beads. The new method could provide a simpler, less-expensive alternative to current microfluidic devices, a technology involving the precise control of tiny amounts of liquids flowing through microscopic channels on a chip in order to carry out chemical or biological analysis of tiny samples. The work may also help scientist better understand the human body. The micro-ants function similarly to cilia, which are tiny hair-like filaments that line organs like the trachea and the intestines. Like the micro-ants, cilia work in unison to create currents that sweep along cells, nutrients, and other particles. The work was led by Professor Alfredo Alexander-Katz and was funded by a grant from DuPont and grants from the German Government. http://web.mit.edu/newsoffice/2009/micro-ants.html

Closing in on Bionic Speed

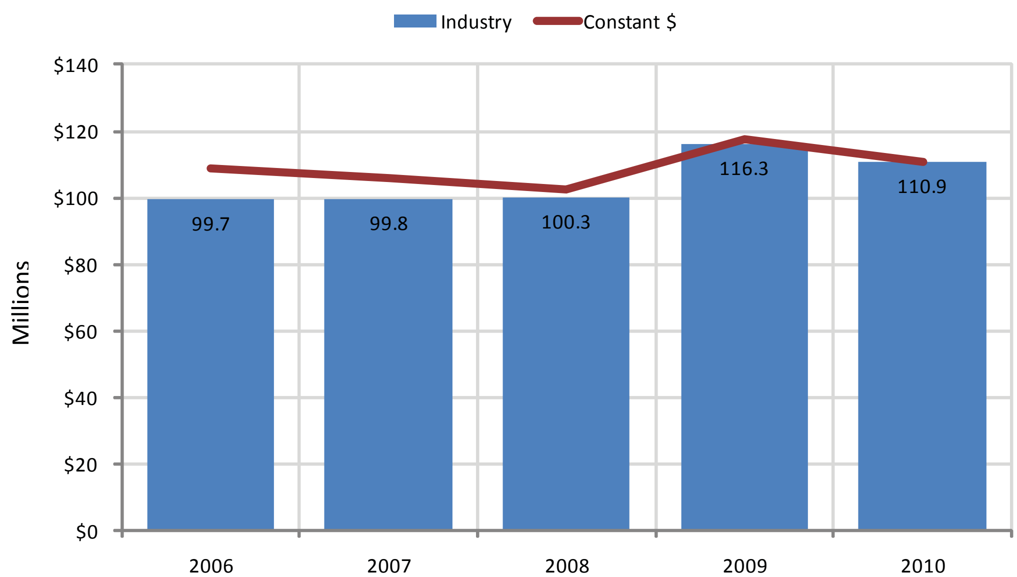
Robots have the potential to go where it is too hot, too cold, too remote, too small, or too dangerous for people to perform any number of tasks, from repairing water leaks to stitching blood vessels together. Now MIT researchers, led by Sidney Yip, professor of nuclear engineering and materials science and engineering, have proposed a theory that might eliminate an obstacle to achieving these goals – the limited speed and control of the "artificial muscles" that make these robots move. Today, engineers construct robotic muscles from polymers that carry an electronic current, which are triggered by activating waves called "solitons." Proposing a model that explains how these waves work, Xi Lin, a postdoctoral associate in Yip's lab, has developed an understanding which will permit engineers to design lighter, much more flexible polymers. Able to transmit the wave much more quickly, they can make the robot muscles move 1,000 times faster than those of humans. This work was supported by Honda R&D Co. Ltd., and DARPA.

Sharper Image

Researchers in MIT's Computer Science and Artificial Intelligence Laboratory have developed a technique for taking some of the blur out of snapshots. Rob Fergus, a postdoctoral associate in the lab, and computer science professor William Freedom, presented the method at the recent Siggraph 2006 conference in Boston. When pictures are taken with lightweight, digital cameras, often the hands holding the camera shake, blurring the resulting images. Using software to remove the blur is the goal of scientists, but it's difficult without knowing how the camera was moving. Knowing that objects tend to have statistically distinctive patterns of light and dark with sharp changes at the edges, Fergus developed software which measures the light-to-dark gradients in a photo and compares them with preprogrammed values to estimate how the camera moved, and then reconstructs the image. The process takes 10 to 15 minutes, and although the resulting images are not perfect, the method has provided serviceable versions of photos that were previously unusable.

MIT Campus Research Expenditures
Fiscal Years 2006-2010

Primary Sponsor	2006	2007	2008	2009	2010
Industry	$99,712,160	$99,771,121	$100,285,250	$116,288,518	$110,853,522
Constant $	$108,603,158	$105,927,950	$102,669,389	$117,413,891	$110,853,522



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

Leading Departments, Laboratories, and Centers Receiving Support in the Most Current Year

MIT Energy Initiative
Chemical Engineering
Media Laboratory
Computer Science & Artificial Intelligence Laboratory
Mechanical Engineering
Sloan School of Management
The Koch Institute for Integrative Cancer Research
Aeronautics and Astronautics
Biological Engineering
Materials Science and Engineering

Sponsored Research

MIT is a leader in conducting research sponsored by industry. More than 400 corporations supported research projects on the MIT campus in FY 2010, with expenditures exceeding $110 million. Companies often join together in these collaborations to support multi-disciplinary research programs in a wide range of fields.

Service to Industry

Deshpande Center for Technological Innovation

The Deshpande Center for Technological Innovation nurtures marketable inventions by engaging industry to spark inventions that solve existing needs, and by funding proof-of-concept explorations with Ignition Grants. The Center fuels market-driven innovation by funding research with Innovation Grants, getting the business community involved at an early stage to help shape the direction of research, and by educating the research community about commercialization. It also implements innovation in the marketplace by catalyzing collaborations, directing researchers to appropriate business and entrepreneurial resources, and serving as a liaison between MIT and the local business community.

The Industrial Performance Center

The Industrial Performance Center supports interdisciplinary research and education aimed at understanding and improving industrial productivity, innovation, and competitiveness. Faculty and students from all five MIT schools participate in its programs. Since its founding in 1992, the Center has conducted research at more than 1,000 firms in major manufacturing and service industries in both advanced and emerging economies.

Leaders for Global Operations

Leaders for Global Operations (LFGO) is an educational and research program that the MIT Sloan School of Management and the School of Engineering conduct in partnership with more than 25 global manufacturing and operations companies. The program educates new leaders in manufacturing and operations, and advances the understanding of manufacturing and operations principles. LFGO views these two functions in the broadest sense, from product concept through delivery. Its 24-month program leads to two Master of Science degrees – one in engineering and the other in management. Students work with faculty in both schools and take part in activities that include six-month internships at partner companies.

MIT Center for Biomedical Innovation

An Institute-wide collaboration of faculty from the MIT Schools of Engineering, Management, and Science, the Harvard-MIT Division of Health Sciences & Technology, and their counterparts from government and industry, the MIT Center for Biomedical Innovation addresses the challenges of translating advances in the life sciences more efficiently and safely, from the laboratory to the public. The center provides a "safe harbor" in which major players across the biomedical spectrum – from medical researchers to federal regulators, payers, and experts in finance and marketing – can better appreciate each other's concerns and communicate and collaborate more effectively.

MIT International Science and Technology Initiatives

The MIT International Science and Technology Initiatives program (MISTI) enlarges students' opportunities for international learning through on-campus resources and internships in foreign companies and laboratories; supports faculty collaborations with researchers abroad; and works with corporations, government, and nonprofit organizations to promote international industry, education, and research. More than 400 students participate annually in MISTI internships, preparing for their stay abroad with integrated courses in foreign languages and cultures. MISTI programs are organized by region. The first one established, MIT Japan, today is the largest center of applied Japanese studies for scientists and engineers in that country. Other programs are in China, France, Germany, India, and Italy. MISTI also supports conferences and workshops that promote international learning and research at MIT, and provides training for corporations.

MIT Sloan Fellows Program in Innovation and Global Leadership

The MIT Sloan Fellows Program in Innovation and Global Leadership is a 12-month, full-time program for high-potential mid-career managers with strong technical and entrepreneurial backgrounds. Integrating management, technology, innovation, and global outreach, the program provides students with a rigorous academic curriculum, frequent interaction with international business and government leaders, and an exchange of global perspectives that enables them to develop their capacities as global innovators. The program attracts people from all over the world from a wide variety of for-profit and nonprofit industries organizations, and functional areas. Students can earn an M.B.A., an M.S. in management, or an M.S. in the management of technology.

Office of Corporate Relations

MIT's Office of Corporate Relations promotes creative collaboration among MIT, industry, and government. Its Industrial Liaison Program enables member firms to draw upon MIT expertise to inform their own technology strategies, and at the same time helps faculty members stay abreast of the latest industrial developments.

Professional Education Programs

To meet industries' need to bring large groups of employees up to speed in new or evolving areas of knowledge, in 2002 the MIT School of Engineering established its Professional Education Programs (PEP). An extension of MIT's Professional Institute (see following entry), PEP offers Internet-based courses that employees can participate in at their home institutions without traveling to Cambridge. MIT faculty also work with corporations to design customized curriculums that meet their specific needs, including those that integrate management with technological advances.

Professional Institute

Founded in 1949, MIT's Professional Institute (PI) brings more than 600 technical, scientific, business, and government professionals from around the world to campus each year for two- to- five-day courses that allow them to develop working knowledge in rapidly evolving technologies, industries, and organizational structures. PI's more than 40 courses, which can involve lectures, discussions, readings, interactive problem solving, and laboratory work, cover a broad range of topics, such as hydrologic modeling, bioinformatics, nanostructured fluids, supply chain network optimization, scientific marketing, and high-speed videography. Recent PI participants include employees from Amgen, Archer Daniels Midland, Johns Hopkins Applied Physics Lab, Kimberly-Clark Corporation, Nagoya City University, San Mateo County Transit District, Delft University of Technology, and the Department of Defense.

System Design and Management

System Design and Management (SDM) educates engineering professionals in the processes of engineering and designing complex products and systems, and gives them the management skills they need to exercise these capacities across organizations. Sponsored by the School of Engineering and the Sloan School of Management, the program offers a joint Master's degree from both schools. Students can pursue these degrees either on campus or through a hybrid on-campus/off-campus curriculum that uses video conferencing and web-based instruction. This flexibility has made it possible for people like a captain in the U.S. Army commanding a division in Iraq, a captain in the Hellenic Air Force, or a General Electric aerospace engineer in Cincinnati to take advantage of SDM's technical, engineering, and management breadth. More than 50 companies and organizations from a wide range of fields have sponsored students in this program.

Strategic Partnerships

In 1994, MIT began to build new kinds of research partnerships, creating longer-term alliances with major corporations that would allow these companies to work with MIT to develop programs and strategies that address areas of rapid change. In return for their research and teaching support, the corporations share ownership of patentable inventions and improvements developed from the partnership. In a number of these alliances, funds are earmarked for specific education projects.

Dupont

Established in 2000 and extended in 2005, the DuPont MIT Alliance (DMA) brings together each institution's strengths in materials, chemical, and biological sciences to develop new materials for bioelectronics, biosensors, biomimetic materials, alternative energy sources, and other high value substances. DuPont also works with MIT's Sloan School of Management to define new business models for these emerging technologies. Among DMA's accomplishments is a device for the tissue-like culturing of liver cells that provides a medium for testing the material similar to the toxicity of new pharmaceuticals. Another is the development of a material similar to the water-repellent surfaces of lotus leaves, which has potential for applications like self-cleaning fabrics, water-repellent windshields, and plumbing that resists the growth of harmful bacteria. To date, MIT and DuPont scientists have applied for more than 40 patents based on their research. In its second stage, DMA has moved into nanocomposites, nanoelectronic materials, alternative energy technologies, and next-generation safety and protection materials.

Ford Motor Company

Since it was launched in 1997, the Ford-MIT Alliance has joined MIT and Ford researchers on a wide range of education and research projects that emphasize environment and design. Built on a long history of working together, the alliance grew from a recognition that changes brought about by globalization and the impact of advanced information technologies require new models of university/industry collaboration. The more than 80 research projects supported by the Ford-MIT Alliance include climate and environmental research, the development of cleaner engine and fuel technologies, computer-aided design, and automobile voice recognition systems, such as the one MIT and Ford researchers are working on to allow drivers to direct their autos' navigation systems by speaking, rather than by entering the information with keystrokes.

Hewlett-Packard Company

With the ultimate goal of expanding the performance and flexibility of the commercial, educational, and personal services that digital information systems provide, Hewlett-Packard and MIT established an alliance in 2000 to investigate new architectures, devices, and user interfaces, and to develop new ways to create and handle digital information. The HP/MIT Alliance has helped launch Dspace, the MIT Libraries' pathbreaking digital archive which opens up the intellectual output of MIT faculty and research staff to researchers around the world. It also supports the MIT Ultra-Wideband group, which is advancing UWB communication, and the MIT Center for Wireless Networking, which explores ways to expand the capabilities of wireless appliances and the networks and server architectures that they use.

Microsoft Corporation

Called iCampus, the Microsoft/MIT collaboration supports projects among Microsoft researchers and MIT students, faculty, and staff that advance IT-enabled teaching models and learning tools for higher education. Established in 1999, iCampus has funded dozens of faculty and student projects. Among its products are a new course in introductory physics; a Web-accessible microelectronics teaching laboratory; and a new tool for environmental researchers in the field – an electronic notebook that makes it possible to streamline data collection and improve its accuracy. This breakthrough was the product of a student-designed course set up with iCampus funding specifically for developing a software application that would enable environmental scientists to dispense with paper notebooks, gather data electronically, integrate it with environmental and GPS sensors, and carry out computations in the field. The tool also lets them transmit data wirelessly to a remote server, where not only are their records invulnerable to the hazards of wind, water, and other factors that make data collection in the field precarious; they also are readily available to other researchers.

Pirelli Labs

Working on the MIT campus and in Pirelli Laboratories near Milan, Italy, scientists from both organizations are collaborating on a new generation of nanotechnology integrated optical systems. By miniaturizing the components and using all of the wavelengths available in a fiber optic cable to maximize the amount of data transmitted on each fiber, this technology will both dramatically reduce manufacturing and delivery costs and make it possible to provide enormous broadband capacity to consumers. The collaboration's ultimate goal is to provide residential subscribers highest-quality broadband telecommunication services and much lower cost.

Project Oxygen Alliance

A partnership among the MIT Computer Science and Artificial Intelligence Laboratory and six corporations – the Acer Group, Delta Electronics, Hewlett-Packard, Nippon Telegraph and Telephone, Nokia, and Philips – Project Oxygen's goal is to make computation and communication resources as abundant and as easy to use as oxygen. Working also with support from the Defense Advanced Research Projects Agency, the project seeks to free people from computer jargon, keyboards, mice, and other specialized devices they rely on now for access to computation and communication. The researchers are creating, for example, speech and vision technologies that enable humans to communicate as naturally with computers as they do with people. They are developing centralized networks and robust software/hardware architectures that can adapt to mobile uses, currently available resources, and varying operating conditions. Researchers also are at work devising security and privacy mechanisms that safeguard personal information and resources.

Quanta Computing

In today's computing environment, people using personal service technologies must navigate among an array of devices – from cell phones to computers to personal digital assistants. In 2005, MIT and Quanta Computing established Project TParty to address this complexity. Engineers from Quanta are collaborating with researchers from MIT's Computer Science and Artificial Intelligence Laboratory to design new platforms for computing and communication, reengineer and extend the underlying technical infrastructures, create new interfaces, and explore new ways of imaging, accessing, and integrating information. Their goal is to design new products that will make the personal use of computer technologies much easier and more productive.

5 Global Engagement

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Global Engagement

The expanding global connections of the 21st Century provide MIT with increasing opportunities to engage in projects and collaborations outside the United States. As President Susan Hockfield noted in a speech delivered to the Confederation of Indian Industries in Mumbai, India in November 2007,

It has never been more clear that the future of innovation will be told in many, many different languages. In a world with so much talent, no one has a monopoly on good ideas. As researchers, if we are driven to find the most gifted collaborators and the most intriguing ideas, we must be prepared to look far beyond our own backyards. And as educators, if we fail to help our students learn to live and work with their peers around the world, then we have failed them altogether.

MIT strives to encourage the free flow of people and ideas through engaging in international research collaborations, providing international study and research opportunities for its students, and by hosting international students and scholars. The following are some of MIT's many international research collaborations:

MIT-Singapore

Singapore University of Technology and Design

In 2010, MIT and the Singapore University of Technology and Design (SUTD) signed an agreement formalizing a detailed collaboration between the two institutions. The partnership is MIT's most significant educational collaboration to date, and includes both education and research components. The alliance will give MIT new opportunities to push the boundaries of design research through cooperation on teaching, curriculum development, and faculty recruitment and development. MIT will also assist in designing programs to encourage innovation and entrepreneurship. A key feature of the research component of the agreement is the establishment of an International Design Centre (IDC). Situated at the heart of SUTD, with a mirror facility at MIT, the IDC is intended to become the world's premier hub for technologically intensive design. The IDC will be a focal point for faculty and students from SUTD, MIT, and partner institutions to collaborate in the design of devices, systems, and services that address the needs of Singapore and the world. In doing so, the IDC will seek to address design challenges facing the world today — including sustainable built environments, engineering for the developing world, and Information and Communication Technology-enabled devices for better living.

Singapore-MIT Alliance

The Singapore-MIT Alliance (SMA) is an innovative engineering education and research collaboration among the National University of Singapore (NUS), Nanyang Technological University (NTU), and the Massachusetts Institute of Technology (MIT). Founded in November 1998 to promote global engineering education and research, SMA brings together the resources of three premiere academic institutions — MIT, National University of Singapore, and Nanyang Technological University — while providing students with unlimited access to exceptional faculty expertise and superior research facilities. http://web.mit.edu/sma/index.htm

Singapore-MIT Alliance for Research & Technology (SMART) Centre

Established in 2007, the SMART Centre is MIT's first research centre outside of Cambridge, MA and its largest international research endeavor. The Centre is also the first entity in the Campus for Research Excellence and Technological Enterprise (CREATE) currently being developed by Singapore's National Research Foundation.

The SMART Centre will: identify and carry out research on critical problems of societal significance and develop innovative solutions through its interdisciplinary research groups (IRGs); become a magnet for attracting and anchoring global research talent to Singapore; develop robust partnerships with local universities and institutions in Singapore; engage in graduate education by co-advising local doctoral students and post-doctoral associates; and help instill a culture of translational research, entrepreneurship and technology transfer through the SMART Innovation Centre.

MIT Energy Initiative (MITEI)

MITEI, established in September 2006, is an Institute-wide initiative designed to help transform the global energy system to meet the needs of the future and to help build a bridge to that future by improving today's energy systems. MITEI strives to address the technical and policy challenges of the coming decades, such as meeting the world's growing demand for energy; minimizing related impacts on the environment; and reducing the potential geopolitical tensions associated with increased competition for energy.

To solve these problems, MITEI pairs the Institute's world-class research teams with varied entities across the global research spectrum. For example, the Initiative is launching a new multi-disciplinary program addressing the energy challenges of the developing world. It has also formed international alliances with research institutions in key regions of the world. One of these alliances is the Low Carbon Energy University Alliance (LCEUA), which is a partnership among MIT, Tsinghua University, and the University of Cambridge. MITEI is also a resource for policy makers and the public, providing unbiased analysis and serving as an honest broker for industry and government. http://web.mit.edu/mitei

The following are examples of MITEI's research:

MIT researchers and their collaborators from South Africa and England have demonstrated that it is possible to create elegant, energy-efficient buildings with little energy consumption and essentially no energy-intensive materials. http://web.mit.edu/mitei/research/spotlights/innovative-buildings.html

MIT researchers are working with Chiquita Brands International Inc. to help gauge the carbon footprint of the supply chain that transports bananas by truck and ship from Central America to the United States. The case study will lead to a Web-based tool that will help other companies calculate and potentially reduce the energy consumption of products moved by land, water, and/or air. http://web.mit.edu/mitei/research/spotlights/bananas.html

Other Global Initiatives

MIT Portugal Program

The MIT Portugal Program is a large-scale international collaboration involving MIT and government, academia, and industry in Portugal to develop education and research programs related to engineering systems. The high-level partnership represents a strategic commitment by the Portuguese government to science, technology, and higher education that leverages MIT's experience in these important areas in order to strengthen the country's knowledge base through an investment in human capital and institution building. http://www.mitportugal.org/

Global Supply Chain and Logistics Excellence (SCALE) Network

The Center for Transportation and Logistics created the Global SCALE Network to increase the development and adoption of new innovations in supply chain management across the world. The SCALE Network consists of independent yet collaborating centers dedicated to shaping the future of education and research in transportation, logistics and supply chain management. Currently there are two international centers in the network located in Europe and South America. The network plans to continue opening centers in Asia, Africa, and elsewhere.

Alliance for Global Sustainability

Established in 1995, the Alliance for Global Sustainability (AGS) is an international partnership among MIT, the Swiss Federal Institute of Technology, the University of Tokyo, and the Chalmers University of Technology in Sweden. AGS brings together scientists, engineers, and social scientists from government, industry, and other organizations to address the environmental issues that affect social and economic progress. With research focused on six sectors — energy, mobility, water, urban systems, cleaner technologies, and climate change — AGS advances the understanding of complex global problems and develops policies and practices that are urgently needed to solve them. http://globalsustainability.org/

MIT-India Initiative

Launched in 2007, the MIT-India Initiative seeks to lead the Institute into a dramatic new phase in its historic relationship with India. The primary mission of the MIT-India Initiative is to foster collaboration between the faculty and students at MIT, and faculty and students at academic and research institutions in India. Among its specific goals are enabling the creation of long-term projects involving groups from both MIT and Indian institutions; and promoting inclusive growth, sustainable development, educational leadership, entrepreneurship, new models of governance, and advanced, results-focused research in India. http://web.mit.edu/india/

The following are some of the many elements that the Initiative encompasses:

The Abdul Latif Jameel Poverty Action Lab (J-PAL)
The Abdul Latif Jameel Poverty Action Lab, based in the MIT Department of Economics, pioneered the use of controlled trials as a means of gauging the effectiveness of anti-poverty strategies. There are more JPAL projects in India than in any other country. Topics under study include health, education, indoor air pollution, government corruption, and the optimal use of micro-credit. Indian organizations collaborating in the Lab's work include government agencies, non-profit organizations, and leading corporations. http://www.povertyactionlab.org/

J-PAL South Asia at the Institute for Financial Management and Research (IFMR)
J-PAL South Asia at IFMR is a regional office of the Jameel Poverty Action Lab at MIT, which is a focal point for development and poverty research based on randomized trials. Based at the Institute for Financial Management and Research, a leading business school in Chennai, India, IFMR also houses the Centre for Microfinance and the Centre for Development Finance. Both are key partners of J-PAL South Asia. http://povertyactionlab.org/southasia/

MISTI India Program
The MIT-India Program, part of the MIT International Science and Technology Initiatives (MISTI), arranges summer internships in Indian research, corporate, and nonprofit settings for MIT students. Among participating organizations are the ICICI Bank, Hikal Pharmaceuticals, and Dr. Reddy's Laboratories. MIT students have also worked in labs at IIT Madras, IIT Bombay, the National Centre for Biological Sciences, and the Indian Institute of Information Technology, Bangalore. The program similarly helps MIT faculty arrange research partnerships with Indian counterparts. http://web.mit.edu/misti/mit-india/

THSTI
The Translational Health Science and Technology Institute (THSTI), in Faridabad, India is modeled after the Harvard-MIT Division of Health Sciences and Technology, and will include physicians, engineers and scientists working together to generate discoveries and inventions that are translated to advance health in the region and around the world. MIT is working with THSTI to recruit and mentor the founding faculty of THSTI. http://thsti.org/

MIT Urban Laboratory
The MIT Urban Laboratory (UrbLab) is a collaborative effort between MIT and the southern Indian town of Erode. UrbLab responds to the challenges associated with India's rapid growth, increasing industrialization, and urbanization. The project builds on a long history of cooperation between India and MIT, including a relationship with the Institute for Financial Management and Research in Chennai, and planning officials in Southern India. As a result of MIT's efforts, the Indian government has taken steps to better integrate physical planning and economic planning at the local level. Future collaborations will be aimed at environmental and urban renewal. http://sap.mit.edu/resources/portfolio/erode/

MIT-Greater China Initiative

MIT and China have a long history of collaboration. In 1908, Tsok Kai Tse and Ching Yu Wen became the first Chinese students to earn degrees from MIT. The MIT- Greater China Initiative is a bold, multidisciplinary effort that facilitates the international flow of ideas and resources. http://global.mit.edu/initiatives/china/

There are currently approximately 100 research initiatives and activities between MIT and China, including the following:

Tsinghua-MIT-Cambridge Alliance (TMCA)

Founded in 2009, the TMCA is a research collaboration focused on low carbon energy, including: clean-coal technology and carbon-capture and sequestration; energy-efficient buildings, urban design, and sustainable transportation systems; biomass energy; and nuclear energy. The Alliance will provide seed funding for early stage research projects on low carbon energy solutions; support development of the MIT Emissions Prediction and Policy Analysis (EPPA) model for integrated assessment of the Chinese energy economy in response to carbon dioxide emission mitigation (with close collaboration from Tsinghua in providing the necessary inputs for the model); fund studies of policy and energy sector decision-making in China, the U.S. and the U.K.; fund visits by faculty, students and research scientists participating in Alliance work to other parties and to explore mechanisms for joint training programs; and support a major annual conference and workshops.

MIT China Educational Technology Initiative (CETI)

The goal of MIT-CETI is to promote cultural exchange between American and Chinese students by exploring science and technology. Each summer since 1996, CETI has sent between 15 and 21 MIT students to high schools in the cities and towns of Anxian, Beijing, Chengdu, Guangzhou, Guilin, Kunming, Mianyang, Nanjing, Shanghai, and Xi'an. Teaching in teams of three, some of the past CETI participants have taught curriculums on web design, programming, robotics, electrical engineering, civil engineering, English, biology, aerospace engineering and more. http://web.mit.edu/mit-ceti/www/

MISTI China Program

Launched in 1994, the MIT International Science and Technology Initiative (MISTI) has sent over 500 students to internships in companies, research institutes, and universities in China, Hong Kong, and Taiwan. The Chinese host institutions are eager to take MIT students because of their excellent technical skills and the language and cultural training they receive through Foreign Languages and Literatures and the MISTI-China program. Recently, MISTI participants have been placed in a number of successful research and development centers in China, including Google Beijing, Yobo.com, the Motorola China Software Center, and Hewlett-Packard Beijing. http://web.mit.edu/misti/mit-china/

OpenCourseWare (OCW)

Launched in 2002, OpenCourseWare makes materials for MIT's courses freely available on the Web. Materials from more than 2,000 MIT courses — including lecture notes, multimedia simulations, problem sets and solutions, past exams, reading lists, and selections of video lectures — are now posted on the OCW website. OCW records an average of over 40,000 visits a day, with nearly a million unique visitors every month.

About half of OCW usage originates outside of North America. OCW materials are used extensively in China (110,000 visits per month), India (100,000 visits per month) and the Middle East (77,000 visits per month). OCW materials have been translated into Chinese, Spanish, Portuguese, Persian and Thai. OCW also distributes and maintains mirror copies of the site at universities in bandwidth-constrained regions, primarily Sub-Saharan Africa. To date, the OCW staff has distributed more than 200 such mirrors.

MIT is pursuing two missions with OCW — sharing its educational materials freely and openly, and, by creating a model other universities can follow and advance, promoting a universally available storehouse for human knowledge. About 43 percent of OCW's visitors identify themselves as self-learners, 42 percent as students enrolled in academic programs, and 9 percent as educators. The following are examples of ways educators, students, and self-learners in the international community use OCW content:

Kuala Lumpur, Malaysia

A secondary school mathematics teacher in Kuala Lumpur, Malaysia, Kian Wah Liew introduces his students to a range of complex concepts, such as matrices, determinants, and differential equations. "I sometimes use the lectures in the classroom. I let the students watch a lecture — for example, the 18.03 Differential Equations video — accompanied by my own explanations," Liew says. Having access to the lectures has impacted his own teaching style, Liew says. "The Western style spends more time on 'ideas' than 'examples.' Here, we spend 20 percent of the time introducing ideas and 80 percent in demonstrating these ideas through examples. At MIT, most of the time is spent on clarifying the ideas, and very few examples are given during the lectures."

Zaria, Nigeria

Kunle Adejumo is finishing up his fourth year of engineering studies at Ahmadu Bello University in Zaria, Nigeria. Though the university boasts a large and well-maintained physical infrastructure, its Internet access — like that of almost all Nigerian universities — is extremely limited. When Adejumo was first introduced to MIT's OpenCourseWare through a CD-ROM in the university computer lab he had only 20 minutes to look through the material. "For example, last semester, I had a course in metallurgical engineering," offers Adejumo. "For one of the lectures, having to do with ion making, I didn't have notes, and I couldn't find the information I needed, so I went to OCW. I was able to download a course outline on this, and also some review questions. I actually took these to the university and gave them to the lecturer to answer. He was able to answer these questions, and helped me gain a deeper understanding of the material." To improve access to OCW for other Nigerian students, Adejumo hopes to work with a local radio station to broadcast OCW course material, as well as publicize the site.

Saint Lucia

Robert Croghan, an entrepreneur in Saint Lucia, has spent the past several years looking for a way to harness geothermal energy created by a dormant volcano underneath the island to create an alternative energy source for the region. Croghan is now developing a high-voltage grid that would deliver energy to several islands through an undersea cable. Crogan used OCW to research the topic of geothermal heat sources. "When I saw OpenCourseWare," Croghan concludes, "it went right to the very core of what I believe: if we hoard information, we can't have progress. We get stagnant, and it gets accumulated in the hands of a few. And if that happens, we miss all sorts of incredible developments and opportunities."

http://ocw.mit.edu/OcwWeb/web/home/home/index.htm

International Scholars

The International Scholars Office (ISchO) facilitates the visas for international researchers and faculty, who come to MIT for a variety of purposes. The ISchO advises on immigration matters, issues visa documents, and provides guidance, workshops, and print and web-based information on a wide range of issues relevant to the international scholar population.

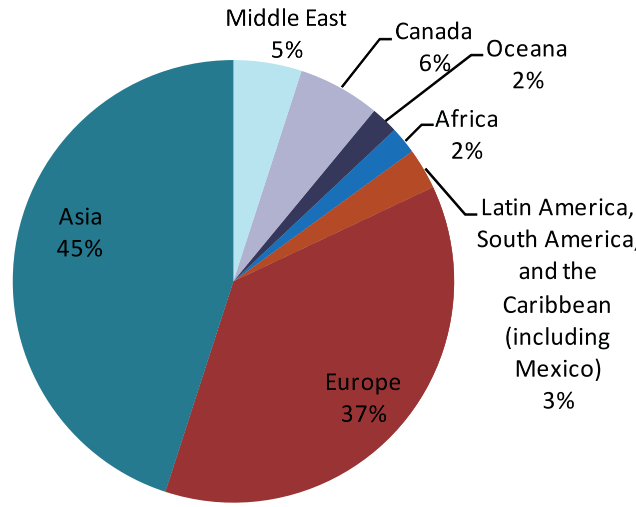
ISchO served 1,882 international scholars (visiting researchers, professors, and lecturers) affiliated with MIT from July 1, 2009 to June 30, 2010. This is a decrease of 3.2 percent since last year (1,944). The Broad Institute separated from MIT on July 1, 2009 and the international scholars working there transitioned out. With the exception of 2008-09 (the year before Broad departure), when the Broad Institute numbers were highest, 1,882 (post-Broad number) is the highest number of scholars assisted by ISchO. During this time period, 79 percent of international scholars were male, and 21 percent were female.

Foreign national scholars came to MIT from 88 countries, with the highest numbers coming from the People's Republic of China, the Republic of Korea, India, Japan, Germany, Canada, Italy, France, and Spain. Scholars from these top 10 countries constituted 67.6 percent of MIT's international scholar population. This distribution of countries and percentage matches that of the entire international scholar population in the US. As a continuing trend, the number of scholars from the combined countries of Asia exceeded the number of scholars from Europe. http://web.mit.edu/scholars/

Top Ten Countries 2009-2010

Country	Number of Scholars
China	305
South Korea	163
India	153
Japan	120
Germany	119
Canada	104
Italy	99
France	80
Spain	68
Israel	65

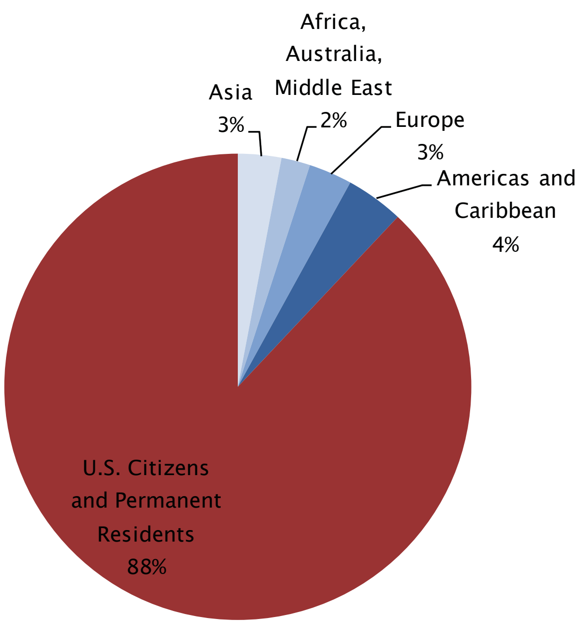
International Scholars by Geographic Region



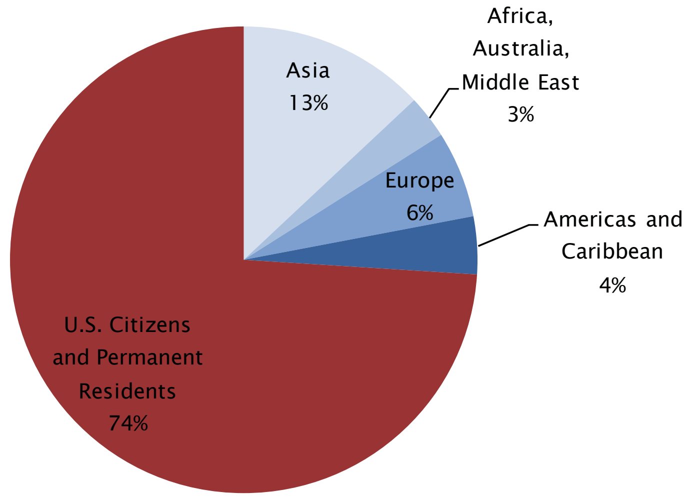
International Students
(continued)

MIT has welcomed international students essentially since its inception. The first student from Canada came to MIT in 1866, the second year MIT offered classes. This student was followed by a steady stream of students from around the globe throughout the 19th century. By 1900, some 50 foreign-born students had traveled to Massachusetts for study; however, the number increased dramatically after World War II when an influx of these students began attending the Institute. The rapid rise of international students from East Asia, led by students from China, changed the demographics of this group beginning in the 1950s.

Changes in immigration law in 1965 opened up the doors to a steadily increasing pool of international talent. As world events and political decisions impact immigration, so MIT's international student population fluctuates in response to a changing international environment. World wars decrease the international student population, while peacetime pressures, such as changing immigration laws, the demise of the iron curtain, the Vietnam War protests, and the Asian financial crisis cause their respective ebbs and surges.



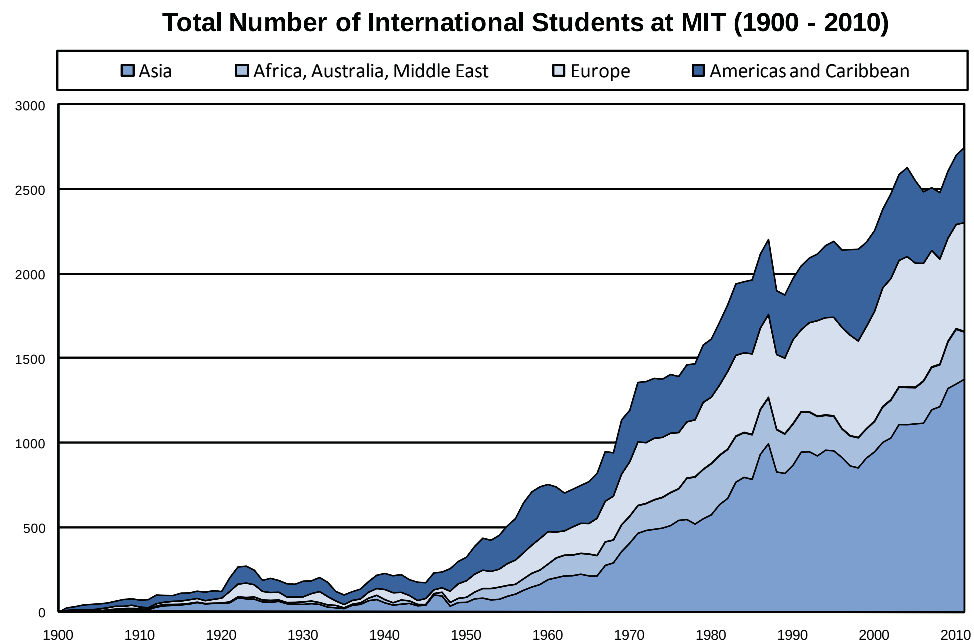
Total Student Population Country of Residence 1960



Total Student Population Country of Residence 2010

The United States has been the destination of choice for international students and scholars for the past 50 years. The number of foreign students has risen steadily since the 1970s, and, according to the 2009 Open Doors Report published by the Institute of International Education, there were 671,616 international students enrolled in U.S. colleges during the 2008-2009 academic year. The same report found that these international students contributed $17.8 billion to the U.S. economy in tuition and fees, and living expenses. According to the Open Doors Report, 65 percent of international students receive the majority of their funds from personal and family sources, and 70 percent of all international students' primary funding comes from sources outside the United States. (see www.opendoors.iienetwork.org).

Of the 75 MIT-affiliated Nobel Prize winners (including faculty, researchers, alumni, and staff), about one-third were foreign born. International faculty recruited through international searches for tenure-track positions remain in the U.S. to teach the next generation of American cancer researchers, physicists, biomedical engineers, business leaders, and computer scientists.



Region	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Asia	2	16	57	52	43	80	205	468	638	949	1007	1381
Africa, Australia, Middle East	0	3	5	15	14	40	117	164	291	237	210	280
Europe	9	8	62	44	59	106	153	375	414	484	701	642
Americas and Caribbean	15	48	81	75	100	164	266	352	371	377	464	444
Total	26	75	205	186	216	390	741	1359	1714	2047	2382	2747

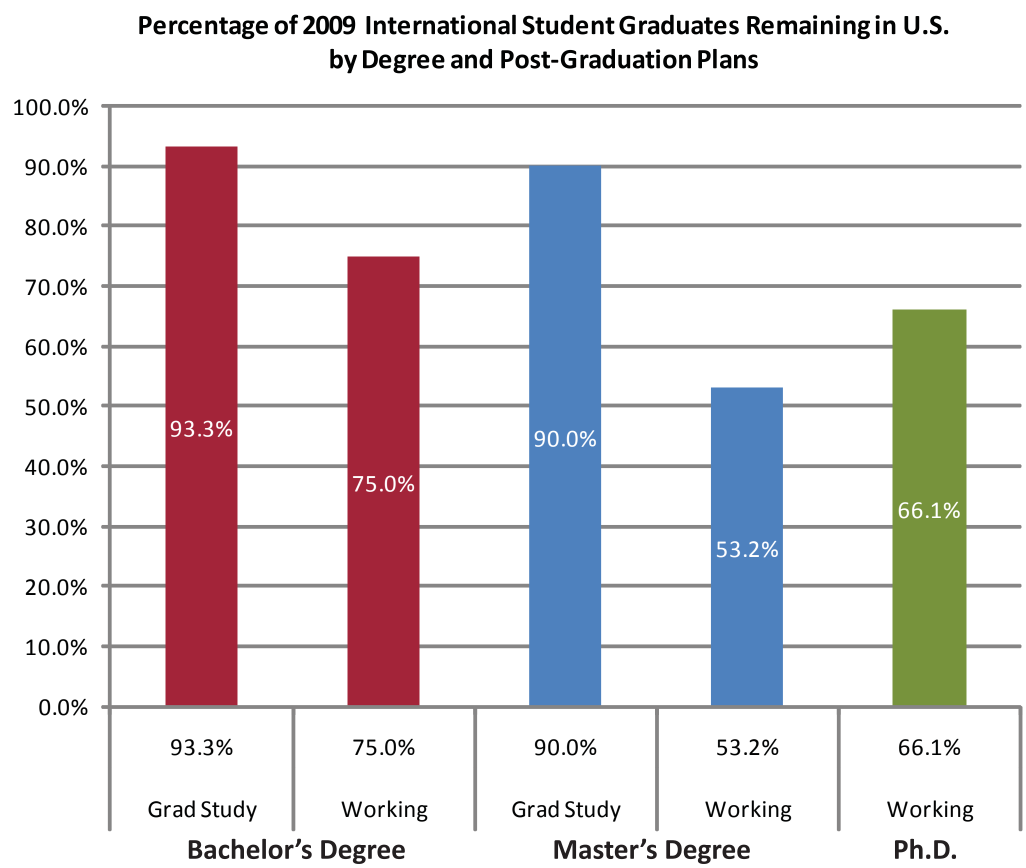
International Students

(continued)

Many international students remain in the U.S. after graduation. The graph below shows the post-graduation plans of international students graduating in 2009, as reported in a survey administered by MIT. Overall, 67 percent of international students plan to remain in the U.S. after graduation.

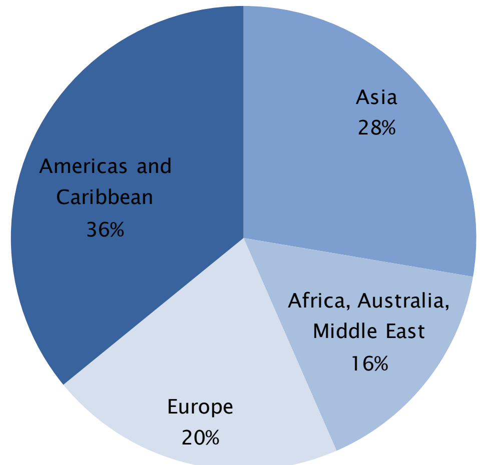
The majority of international students at MIT have F-1 Visa status. The majority of international non-student scholars at MIT were sponsored on MIT's J-1 exchange visitor program.

Currently MIT undergraduate freshman admissions policy has a target for international students of 8 percent of the total student population.



Top 10 countries of International Undergraduates Enrolled in fall 2010

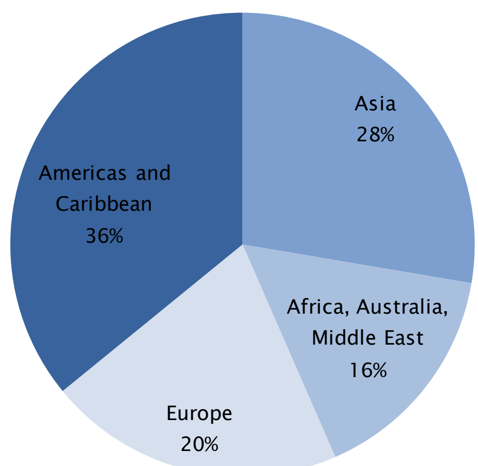
Home Country	Number of Students
China	31
India	28
Canada	25
South Korea	18
Taiwan	12
Kenya	11
Brazil	11
Pakistan	10
Malaysia	9
Turkey	8



International Students Region of Residence 1960

Top 10 countries of International Graduate Students Enrolled in fall 2010

Home Country	Number of Students
China	353
South Korea	257
India	222
Canada	184
Singapore	91
France	79
Taiwan	76
Japan	73
Germany	63
Mexico	54



International Students Region of Residence 2010

International Entrepreneurs

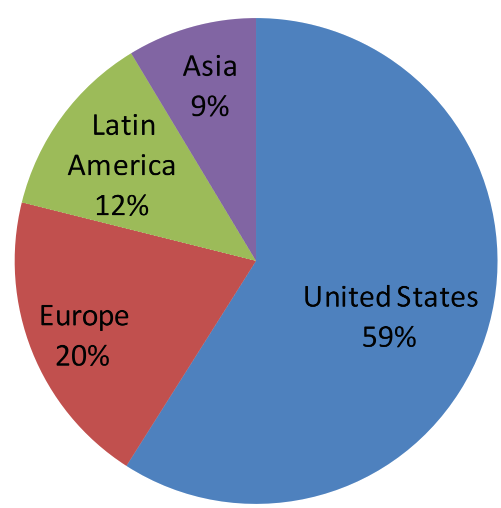
A 2009 Kauffman Foundation report on the Entrepreneurial Impact of MIT found the following:

"As a result of MIT's presence, Massachusetts is 'importing' company founders. More than 38 percent of the software, biotech, and electronics companies founded by MIT graduates are located in Massachusetts, while less than 10 percent of arriving MIT freshmen are from the state. Not only do MIT alumni, drawn from all over the world, remain heavily in Massachusetts, but their entrepreneurial offshoots benefit the state and the country significantly. Greater Boston, in particular, as well as northern California and the Northeast, broadly, are homes to the largest number of MIT alumni companies, but significant numbers of companies are also in the South, the Midwest, the Pacific Northwest, and in Europe. About 30 percent of MIT's foreign students form companies, of which at least half are located in the United States. Those estimated 2,340 current firms located in the United States but formed by MIT foreign-student alumni employ 101,500 people. In other words, talented foreign-born students attending MIT play an increasingly important role in creating U.S. companies, making MIT a magnet for worldwide talent that significantly benefits the U.S. economy."

Estimated Number of Companies Founded by International MIT Alumni

Location	Total
United States	2,340
Europe	790
Latin America	495
Asia	342

Location of Companies Founded by International MIT Alumni



International Alumni

MIT alumni and scholars have made extraordinary contributions in their home countries, the United States, and the world. The following are some examples:

Kofi Annan, M.S. Management 1972

Kofi Annan, the seventh Secretary-General of the United Nations and recipient of the Nobel Peace Prize, was born in Kumasi, Ghana, and attended the University of Science and Technology in Kumasi before completing his undergraduate studies at Macalester College in St. Paul, Minnesota. He undertook graduate studies in economics at the Institut universitaire des haute etudes internationals in Geneva, and earned his M.S. in Management as a Sloan Fellow at MIT. Annan worked for the World Health Organization and the Ghana Tourist Development Company, but has spent most of his career at the United Nations. In 2001 Kofi Annan and the United Nations received the Nobel Peace Prize for "their contributions to a better organized and more peaceful world."

Tony Tan, Singapore, S.M. Physics 1964

Following his degrees from MIT and his Ph.D. from the University of Adelaide in applied mathematics, Tan taught mathematics at the University of Singapore. Tan was elected to the Parliament of Singapore in 1979, and has served in numerous leadership positions in the Singapore government. In December 1991, Tan stepped down from the Cabinet to return to the private sector as the Overseas-Chinese Banking Corporation's Chairman and Chief Executive Officer. He rejoined the Cabinet in 1995 as Deputy Prime Minister and Minister for Defense. In August 2003, Tan became Deputy Prime Minister and Co-ordinating Minister for Security and Defense.

Ngozi Okonjo-Iweala, Nigeria, M.C.P. 1978
Ph.D. Planning 1981

Currently the Managing Director of World Bank, Ngozi Okonjo-Iweala was the first woman to hold the position of Finance Minister in Nigeria. During her term from 2003 to 2006 she launched an aggressive campaign to fight corruption. She implemented a series of economic and social reforms, including a zero-tolerance policy for corruption; international and local governmental contract bidding; privatizing state-owned refineries; and the Extractive Industry Transparency Initiative, which aims to bring openness to the oil sector. Under her leadership, the country has tripled its reserves from $7 billion to $20 billion; the annual GDP grew at 6 percent; and inflation is down from 23 percent to 9.5 percent. Okonjo-Iweala started her career at the World Bank, where she was the first woman ever to achieve the positions of vice president and corporate secretary. http://sap.mit.edu/resources/portfolio/ngozi_okonjo-iweala/

Benjamin Netanyahu, S.B. Architecture 1975
S.M. Management 1976

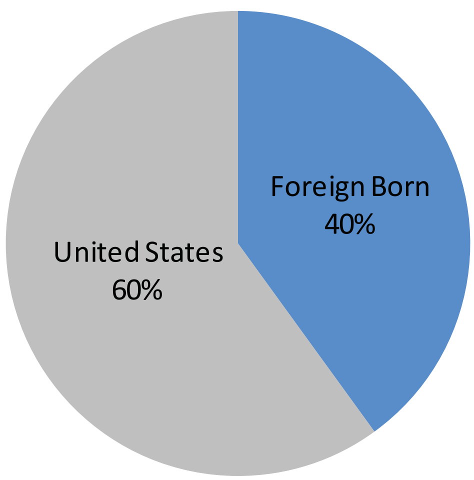
Current Prime Minister of Israel and formerly Israel's ambassador to the United Nations, Benjamin Netanyahu was born in 1948 in Tel Aviv, Israel and grew up in Jerusalem. He served as Israel's ambassador to the United Nations from 1984 to 1988, during which time he led the effort to declassify the United Nations' archive on crimes committed by Nazi Germany. Netanyahu, a member of the Likud party, was Israel's Prime Minister from 1996 until 1999. During his term as Prime Minister, Netanyahu implemented policy that combined fighting terror with advancement of the peace process. Its cornerstone was the conclusion of well-measured agreements with the Palestinians that insisted on reciprocity. During his three-year term the number of terror attacks drastically decreased. http://www.netanyahu.org/

I. M. Pei, S.B. Architecture 1940

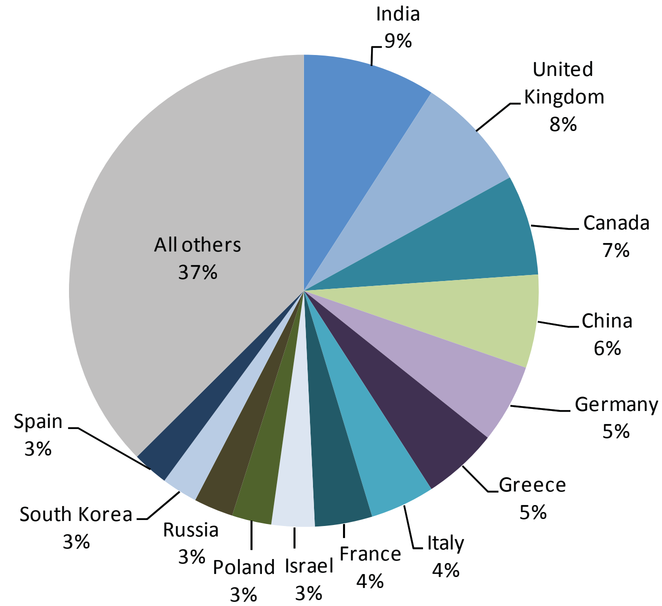
Ieoh Ming Pei, influential modernist architect and founder of the firm Pei Cobb Freed & Partners, was born in China in 1917. He completed his Bachelor of Architecture degree at MIT in 1940. Pei has designed more than 60 buildings, including the John Fitzgerald Kennedy Library in Boston, Massachusetts, the Grand Louvre in Paris, France, the Miho Museum in Shiga, Japan, the Bank of China Tower in Hong Kong, and the Gateway Towers in Singapore.

Origin of MIT Faculty

Faculty Country of Origin



Country of Origin of Internationally Born Faculty



International Study Opportunities

Just as with other aspects of an MIT education, there is a broad range of global activities for students to choose from. These run the gamut from traditional study-abroad programs to innovative short term projects, but most are infused with the Institute's philosophy of *mens et manus*. In the spring of 2009, 32 percent of students graduating with a Bachelor's Degree, and 41 percent of students graduating with a Master's Degree reported having educational experiences abroad.

The following are examples of programs that provide students with experiences abroad:

Cambridge-MIT Exchange

The Cambridge-MIT Exchange (CMI) is a collaboration between the University of Cambridge and MIT that allows MIT juniors to study at the University of Cambridge in England. Now in its eighth year of operation, 14 MIT departments and 10 Cambridge departments participate in the exchange. Funded by British government and industry, CMI's mission is to enhance competitiveness, productivity, and entrepreneurship in the United Kingdom. CMI supports student and faculty exchanges, educational innovation, and research partnerships between MIT and Cambridge faculty, particularly in the area of knowledge exchange among universities, government, and industry. CMI also works with other U.K. universities to share best practices and innovative approaches to education. http://web.mit.edu/cmi/ue/

Departmental Exchanges

Several academic departments — Aeronautics/Astronautics, Architecture, and Materials Science and Engineering — have launched small departmental exchanges involving one to three students, most of whom are undergraduates. Partner institutions include Imperial College London, Delft University of Technology, the University of Hong Kong, and Oxford University. http://web.mit.edu/geo/

D-LAB and the Public Service Center

D-Lab and the Public Service Center help students undertake hands-on public service projects in developing countries. http://web.mit.edu/d-lab/
http://web.mit.edu/mitpsc/

G-LAB

The flagship international internship course offered at the Sloan School of Management, G-Lab is a mix of classroom learning matched with a global internship in an emerging market.
http://actionlearning.mit.edu/g-lab/

SMART Centre

The Singapore-MIT Alliance for Research and Technology (SMART) Centre gives undergraduates the opportunity to spend the summer collaborating on research projects with faculty and students in Singapore. http://web.mit.edu/smart/

Study-Abroad Programs

MIT manages a variety of programs that provide students with educational experiences abroad. There are semester-long programs, such as MIT-Madrid, as well as shorter programs available during the winter Independent Activity Period, such as IAP-Madrid and IAP-Germany. http://web.mit.edu/geo/

The International Science and Technology Initiatives

MISTI connects MIT students and faculty with research and innovation around the world. MIT's largest international program, MISTI is a pioneer in applied international studies. Working closely with a network of premier corporations, universities and research institutes, MISTI matches more than 400 MIT students with internships and research abroad each year. After several semesters of cultural and language preparation on campus, MISTI students plunge into rigorous, practical work experience in industry and in academic labs and offices. MISTI also organizes the MISTI Global Seed Funds, which encourage MIT students to work on faculty-led international research and projects. MISTI programs are available in the following locations: Africa, Brazil, China, France, Germany, India, Israel, Italy, Japan, Mexico, and Spain.

MISTI's approach to international education builds on MIT's distinctive traditions of combining classroom learning and hands-on experience in Undergraduate Research Opportunities (UROPs), cooperative programs with industry, practice schools, and internships. In contrast to other universities' internationalization programs that mainly involve study abroad, MISTI matches individual students with work or research opportunities in their own fields. http://web.mit.edu/misti/

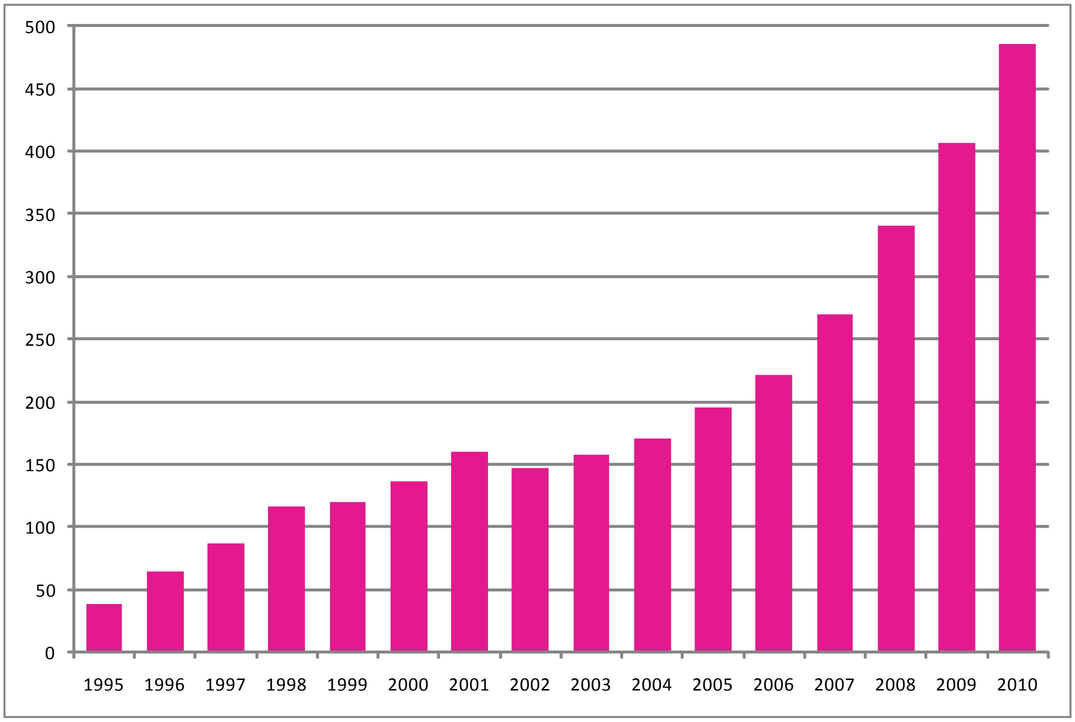
Here are a few examples from the more than 3,000 students MISTI has placed since it began by sending a handful of interns to Japan at the end of the 80s:

Chemical Engineering student Nathalia Rodriguez worked on gene therapy for muscular dystrophy at Genpole, a French biotech cluster.

Matthew Zedler, a Mechanical Engineering graduate, examined Chinese auto growth and energy at Cambridge Energy Research Associates in Beijing.

Physics major Jason Bryslawskyj designed superconducting magnetic bearings for electric motors at Siemens in German. He wrote two patents at Siemens.

Ammar Ammar, an EECS undergrad, designed and tested a Google/YouTube project at Google Israel.



Year	Japan	China	Germany	India	Italy	France	Mexico	Spain	Israel	Brazil	Total
1983-1994	318										318
1995	36	2									38
1996	42	22									64
1997	37	28	22								87
1998	25	48	37	6							116
1999	32	35	33	15	5						120
2000	28	48	38	17	5						136
2001	17	57	36	14	8	28					160
2002	28	44	36	0	8	31					147
2003	35	15	40	6	13	49					158
2004	33	35	25	16	9	52	1				171
2005	32	42	45	26	9	33	9				196
2006	35	33	50	28	9	49	12	3	2		221
2007	32	40	60	26	25	40	20	27	0		270
2008	33	45	73	39	28	44	26	37	15		340
2009	33	43	77	41	32	78	23	47	33		407
2010	38	55	88	55	44	84	29	51	37	5	486
Total	834	592	660	289	195	488	120	165	87	5	3435

Campus Research Sponsored by International Organizations

Current Selected Projects

Center for Clean Water and Clean Energy at MIT and KFUPM

A group of Mechanical Engineering faculty have entered into a seven-year research and educational collaboration with King Fahd University of Petroleum and Minerals (KFUPM) in Dhahran, Saudi Arabia, leading to the creation of the Center for Clean Water and Clean Energy at MIT and KFUPM within the department. The Center's research focuses on water desalination and purification and on low-carbon energy production from both solar energy and fossil fuels. Additional research activities involve design and manufacturing, with a focus on technologies related to water and energy production. This collaboration began in fall 2008; and, during the first year, a diverse group of approximately 20 MIT faculty participated in the Center along with 35 MIT graduate students and 10 MIT postdocs. The Center will grow further in years two and three. Funds from the Center will support major space renovations in the Department over the coming years. In addition, the Center includes a program to bring Saudi Arabian women to MIT for research and educational activities. The Center is directed by Professor John H. Lienhard V and co-directed by Professor Kamal Youcef-Toumi. http://engineering.mit.edu/research/labs_centers_programs/kfupm.php

Novartis-MIT Center for Continuous Manufacturing

The Novartis-MIT Center for Continuous Manufacturing is a $65 million Center fully funded by Novartis with the aim of transforming pharmaceutical manufacturing. Currently, pharmaceutical manufacturing is performed in batch mode, in which each step of a manufacturing process is physically separated from the other steps. The contents from a given process unit must be removed after completion of the operation, placed in a transportation vessel, and moved to the next process unit, through perhaps 20 steps. Each time the equipment must be cleaned and potential variation in batches must be watched vigilantly. On the other hand, continuous processing, in which materials flow uninterrupted through the process, offers the potential for leaner processing, higher quality, more flexibility, and in the end, cost savings.

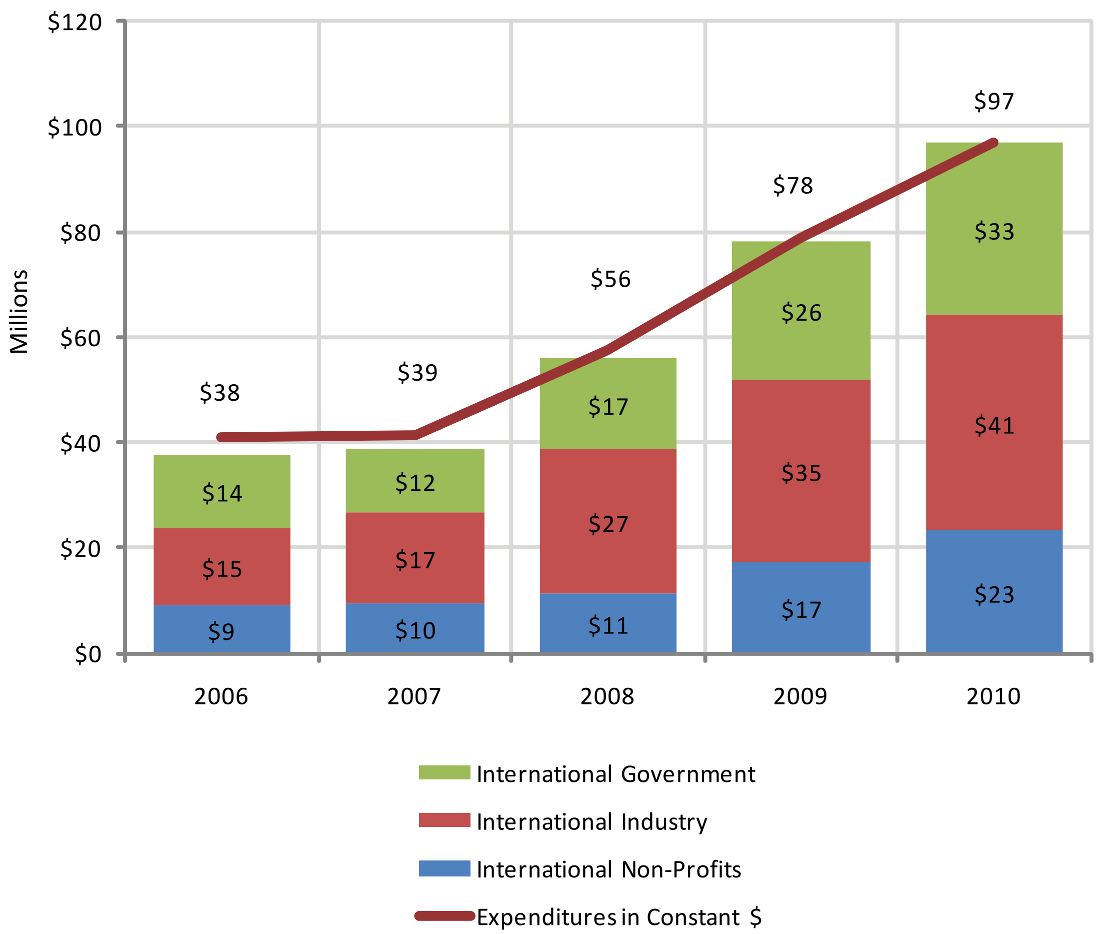
In order to accomplish this goal of continuous pharmaceutical processing, the Center is developing new technologies across a diverse range of areas, including chemical reactions, reactors, separations approaches, final finishing steps, and process modeling and control. In addition to pursuing these research activities, the team is working on developing a full, end-to-end continuous bench scale pharmaceutical plant at MIT. This bench scale plant will be a modular research tool, in which various approaches to continuous manufacturing will be evaluated, in addition to the various technologies that will be developed by the Center. The plant will produce a Novartis drug, and in addition to yielding important research results, it will be an excellent educational tool for our students. http://engineering.mit.edu/research/labs_centers_programs/novartis.php

Reinventing the Wheel

A new bicycle wheel designed by MIT researchers can boost a rider's power while tracking the rider's friends, fitness, smog, and traffic. The wheel, called the Copenhagen Wheel, stores energy every time the rider brakes, which can then be used to assist the rider in going up a hill or add a burst of speed in traffic. In addition to storing power, the Copenhagen Wheel uses a series of sensors and a Bluetooth connection to the rider's iPhone to collect data about the bicycle's speed, direction and distance traveled, as well as picking up data on air pollution, and even the proximity of the rider's friends. The resulting data can both help the individual rider – for example, by providing feedback on fitness goals – and help the city (if the user opts to share the information) by building a database of air quality, popular biking routes, and areas of traffic congestion. The Copenhagen Wheel was developed by Associate Professor Carlo Ratti, and was funded by the city of Copenhagen, the Italian company Ducati, and the Italian environment ministry. http://web.mit.edu/newsoffice/2009/ratti-copenhagen-1216.html

Campus Research Sponsored by International Organizations
Fiscal Years 2006-2010

International Primary Sponsor Type	2006	2007	2008	2009	2010
International Non-Profits	9,017,313	9,516,858	11,392,919	17,375,071	23,170,052
International Industry	14,853,208	17,188,998	27,146,950	34,592,066	41,030,728
International Government	13,844,352	12,133,685	17,444,906	26,299,968	32,633,438
Total International Sponsorship	37,714,873	38,839,541	55,984,775	78,267,105	96,834,218
Expenditures in Constant $	41,077,781	41,236,312	57,315,734	79,024,528	96,834,218



Constant $ calculated using the CPI-U weighted for the fiscal year with 2010 = 100

6 Undergraduate Financial Aid

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Undergraduate Financial Aid

Principles of MIT Undergraduate Financial Aid

To ensure that MIT remains accessible to all qualified students regardless of their financial resources, MIT is committed to three guiding financial aid principles:

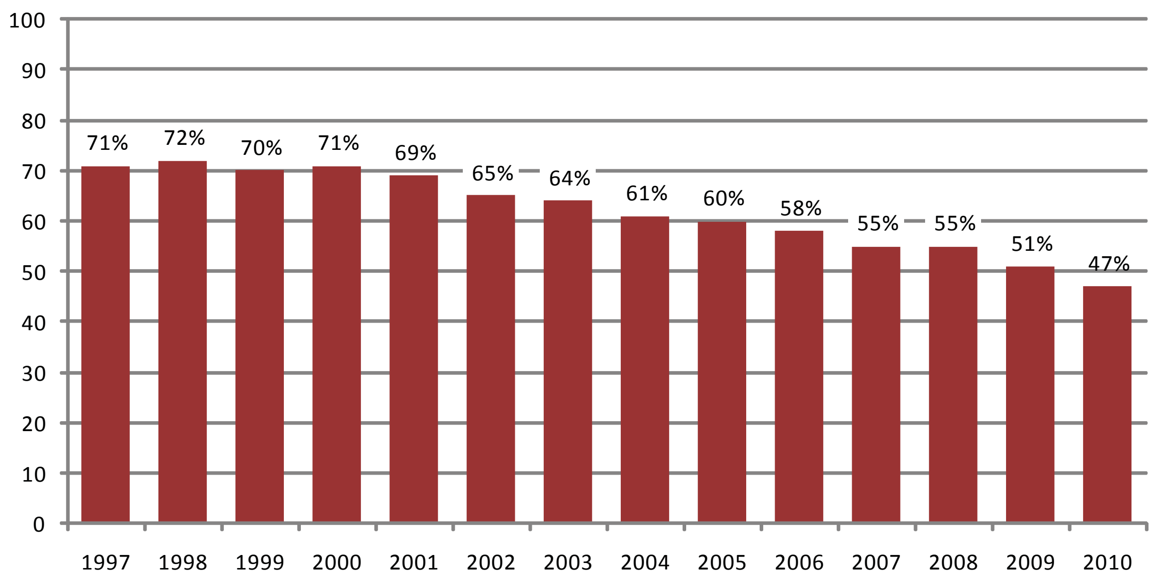
Need-blind admissions: MIT recruits and enrolls the most talented and promising students without regard to their financial circumstances.

Need-based financial aid: MIT awards aid only for financial need. It does not award undergraduate scholarships for academic or athletic achievements or for other non-financial criteria.

Meeting full need: MIT guarantees that each student's demonstrated financial need is fully met.

As a result of these guiding principles, the Institute continues to assume an increasingly higher percentage of net undergraduate tuition and fees, which reduces the cost to the student, as exhibited by the chart below.

Net Undergraduate Tuition and Fees as a Percentage of Total Tuition and Fees*



*Net tuition and fees calculated as gross undergraduate tuition and fees received, minus MIT undergraduate scholarships.

Who Pays for an MIT Undergraduate Education

In 2009–2010, the annual price of an MIT education totaled $52,400 per student—$37,782 for tuition and fees, $11,360 for room and board, an estimated $2,858 for books, supplies, and personal expenses, and a per-student average of $400 for travel. With 4,218 undergraduates enrolled, the collective price for undergraduates was $221 million. Of this amount, families paid $105.4 million, or 48 percent, and financial aid covered the remaining 52 percent. Since MIT subsidizes the cost of educating undergraduates through its tuition pricing and continues to be the largest source of financial aid to its undergraduates, the Institute is the primary source for paying for an MIT undergraduate education, and families the secondary source.

Additionally, for students who received MIT scholarships the family share is mainly based on family income with needier families paying a significantly smaller share of the price.

Average 2009-2010 Financial Aid Packages and share of Price by Family Income					
Family income of MIT grant recipients[1]	Number of MIT grant recipients	% of Undergrads with MIT Grant	Average financial aid package	Family share of price[2]	Financial aid share price
$0-$25,000	365	97%	$42,159	1%	99%
$25,001-$50,000	443	99%	$40,501	5%	95%
$50,001-$75,000	363	97%	$39,240	12%	88%
$75,001-$100,000	396	99%	$34,936	20%	80%
$100,001-$125,000	366	96%	$27,535	33%	67%
$125,001-$150,000	282	91%	$21,397	47%	53%
$150,001-$175,000	184	83%	$17,753	53%	47%
$175,001-$200,000	101	61%	$12,718	68%	32%
$200,001 and up	111	24%	$11,653	77%	23%
Totals	2,611	62%	$31,928	32%	68%

1 Median family income for the 2009-2010 MIT scholarship recipients is $97,965.

2 Family share of price is computed as the difference between each student's expense budget and their financial aid package; it may differ from the calculated family contribution.

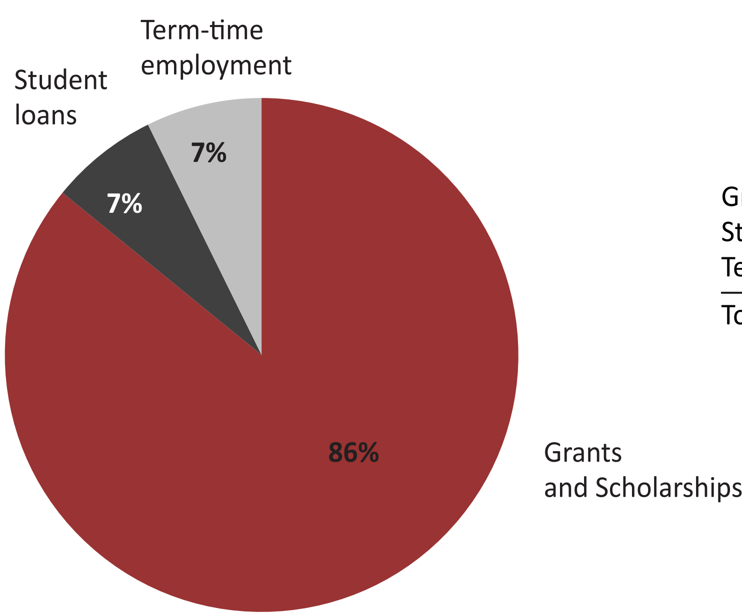
Forms of Undergraduate Financial Aid

The primary form of financial aid to MIT undergraduates is grants or scholarships — terms that are used interchangeably, although grants are gift aid based on need and scholarships are gift aid based on merit. The share of undergraduate financial aid in the form of grants/scholarships is steadily increasing with MIT's efforts to reduce student self-help (i.e. loan and job expectations). Since 2005-2006 the share of undergraduate aid in the form of grants/scholarships increased from 81 to 86 percent, while the share in the form of student loans decreased from 11 to 7 percent, and term-time work decreased from 8 to 7 percent.

From students' perspectives, grants are the sole form of aid that unambiguously increases the financial accessibility of college, since they don't require repayment and don't increase the students' indebtedness. The preponderance of grant aid at MIT sets the Institute apart from the national trend toward student loans as the primary form of undergraduate financial aid.

During the 2009-2010 academic year undergraduates borrowed a total of $8.4 million in student loans from all sources. Twenty-nine percent of undergraduates borrowed, with an average loan of $6,813 per student. Student employment from on-campus jobs and Federal Work-Study Program positions (which include both on- and off-campus work) totaled $7.9 million, with 62 percent of undergraduates working and earning an average of $2,992 each.

Types of Financial Aid for MIT Undergraduates
2009-2010



Grants and Scholarships:	$99,256,118
Student Loans:	$8,435,046
Term-time employment:	$7,884,295
Total:	$115,575,459

Sources of Undergraduate Financial Aid

In 2009-2010, MIT provided 78 percent of undergraduate financial aid. The federal government provided 13 percent, and the remaining 9 percent came from state and private resources. In this respect, MIT differs from the national trend of relying on the federal government as the largest source of financial aid.

MIT Financial Aid

Ninety-three percent of the financial aid that MIT provides comes in the form of grants. In 2009-2010, approximately 62 percent of MIT undergraduates received an MIT grant, averaging $31,928 each. These grants come primarily from MIT's endowed funds, gifts from alumni and friends, and general Institute funds.

Federal Financial Aid

The U.S. Department of Education is the second-largest source of financial aid to MIT undergraduates. MIT participates in the Federal Pell Grant, the Federal Supplemental Educational Opportunity Grant, the Academic Competitiveness Grant and the National Science and Mathematics Access to Retain Talent Grant Programs, all of which provide need-based aid. Approximately 19 percent of MIT undergraduates receive Pell Grants. Acknowledging the decline in federal funding for student financial aid, MIT now matches Federal Pell Grants for all eligible students attending the Institute starting in September 2006, effectively doubling Pell Grant funds for eligible students.

MIT undergraduates also receive Robert C. Byrd Scholarships, the federally funded, state-administered grants which recognize exceptionally able high school seniors.

Forty-one percent of the federal aid that MIT undergraduates receive is in the form of loans. In 2009-2010, approximately 27 percent of MIT undergraduates received federal loans, which averaged $5,403 each.

MIT is a lender under the Federal Perkins Loan Program, which provides subsidized student loans; and takes part in the Federal Direct Loan Program, which offers both subsidized and unsubsidized loans. It also participates in the Federal Work-Study Program, which provides student jobs, including paid community service positions. All of these programs are partnerships between the government and participating institutions, where institutions match the federal contributions with their own funds. MIT has participated in these programs since their inception and values their role in making an MIT education accessible to all qualified students.

In addition, MIT undergraduates receive federal aid for their participation in the Air Force, Army, and Navy ROTC. This aid is not based on need.

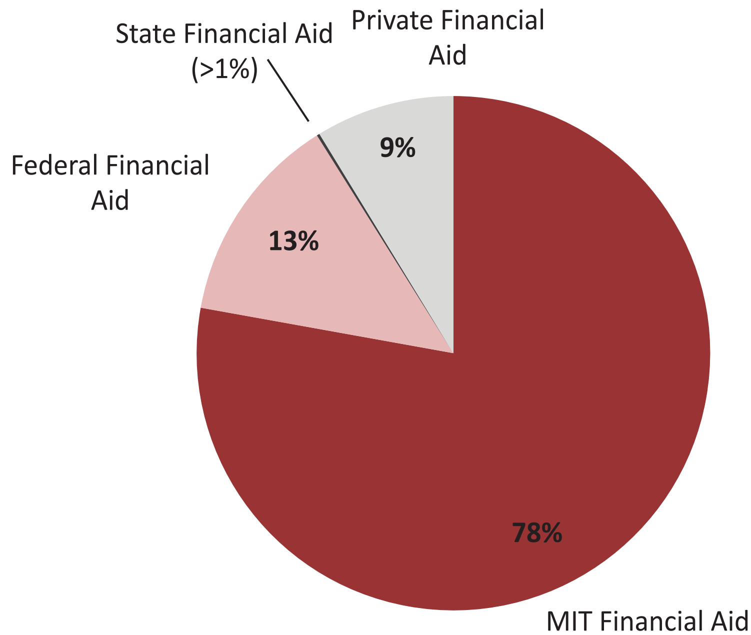
Private and State Financial Aid

Private sources of financial aid — including charitable and civic organizations, corporations, foundations, banks, and other financial institutions — are the third-largest source of financial aid to MIT undergraduates. This aid includes private grants and alternative student loans (so called to distinguish them from federal loans).

Students receive private scholarships in recognition of their academic accomplishments, athletic or musical skills, career interests, and many other criteria. Alternative loans ordinarily are unsubsidized and are based on the cost of education, less other financial awards, without any additional consideration for financial need.

Several states, in addition to Massachusetts, allow their residents to receive a state grant while attending MIT. They include Connecticut, Delaware, Maine, New Hampshire, Pennsylvania, Rhode Island and Vermont. Most state grants are need-based. No state loan or employment programs are available to MIT undergraduates.

Sources of Financial Aid for MIT Undergraduates
2009-2010



MIT Financial Aid:	$89,954,711
Federal Financial Aid:	$15,307,091
State Financial Aid:	$209,221
Private Financial Aid:	$10,104,436
Total:	$115,575,459

The following table summarizes the sources and types of financial aid MIT undergraduates received in 2009-2010.

Type	Scholarship		Student Loan		Student Employment		Total*	
Source	Students	Amount	Students	Amount	Students	Amount	Students	Amount
Institutional	2,454	$73,352,577	118	$330,037	2,245	$6,160,882	3,441	$79,843,496
Federal	1,015	$6,620,654	1,098	$5,809,768	560	$1,609,662	2,077	$14,040,084
State	122	$269,429	N/A	N/A	N/A	N/A	122	$269,429
Private	1,203	$7,268,760	174	$3,558,510	N/A	N/A	1,321	$10,827,270
Total*	**2,912**	**$87,511,420**	**1,263**	**$9,698,315**	**2,652**	**$7,770,544**	**3,737**	**$104,980,279**

*The total column and row are unduplicated numbers of students.

7 Service to Local, National, and World Communities

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Service to Local, National, and World Communities

Founded with the mission of advancing knowledge to serve the nation and the world, MIT has been strongly committed to public service from its start. Members of the MIT community helped build the Boston Public Library in the late 19th century and dam the Charles River early in the 20th century. Research and development during World War II included radar systems; submarine and aircraft detection systems; a long-range navigation scheme based on radar principles; the SCR-584 radar for directing anti-aircraft fire; the Ground Controlled Approach System for landing aircraft in low visibility; and the Draper Gun Sight which positions a gun at the proper lead angle to fire at moving targets.

In 1985, Eric Chivian, a physician in MIT's medical department and a founder of International Physicians for the Prevention of Nuclear War, shared a Nobel Peace Price for the group's service to humanity. More recently, Amy Smith, an MIT alumna and mechanical engineering instructor in MIT's Edgerton Center, won a MacArthur "genius grant" for her commitment to inventing simple technologies to solve problems in the world's poorest places, such as low cost water-purification systems, or a simple and efficient technology for grinding grain. A recent Washington Monthly article ranking the public service commitment of the nation's colleges and universities named MIT first in the country.

While MIT faculty, students, and staff regularly engage in conventional projects that such as raising money for hurricane victims, renovating old housing, or restoring local nature reserves, MIT's scientific and technological orientation gives its public service outreach a particular emphasis. Many of its public service programs are specifically devoted to inventing new technologies and applying new knowledge that will advance social well-being.

Key Programs

Abdul Latif Jameel Poverty Action Lab (J-PAL)

Founded in 2003 by faculty in MIT's Department of Economics, the Abdul Latif Jameel Poverty Action Lab's (J-PAL) goal is to reduce poverty by ensuring that policy is based on scientific evidence. The lab runs randomized evaluations of poverty programs in over 30 countries, builds capacity of others to run these evaluations (including graduate students at MIT), and works to disseminate results and promote the scale-up of effective policies. Working on issues as diverse as boosting girls' attendance at school, improving the output of farmers in Sub-Saharan Africa, or overcoming racial bias in employment in the U.S., the lab's objective is to provide policy makers with clear scientific results that will enable them to improve the effectiveness of programs designed to combat poverty. The J-PAL has a target that 100 million lives will be reached through the scale-up of programs found to be effective through its research by 2013.

OpenCourseWare

Launched in 2002, OpenCourseWare (OCW) makes materials for MIT's courses freely available on the Web. Materials from more than 2,000 MIT courses – including lecture notes, multimedia simulations, problem sets and solutions, past exams, reading lists, and selections of video lectures – are now posted on the OCW website. OCW records an average of over 40,000 visits a day, with nearly a million unique visitors every month.

About 43 percent of OCW's visitors identify themselves as self-learners, 42 percent as students enrolled in an academic program, and 9 percent as educators who use the material to develop curriculum, enhance their understanding, advise students, and support their research. MIT is pursuing two missions with OCW – sharing its educational materials freely and openly, and, by creating a model other universities can follow and advance, promoting a universally available storehouse for human knowledge. MIT helped to create the OCW Consortium, an association of more than 200 universities worldwide that now share materials from an estimated 13,000 courses.

Service Learning

In 2001, MIT's Public Service Center and Edgerton Center began working with faculty to design service-learning courses that enable students to contribute to society as they learn. At the program's beginning, MIT offered three such courses, with 35 students enrolled. Five years later, the Institute was offering 19 courses to more than 200 students. Students have used these classes to develop a voice-activated toy that helps speech therapists working with children, a technology for converting sawdust, a common waste product in some developing countries, into cooking fuel, and a tree mover that eases the job of public service forestry volunteers who plant trees in urban areas.

International Development Initiative

With a focus on invention, wide-spread dissemination, and technology transfer, MIT's International Development Initiative works with impoverished communities around the world to help them develop and deploy appropriate solutions that enable them to improve their ability to provide for their basic needs and develop their economies. Its programs let MIT students travel to developing countries, work with partner organizations to identify needs and the challenges in meeting them, and develop solutions.

Key Programs
(continued)

D-Lab

A year-long series of classes and field trips, D-Lab enables students to learn about the technical, social, and cultural aspects of development work in selected countries, then provides them with the opportunity for field work and implementation. Among D-Lab's achievements are a low-cost, low-maintenance device that allows health care workers in Uganda, who lack access to conventional – and expensive – electrically-powered equipment, to test for microorganisms in local water supplies and determine which chemicals will kill them; a technology developed for Haiti that makes cooking fuel out of sugar cane waste, thus helping the island nation preserve its forests and prevent health problems caused by inhaling wood smoke (D-Lab students are now adapting this technology for paddy straw to use in India); and an automated flash-flood warning system developed with engineers in Honduras.

IDEAS Competition

The IDEAS Competition encourages teams of students to develop innovative solutions that address community needs. With a grant that covers the cost of materials and mentoring from faculty, staff, and industry professionals, competing teams of students work through a needs analysis, the products development process, and group organization. Winners receive cash grants that provide seed money for launching their projects.

International Fellowships

These fellowships provide stipends that enable students to work full-time on capacity-building community projects all over the world. Projects can be initiated by students or by community organizations or donors.

International Development Grants

These grants support international development projects that involve MIT students. Faculty, students, and other MIT community members can use them to cover materials, travel, and other expenses in projects that serve communities in developing regions.

Selected Recent Projects

Cell Phone Applications in Developing Countries

With more than 4 billion users worldwide, cell phones have become one of the world's most readily available technologies. MIT students are using these common devices to bring life-changing technology to developing countries. Students from MIT Media Lab's NextLab program have created an opensource medical diagnosis application called Mobile Care, or Moca. The application gives residents of underdeveloped rural areas easy access to diagnostic medical care. Zaca, also a NextLab project, aims to economically empower farmers in the Mexican state of Zacatecas. The application connects farmers to a peer-to-peer network to help them obtain fair pricing for their crops. Yet another NextLab project, Celedu, short for cellular education, is teaching children in rural Indian villages to read using cell phone-based games and quizzes. Adnan Shahid, a fellow at the Legatum Center for Development and Entrepreneurship, is developing a cell phone recycling program in Pakistan. Another Legatum fellow, Ravi Inukonda, is developing a program to bring mobile services, such as updates on water and power shutdowns and current market rates for produce, to rural phone users in India.

Legatum Center for Development and Entrepreneurship

The Legatum Center for Development and Entrepreneurship operates on the premise that economic progress and good government grow from the bottom up. Founded in 2007, and led by Iqbal Z. Quadir, the founder of GrameenPhone and Emergence BioEnergy, the Center supports individual entrepreneurship in low-income countries. The Center provides seed grants for MIT students who intend to launch enterprises in these areas. In the summer of 2009, the Center awarded grants to eight student teams. One team, IDC India, plans to manufacture wheelchairs to help handicapped people in Mumbai, India, start their own businesses. Another team, Creaciones Norteñas del Peru: Scaling Up, plans to help women and their families achieve financial stability by expanding a Peruvian women's knitting cooperative, Creaciones Nortenas.

Bicilavadora – The Human-Powered Washing Machine

In areas without electricity, laundry is time consuming and washing clothes in lakes and streams creates pollution. The bicilavadora, winner of the 2004-2005 MIT IDEAS Competition, is a pedal-powered washing machine designed for use in the developing world. MIT students and staff created the machine as an inexpensive solution that uses bicycle parts and empty barrels. The bicilavadora can be assembled locally, and the washing mechanism can be taken apart and stored flat for transportation. In 2009, students tested a prototype in an orphanage outside Lima, Peru.

Monitoring Drug-Resistant TB with PDAs

Treatment of drug-resistant Tuberculosis is a two-year process that involves close monitoring of treatment schedules. In areas without electronic records, this process generates huge amounts of paperwork. Joaquin Blaya, a Harvard-MIT Health Sciences and Technology Ph.D. student, worked with MIT faculty and experts at Brigham and Women's hospital to create a personal digital assistant (PDA) application to track these treatment schedules. The program's goal was to improve doctors' access to timely and accurate test results. When it was launched in Lima, Peru, the application reduced the average time it took test results to reach doctors from 23 days to 8 days. The program has since been implemented in all five of Lima's districts.

Selected Recent Projects
(continued)

Portable Pedal-Powered Corn Processor

In Tanzania and other parts of Africa, processing the corn harvest is a labor-intensive process that can last as long as two weeks. A bicycle-powered machine, adapted by MIT undergraduate Jodie Wu, can make this process up to 30 times faster. Wu designed the bicycle add-on as a D-Lab: Design class project, creating a machine that was both affordable and portable. Previous models had required complete conversion of a bicycle, making the bike unrideable. Wu refined the corn sheller so it could be attached to the chain of a regular bicycle and then later removed. Wu then spent a summer visiting villages in Tanzania introducing the device.

MIT Public Service Center

Created to motivate, facilitate, and celebrate the ethic and activities of public service at MIT, the Public Service Center supports more than 15 service programs. Many of these programs focus on connecting MIT students with the local community. CityDays, which is part of freshman orientation, places MIT students with community agencies for a day to complete service projects, including painting, cleaning, working with children, and working in food distribution. Every spring, MIT hosts the MIT/Cambridge Science Expo, an event that gives 7th and 8th grade students from Cambridge public schools the opportunity to meet student volunteers from MIT. The Public Service Center also co-sponsors the ReachOut: Teach a Child to Read program, which connects tutors with local children who are identified as needing help with reading.

Post-Katrina Environmental Issues

Members of the Department of Urban Studies and Planning (DUSP) participated in a variety of projects in response to the devastation of New Orleans by Hurricane Katrina. Included among them was the spring 2006 "The Katrina Practicum" taught in New Orleans by DUSP faculty members. The class researched affordable housing, community development, and post-disaster environmental issues on behalf of two community development corporations in New Orleans. The MIT practicum group focused on the historic Treme neighborhood, sometimes identified as the oldest African-American neighborhood in the United States.

Lake Pontchartrain Ecosystem

The Department of Civil and Environmental Engineering has participated in several Katrina-related projects. Instructors and students from the Aquatic Chemistry and Biology Lab traveled to New Orleans to focus on the impacts of dewatering operations on the Lake Pontchartrain ecosystem. The project also saw collaboration with professors from Louisiana State University who were examining the occurrence and distribution of pathogens in the sediments.

Inexpensive Glasses: Sight for the Poor

As many as 1.4 billion people around the world need corrective lenses but can't afford them. Not only is their quality of life significantly reduced, but their productivity also slows, they are more prone to accidents, and, in some cases, they can't function. As an alternative to far more expensive glass molding machines currently in use, MIT Media Lab graduate student Saul Griffith invented a portable machine with a programmable mold that in about 10 minutes forms a low-cost acrylic lens in the exact shape required. Griffith also has a patent pending for a low-cost prescription testing device that will make vision evaluation much more accessible.

Clean Water for Developing Countries

According to UNICEF, 1.7 billion people lack access to clean drinking water. Waterborne diseases are a major cause of illness and death across much of the developing world. In Nepal alone, 44,000 children under the age of five die annually from such diseases. In 1999, Susan Murcott, a research engineer in the Department of Civil and Environmental Engineering, launched the Nepal Water Project, a Master's program whose goal is to develop quick, cheap, and relatively simple systems that Nepal's rural poor can use to clean their water. In collaboration with the Environment and Public Health Organization in Katmandu and the Rural Water Supply and Sanitation Support Programme in Butwal, Tommy Ngai, one of Murcott's students, developed an arsenic-biosand filter (ABF) constructed of a round plastic bin, layers of sand, brick chips, gravel, and iron nails. The system removes both arsenic and pathogens that can lead to dehydration, malnutrition, stunted growth in children, and sometimes death. In 2004, with an award from the World Bank, Ngai, his MIT team, and their Nepali partners, installed ABFs in 25 Nepalese villages and established a center to forward research and provide villagers with training in the ABF technology.

Water-chemistry variation among countries makes it difficult to find one technology that will suit all areas, so Murcott and her students have been developing a collection of water-treatment systems that are low-cost, easy to maintain, and match the targeted country's needs and resources. The program has now expanded to include water and wastewater research in Bolivia, Brazil, Haiti, and Nicaragua.

Gasoline Storage Tank Leak Detection

Developed by Andrew Heafitz, a graduate student in Mechanical Engineering, and Carl Dietrich, a graduate student in Aeronautics and Astronautics, this new low-cost technology enables owners of gasoline tanks in developing countries to continually test the water in the tanks' monitor wells, thus reducing the risks of environmental and health damage caused when the tanks leak. If the system detects gasoline in the well, a window in the well cover changes from green to red; and because they no longer have to unbolt the cover, tank owners can check wells for contamination much more frequently. The new system replaces the need for both unaffordable electronic detection equipment and the tedious process of testing water manually. A simple practical, and inherently safe mechanical system, the technology is particularly useful for a very cost-sensitive industry.

Passive Incubator for Premature Infants

Every year, 4 million infants die within the first 28 days of life. Of this number, 3.9 million live in the developing world. Complications of prematurity — most frequently heat loss and dehydration — cause 24 percent of these deaths. Electric incubators can minimize this problem, but in the developing world the lack of electricity in most rural regions and the frequent loss of power in urban areas render this technology worthless. Using phase-change material that once heated, for example by wood or coal fire, maintains its temperature for 24 hours, and devising ways to use indigenous raw materials for an outer shell, a team of MIT students are designing a low-cost incubator that will operate without electricity. The students now are reviewing their design with Médecins Sans Frontières in Sri Lanka, and once they have built a working model, they will meet with Sri Lankans to implement field tests.

Selected Recent Projects
(continued)

iMath – Keeping Kids Interested in School

Invented by MIT undergraduate John Velasco while visiting his own middle school in San Diego as a volunteer, iMath is an interactive Internet-based curriculum that, with its mentoring component, helps eighth graders understand and apply math concepts and expand their technical skills, while motivating and inspiring them to pursue their education. When he returned to MIT, Velasco implemented his new program in the Cambridge public schools. iMath now involves 70 eighth graders and MIT undergraduates, graduate students, and alumni – with teachers and parents reporting a dramatic change in students' attitudes toward math and learning in general. In 2005 Velasco received the prestigious national Howard R. Swearer Student Humanitarian Award, presented annually to five students across the country for outstanding commitment to community service.

Understanding How to Serve the Homeless

Lack of data is one of the major barriers to combating the root causes of homelessness. Because groups undertaking research on questions concerning the links between homelessness and poor health or education have little hard data, their results and proposed solutions are often questioned. Furthermore, with no good way to collect data, organizations that serve the homeless have no way to evaluate their clients' needs and monitor the effectiveness of their services. The Salvation Army of Cambridge, Massachusetts, came to a group of MIT students on MIT Graduate Student Volunteer Day and asked if they could help with this problem. The students designed a system that, instead of asking clients who came to the shelter for services to sign in with paper and pencil, enabled them to register with a bar-coded card. Now able to collect data accurately and reliably, the shelter can study how to best use its resources to meet its clients' needs. To encourage use of the card, the Salvation Army worked with community partners to provide benefits such as meal discounts and free use of public transportation. The students also designed the system to ensure users' privacy. The Cambridge Salvation Army has been using the system since 2003.