
Section 5

MIT and Industry

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MIT and Industry

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 applications of science in connection with arts, agriculture, manufacturers, and commerce.” The Institute’s motto, *mens et manus*—mind and hand—codifies its continuing commitment to servicing society through the practical application of university research.

- According to the National Science Foundation, MIT ranks first in industry-financed R&D expenditures among all universities and colleges without a medical school.
- In FY2012, 712 companies provided R&D/gift support to MIT; 41 companies funded \$1 million+, 174 companies funded \$100 thousand–\$1 million.
- Currently over 700 companies are working with faculty and students on projects of mutual interest. Among these corporate sponsors are such global leaders as BAE, BP, Boeing, DuPont, Eni, Ford Motor, Google, Intel, Lockheed Martin, Novartis, Quanta Computer, Raytheon, Samsung, Sanofi, Shell, Siemens, TOTAL, etc.

Partnering at MIT

Industry partners at MIT are global industry leaders who understand that technological advantage and innovation are key drivers to their competitive advantage. These are leaders who have created and defined industries, who quickly grasp the implications of breakthrough technology. Industry managers engage fully in MIT’s collaborative, interdisciplinary culture, and join big thinkers who are perpetually focused on wringing practical applications from excellent ideas.

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.

A selection of these partnerships are described below.

DuPont

Established in 2000, the DuPont MIT Alliance (DMA) brings together each institution’s strengths in materials and chemical and biological sciences to develop new materials for bioelectronics, biosensors, biomimetic materials, alternative energy sources, and new high-value materials. DuPont also works with MIT’s Sloan School of Management to define new business and policy models for these emerging technologies. Each year, the DMA supports first-year graduate students through its DuPont Fellows program.

Eni S.p.A

In February 2008, an alliance was signed between Eni and MIT. This alliance brought the creation of the Eni-MIT Solar Frontiers Center (SFC). The SFC, headquartered on the MIT campus, promotes research in advanced solar technologies through projects ranging from new materials to hydrogen production from solar energy. Eni collaboration with MIT promotes the creation of technological and cultural synergies through a multidisciplinary approach. In particular, the cooperation between MIT researchers and those of the Research Center for Non Conventional Energy, Eni Donegani Institute, promotes the exchange of expertise through the pursuit of common objectives. In addition to the SFC, Eni supports projects in energy research at MIT on traditional hydrocarbons, methane hydrates, global climate change, and transportation options.

Ford Motor Company

Ford and MIT have been collaborating since the 1950s. In 1998 the Ford-MIT Alliance was formalized and has created a model for mutually beneficial university-corporate research. Ford and MIT collaborate on a broad range of technical, business, and policy topics focused on the future of transportation, including: vehicle autonomy, active safety, materials science, energy storage, powertrain efficiency, enterprise modeling, and health and wellness.

Novartis

Novartis and MIT have launched a long-term research collaboration aimed at transforming the way pharmaceuticals are produced. The partnership, known as the Novartis-MIT Center for Continuous Manufacturing, will work to develop new technologies that could replace the conventional batch-based system in the pharmaceuticals industry—which often includes many interruptions and work at separate sites—with continuous manufacturing processes from start to finish. The Novartis-MIT Center for Continuous Manufacturing combines the industrial expertise of Novartis with MIT’s leadership in scientific and technological innovation.

Project Oxygen Alliance

A partnership among the MIT Computer Science and Artificial Intelligence Laboratory and six corporations—Acer, Delta Electronics, Hewlett-Packard, Nippon Telegraph and Telephone, Nokia Research Center, and Philips Research—Project Oxygen’s goal is to make computation and communication resources as abundant and 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. For example, the researchers are creating speech and vision technologies that enable humans to communicate as naturally with computers as they do with people.

Quanta Computing

Taiwan-based Quanta Computer Inc., the world’s largest original design manufacturer of notebook computers, and MIT Computer Science and Artificial Intelligence Laboratory began the T-Party project collaboration in 2005. The goal of this project is to make the dream of having complete access to your own personalized environment—your notes, presentations, music, TV recordings, photo albums, recipes—from anywhere in the world, anytime a reality. The technologies they are exploring to support their vision fall into five categories: connectivity, devices, applications, automation, and natural interactions.

Selected Projects

MIT report identifies keys to new American innovation

An intensive, long-term study by a group of MIT scholars suggests that a renewed commitment to research and development in manufacturing, sometimes through creative new forms of collaboration, can spur innovation and growth in the United States as a whole. The findings are outlined in a 2013 report issued by a special MIT commission on innovation, called *Production in the Innovation Economy*, co-chaired by Suzanne Berger and Phillip A. Sharp. The report follows two years of in-depth research on hundreds of firms across various industrial sectors, ranging in size from high-tech startups to small “Main Street” manufacturers and multinational corporations.

<http://web.mit.edu/newsoffice/2013/production-in-the-innovation-economy-report-mit-0222.html>

MIT researchers build Quad HD TV chip

In January 2013, several manufacturers debuted new ultrahigh-definition, or UHD, models (also known as 4K or Quad HD) with four times the resolution of today’s HD TVs. In addition to screens with four times the pixels, UHD also requires a new video-coding standard, known as high-efficiency video coding, or HEVC. In February 2013, MIT researchers unveiled their own HEVC chip. The chip was designed by Anantha Chandrakasan, graduate students Mehul Tikekar and Chiraag Juvekar, former postdoc Chao-Tsung Huang, and former graduate student Vivienne Sze, now at Texas Instruments (TI). The researchers’ design was executed by the Taiwan Semiconductor Manufacturing Company, through its University Shuttle Program, and TI funded the chip’s development.

<http://web.mit.edu/newsoffice/2013/mit-researchers-build-quad-hd-tv-chip-0220.html>

A cooler way to protect silicon surfaces

Silicon, the material of high-tech devices from computer chips to solar cells, requires a surface coating that “passivates” it to prevent oxidation that would ruin its electrical properties. Typically, silicon surfaces are passivated with a coating of silicon nitride, which requires heating a device to 400 degrees Celsius. By contrast, the process Karen Gleason, Tonio Buonassisi, and graduate student Rong Yang uses organic vapors over wires heated to 300°C, but the silicon itself never goes above

20°C—room temperature. Heating those wires requires much less power than illuminating an ordinary light bulb, so the energy costs of the process are quite low. The research was supported by the Italian energy company Eni S.p.A., under the Eni-MIT Alliance Solar Frontiers Program.

<http://web.mit.edu/newsoffice/2013/a-cooler-way-to-protect-silicon-surfaces-0213.html>

That’s the way the droplets adhere

Understanding exactly how droplets and bubbles stick to surfaces—everything from dew on blades of grass to the water droplets that form on condensing coils after steam drives a turbine in a power plant—is a “100-year-old problem” that has eluded experimental answers, says Kripa Varanasi. Furthermore, it’s a question with implications for everything from how to improve power-plant efficiency to how to reduce fogging on windshields. Now this long-standing problem has finally been licked, Varanasi says, in research he conducted with graduate student Adam Paxson. They achieved the feat using a modified version of a scanning electron microscope in which the dynamic behavior of droplets on surfaces at any angle could be observed in action at high resolution. The work was supported by the National Science Foundation and the DuPont-MIT Alliance.

<http://web.mit.edu/newsoffice/2013/droplet-surface-adhesion-0219.html>

Continuous drug manufacturing offers speed, lower costs

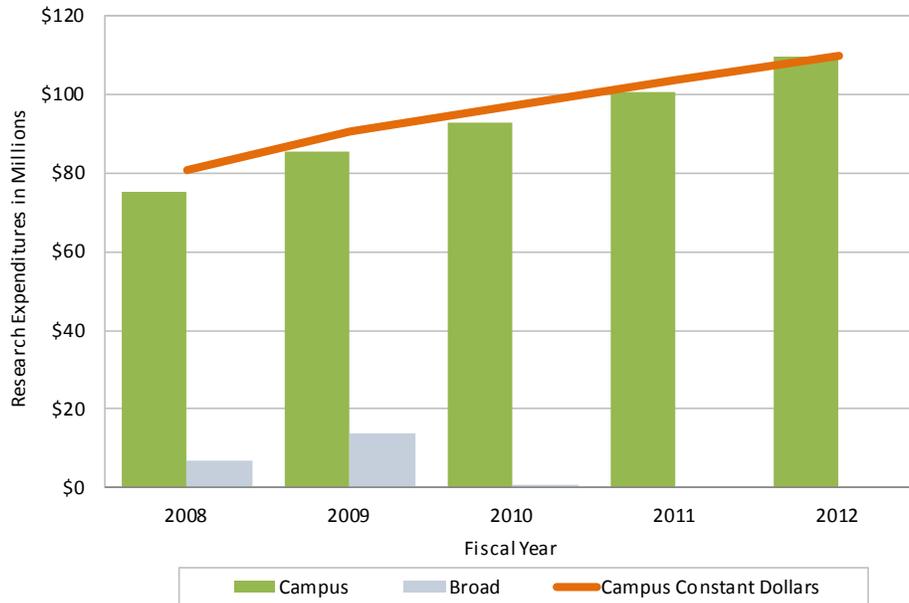
Traditional drug manufacturing is a time-consuming process. Active pharmaceutical ingredients are synthesized in a chemical manufacturing plant and then shipped to another site where they are converted into giant batches of pills. In 2007, MIT and pharmaceutical company Novartis launched a research effort, known as the Novartis-MIT Center for Continuous Manufacturing, to transform those procedures. Bernhardt Trout and other MIT researchers have now developed and demonstrated a prototype continuous-manufacturing system—the first that can transform raw materials into tablets in a nonstop process. In addition to Trout, MIT faculty members involved in the project include Klavs Jensen, Stephen Buchwald, Tim Jamison, Gregory Rutledge, Allan Myerson, Paul Barton, and Richard Braatz.

<http://web.mit.edu/newsoffice/2012/manufacturing-pharmaceuticals-0312.html>

Campus Research Sponsored by Industry

Industry Campus and Broad Institute Research Expenditures (in U.S. Dollars)*
Fiscal Years 2008–2012

	2008	2009	2010	2011	2012
Campus research	75,259,081	85,562,146	92,649,701	100,762,512	109,744,829
Broad Institute research	6,935,104	13,656,981	680,132	0	0
Total Industry	82,194,185	99,219,127	93,329,833	100,762,512	109,744,829
Constant dollars†	88,352,894	105,185,002	97,993,272	103,714,730	109,744,829



*The Broad Institute separated from MIT on July 1, 2009 and no longer receives funding through MIT. The chart above displays both MIT campus research expenditures and Broad Institute research expenditures funded through MIT.

†Constant dollars are calculated using the Consumer Price Index for All Urban Consumers weighted with the fiscal year 2012 equaling 100.

Leading Departments, Laboratories, and Centers Receiving Support in Fiscal Year 2012 (shown in descending order of expenditures)

MIT Energy Initiative
 Chemical Engineering
 Computer Science and Artificial Intelligence Laboratory
 Media Laboratory
 Sloan School of Management
 Mechanical Engineering
 Koch Institute for Integrative Cancer Research
 Sociotechnical Systems Research Center
 Aeronautics and Astronautics
 Research Laboratory of Electronics

MIT is a leader in conducting research sponsored by industry. Approximately 200 industrial sponsors supported research projects on the MIT campus in FY2012, with nearly \$110 million in expenditures. Companies often join together in these collaborations to support multi-disciplinary research programs in a wide range of fields.

Managing the Industry/ University Interface

Drawing on decades of successful industry collaboration, MIT has assembled a coordinated team of professionals who expertly manage the important industry/university interface, leveraging and exploiting proven pathways for two-way knowledge transfer.

Industrial Liaison Program

Officers at MIT's Industrial Liaison Program (ILP) help company managers by scheduling and facilitating face-to-face meetings with MIT faculty, coordinating on-campus networking activities, and advising company managers on how to navigate, adapt and benefit from the dynamic, interdisciplinary MIT environment. Over 200 of the world's leading companies partner with the Industrial Liaison Program to advance their research agendas at MIT, and ILP member companies account for approximately 54% of all single-sponsored research expenditures and corporate gifts/grants at MIT (FY2012).

Office of Corporate Relations

MIT's Office of Corporate Relations (OCR), the organizational parent of the ILP, aids and directs companies interested in pursuing significant, multi-year, multi-disciplinary involvement with the Institute. OCR works with MIT senior administration, faculty, and company executives to structure and define individualized alliances that mutually benefit the company and MIT. The result is a holistic industry/university relationship that addresses broad needs and interests, from specific research projects and initiatives, to executive education, technology licensing, and recruitment.

Technology Licensing Office

The MIT Technology Licensing Office (TLO) is a world class model of excellence in university technology licensing. Its staff is especially attuned to the needs of pre-competitive research and promotes an Intellectual Property protocol that accelerates commercialization, and, at the same time, honors MIT's obligations to education and research. The TLO oversees a vibrant flow patenting/licensing activity

Technology Licensing Office Statistics for FY2012

Total number of invention disclosures	694
Number of U.S. new utility patent applications filed	198
Number of U.S. patents issued	199
Number of licenses granted (not including trademarks and end-use software)	81
Number of options granted (not including options as part of research agreements)	26
Number of software end-use licenses granted	32
Number of companies started (venture capitalized and/or with a minimum of \$500K of other funding)	16

Entrepreneurship

Beginning with the founding of Arthur D. Little, Inc. in Cambridge in 1886, MIT alumni, faculty, and students have played key roles in launching thousands of companies worldwide, ranging from small, specialized high-tech operations to corporate giants such as Genentech, Gillette, Hewlett-Packard, Teradyne, and Raytheon. Many of these companies have formed the cornerstone of new industries, including biotechnology, streamlined digital technologies, local computer networks, defense, semi-conductors, minicomputers, advanced computers, and venture capital. MIT scientists and entrepreneurs laid the groundwork for much of the current biotech industry, and biomedical advances have continued with MIT-originated developments such as the first effective new treatment for brain cancer in a generation.

- According to a 2009 Kauffman Foundation Entrepreneurship Study, 25,000+ companies have been founded by MIT alums creating 3.3+ million jobs and \$2 trillion in annual world sales.
- Five states gaining the most jobs from companies started by MIT alumni were Massachusetts, with just under 1 million jobs; California, with 526,000 jobs; New York, with 231,000 jobs; Texas, with 184,000 jobs; and Virginia, with 136,000 jobs.
- MIT acts as a magnet for foreign entrepreneurs. 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."

Martin Trust Center for MIT Entrepreneurship

The Martin Trust Center for MIT Entrepreneurship is committed to fostering and developing MIT's entrepreneurial activities and interests in three primary areas: education and research, alliance, and community. The Center educates and nurtures students from across the Institute who are interested in learning the skills to design, launch, and grow innovation-based ventures. The Center facilitates business and technology partnerships by combining breakthrough academic research with practical, proven experience. The people of the Center cultivate and nourish a thriving network that unifies academic, government, and industry leaders around the vision of entrepreneurial success.

Deshpande Center for Technological Innovation

The Deshpande Center for Technological Innovation was established at the MIT School of Engineering in 2002 to increase the impact of MIT technologies in the marketplace, and support a wide range of emerging technologies including biotechnology, biomedical devices, information technology, new materials, tiny tech, and energy innovations. Since 2002, the Deshpande Center has funded more than 80 projects with over \$9 million in grants. Eighteen projects have spun out of the center into commercial ventures, having collectively raised over \$140 million in outside financing. Thirteen venture capital firms have invested in these ventures.

\$100K Entrepreneurship Competition

The MIT \$100K Entrepreneurship Competition (student group) is the leading business plan competition in the world. The competition was founded in 1990 to encourage students and researchers in the MIT community to act on their talent, ideas, and energy to produce tomorrow's leading firms. Entirely student-managed, the competition has produced hundreds of successful ventures that have created value and employment.

Learning**Sloan Executive Education**

MIT Sloan Executive Education programs are designed for senior executives and high-potential managers from around the world. From intensive two-day courses focused on a particular area of interest, to executive certificates covering a range of management topics, to custom engagements addressing the specific business challenges of a particular organization, their portfolio of non-degree, executive education and management programs provides business professionals with a targeted and flexible means to advance their career development goals and position their organizations for future growth.

Professional Education

MIT Professional Education provides short courses, semester or longer learning programs and customized corporate programs for science and engineering professionals at all levels. Taught by renowned faculty from across the Institute, MIT Professional Education programs offer professionals the opportunity to gain crucial knowledge in specialized fields to advance their careers, help their companies, and have an impact on the world.

- **Short Programs**—Over 40 courses, in two-to-five day sessions, are taught on the MIT campus each summer by MIT faculty/researchers and experts from industry and academia. Participants earn Continuing Education Units (CEUs) and a certificate of completion.
- **Advanced Study Program**—Enroll at MIT for a 16-week, non-matriculating, non-degree program that enables professionals to take regular MIT courses to gain the knowledge and skills needed to advance their careers and take innovative ideas back to their employers. Participants earn grades, MIT credit, and an Advanced Study Program certificate.
- **Custom Programs**—Enhance your organization's capabilities and expertise through customized programs tailored to meet your specific needs and priorities. These programs can be a single week or several weeks over a year with interrelated projects. These specialized courses can be delivered at MIT, the company site, or off site.

Leaders for Global Operations

The Leaders for Global Operations (LGO) program is an educational and research partnership among global operations companies and MIT's School of Engineering and Sloan School of Management. Its objective is to discover, codify, teach, and otherwise disseminate guiding principles for world-class manufacturing and operations. The 24-month LGO program combines graduate education in engineering and management for those with two or more years of full-time work experience who aspire to leadership positions in manufacturing or operations companies. A required six-month internship comprising a research project at one of LGO's partner companies leads to a dual-degree thesis, culminating in two master's degrees—an MBA (or SM in management) and an SM in engineering.

MIT Sloan Fellows Program in Innovation and Global Leadership

This full-time, 12-month (June–June) immersive MBA program is designed for high-performing mid-career professionals. The program typically enrolls more than 100 outstanding individuals with 10–20 years of professional experience from at least two dozen nations, representing a wide variety of for-profit and nonprofit industries, organizations, and functional areas. Many participants are sponsored by or have the strong support of their employers, but the program also admits independent participants, many with unique entrepreneurial experiences and perspectives. The program is characterized by a rigorous academic curriculum, frequent interactions with international business and government leaders, and a valuable exchange of global perspectives.

System Design and Management

The System Design and Management program 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.

Recruiting

Global Education and Career Development

The MIT Global Education and Career Development center assists employers in coordinating successful on- and off-campus recruitment of MIT students and provides students with opportunities to interact and network with professionals and obtain quality internships and full-time positions. MIT is proud to serve the needs of undergraduates (including Sloan), graduates and MIT alumni. (Departments that conduct their own recruiting include Chemistry, Chemical Engineering, and Sloan School of Management).

Sloan's Career Development Office

Sloan's Career Development Office (CDO) serves a vital role in connecting MIT Sloan's innovative master's students and alumni with the world's leading firms. The CDO is dedicated to supporting employer recruiting goals and helping them identify the best candidates for their organization.