

MIT Portugal Program

The MIT Portugal Program, launched in October 2006, is a strategic investment in people, knowledge, and ideas by the Portuguese government to strengthen the country's knowledge base and international competitiveness. This transatlantic collaboration involves MIT, together with government and academia in Portugal and global and Portuguese companies, in the development of education and research programs in engineering systems.

MIT Portugal is hosted by the Engineering Systems Division (ESD) and is led at the Institute by its founding director, professor Daniel Roos, who serves as MIT director of the program. Numerous other departments and divisions within the Institute's five schools are also active participants in MIT Portugal.

President Hockfield Visits Portugal

From November 24–26, 2009, MIT president Susan Hockfield visited Portugal on behalf of the MIT Portugal Program and the Sloan School of Management's Lisbon MBA program. During her visit, she participated in several key program events, including the launch of three international research networks and the awarding of the first national certificates to graduates of the program's executive master's courses. President Hockfield also met with prime minister José Socrates and Mariano Gago, minister of science, technology, and higher education, as well as key corporate and foundation leaders. The president was awarded the first-ever doctorate honoris causa jointly presented by three leading Portuguese universities: the University of Porto, the Technical University of Lisbon, and the New University of Lisbon. During her acceptance speech, President Hockfield saluted the commonalities between MIT and its Portuguese partners as “a shared appreciation for the role of science and engineering in tackling the world's most pressing challenges and a commitment to producing innovations and innovators that together drive economic growth.”

Education

The MIT Portugal Program plays a significant role in Portugal's effort to reform and internationalize its science and engineering training, an undertaking aimed at training future leaders in the knowledge-based economy, bringing about economic development, and addressing pressing social challenges.

MIT Portugal offers a portfolio of graduate degrees to which MIT quality standards are applied. During the program's first year, we established four PhD and three executive master's programs that focus on four areas of significance to systems thinkers: bioengineering, engineering design and advanced manufacturing, sustainable energy systems, and transportation systems. Courses are cotaught by faculty at Portuguese institutions and by MIT (including ESD) faculty, and students have opportunities to conduct research at MIT collaborating laboratories for a year or longer. We formed consortia of universities throughout Portugal to establish these degree programs—the first such university collaborations in Portugal and the first to grant national degrees.

On November 25, 2009, the program awarded its first graduation certificates to 52 graduates of our executive master's programs in sustainable energy systems, technology management enterprise (in the engineering design and advanced manufacturing area), and transportation systems. The certificates, the first ever issued by consortia of Portuguese universities, recognized the contribution of MIT to these programs. President Hockfield was present to congratulate the graduates at a ceremony held at the Luso-American Development Foundation (FLAD) in Lisbon, whose MIT Portugal Enhanced Gift Fund at MIT helps support innovations in education and other program initiatives.

MIT faculty and staff support the transfer of best practices in teaching by hosting Portuguese faculty at MIT and by conducting workshops in Portugal. In September 2009, Dr. Janet Rankin, associate director of the MIT Teaching and Learning Laboratory, led a workshop in Porto for over 30 Portuguese faculty who teach in the engineering design and advanced manufacturing and sustainable energy systems programs. Dr. Rankin's presentation linked contemporary understanding of cognition to effective teaching and curriculum development practices. Several faculty participants said the workshop had an immediate impact on their teaching practice.

From September through November 2009, three junior faculty in the bioengineering systems area were resident at MIT as participants in the iTeams course given at the Sloan School, as part of the bioengineering area's commitment to building capacity for innovation within the Portuguese system. These visiting faculty were also hosted by staff at the Industrial Liaison Program and the Technology Licensing Office and met with MIT faculty and students who engage in entrepreneurial activities outside MIT. A total of 15 faculty from Portugal have now participated in the iTeams course, allowing the implementation of this course in Portugal (BioTeams) to be acknowledged as one of the program's most successful innovations.

Another MIT-led innovation has been the recognition and reward of the highest-performing Portuguese faculty. The program presented its first Education Innovation Awards in May 2010, recognizing outstanding teaching and educational program development from faculty during the past academic year. The awards program is another initiative supported by the FLAD MIT Portugal Enhanced Gift Fund.

In addition, MIT faculty conduct outreach in Portuguese secondary schools; in more than 15 visits, they have reviewed projects and engaged in question-and-answer sessions with more than 2,500 Portuguese students.

More than 1,200 candidates from around the world have applied to MIT Portugal's degree programs, and the program has granted 179 PhD scholarships to date. By spring 2010, over 500 students from 33 countries had enrolled in or graduated from the MIT Portugal Program. The admitted doctoral students in the 2010–2011 cohort include graduates of MIT, the University of Michigan, Imperial College, ETH Zurich, IIT Bombay, and other distinguished international institutions, and this is the second consecutive year in which more than 40% of admitted MIT Portugal PhD students have come from outside Portugal.

Research

The consortia created by the MIT Portugal Program connect eight Portuguese universities with 20 Portuguese research centers and national associated laboratories. These consortia, working with laboratories and departments at MIT, have developed an array of leading-edge MIT Portugal research projects that are carried out at the Institute as well as in Portugal by program faculty, students, and industry affiliates. At MIT, funding is provided for 159 individuals: 32 professors and lecturers, 14 postdoctoral fellows, 80 research assistants, 15 research staff, and 18 administrative staff.

The initial round of research in the program was conducted within the same four focus areas as those in which we offer educational programs. The projects funded in this phase are largely drawing to a close during AY2010 and early AY2011. During 2009, a strategic review led to a new focus on three application areas: sustainable energy and transportation systems, stem cell engineering for regenerative medicine, and materials and design-inspired products. This research will include developing renewable, sustainable energy systems; designing alternative modes of transportation that are both energy efficient and effective; and developing next-generation biomedical products and therapies.

In order to broaden the impact of the program's research in the Portuguese research community, as well as within MIT, in fall 2009 the Portuguese Science Foundation (FCT) opened a call for research proposals for projects targeting the program's three application areas. For the first time, funding was offered to joint teams at MIT and at any Portuguese institution for proposals including participation by at least two Portuguese institutions and one company. Grants in this call for proposals are for approximately 120,000 euros annually for two or three years. The awarded projects and their MIT principal investigators are detailed below.

Awarded Projects and MIT Principal Investigators

MIT Principal Investigator	Project Title
Professor Richard de Neufville (ESD/Civil Engineering)	Forest Fire Protection: Risk Management
Professor Randy Kirchain (ESD/Materials Science)	Capturing Uncertainty in Bio-derived Fuels for Transportation: Resolving Environmental Performance and Enabling Improved Use
Professor Randy Kirchain (ESD/Materials Science)	Economic and Environmental Sustainability of Electric Vehicle Systems
Professor Robert Langer (Chemical Engineering)	Micro/Nano Design of Functional Stem Cell-Instructive Materials for Bone Tissue Regeneration
Professor Richard Larson (ESD/Civil Engineering)	A Learning, Adaptive, Communicating Energy Box
Professor Joseph Sussman (ESD/Civil Engineering)	Strategy for High Speed—Supporting a Multimodal, Multisectoral Deployment Strategy for HSR in Portugal

Another important development was the launch in November 2009, in conjunction with the visit of President Hockfield, of the following three international research networks that seek to expand and make sustainable the program's research in key areas.

- The Sustainable Cities Forum and Research Network brings together the MIT Energy Initiative (MITEI) and city officials and urban experts from around the world to benchmark sustainability and help design, test, and implement new policies for greener cities. This network leverages the emerging field of urban metabolism, in which MIT Portugal is a leader. The aim of the network is to contribute directly to the real-world needs of Portuguese cities while also advancing global efforts toward a humane and sustainable urban future. One distinct output from this research is a book on urban metabolism jointly authored by MIT professor John Fernández and professor Paulo Ferrão of the Instituto Superior Técnico (IST); building on Professor Fernández's sabbatical in Portugal during AY2009, the book is expected to be released in early 2011 by MIT Press.
- The Sustainable Energy Systems and Electric Mobility Research Platform and Network (E2 Net) aims at making Portugal a center for new research and advanced training. Bringing together industry, academia, and governmental agencies, E2 Net builds on recent initiatives in Portugal to implement various forms of electric mobility and renewable sources of energy generation and integrates research developed by more than 80 MIT Portugal PhD researchers at Portuguese universities.
- StemCellnet has been launched to develop the emerging field of stem cells for regenerative medicine, with a focus on treatment of cancer, hematological and genetic disorders, and autoimmune diseases. The network addresses both development and implementation. As President Hockfield said at the launch event for the network, efforts such as this involve "the great convergence of the life sciences with engineering and the physical sciences."

As a measure of the recognition of the program's research at an international level and of its spillover effects on other collaborations between MIT and Portuguese researchers, three major competitive grants were made this year to projects that involve MIT Portugal faculty at MIT and/or in Portugal:

- Professor Chris Zegras of MIT's Department of Urban Studies and Planning and his co-coordinator of the MIT Portugal transportation systems focus area, professor José Viegas (IST-Technical University of Lisbon), were among the leaders of a consortium granted the eighth Volvo Research Foundation Centre of Excellence. The \$3.5 million program will focus on bus rapid transit systems worldwide.
- Professor Ki Goosens of the Department of Brain and Cognitive Sciences received a \$3 million grant from the Defense Advanced Research Projects Agency for her research on fear, anxiety, and stress, with the goal of developing future therapeutic interventions for anxiety and other diseases. Professor Rodrigo Cunha from the Center for Neurosciences at the University of Coimbra in Portugal was invited to participate as a co-principal investigator, and

approximately \$500,000 of the grant is directed at the joint research conducted by Professors Goosens and Cunha.

- Dr. Zach Mainen of the Champalimaud Foundation in Lisbon, who is among the Gulbenkian Institute coordinators of MIT Portugal's neurosciences module, received a 2.3 million euro grant from the European Research Council for his investigation into the role of serotonin in the regulation of key bodily functions and in anxiety and depression disorders. Mainen supervises MIT Portugal bioengineering doctoral student Sara Matias, who works with him on the project that won the grant.

Industry and Entrepreneurship

The MIT Portugal Program launched a major new component during the past year to strengthen Portugal's business education, technological innovation, and entrepreneurship; continued to support knowledge transfer in Portuguese institutions; announced a significant new corporate partnership; and began to see concrete results in the career marketplace for its investment in human capital.

The program launched the Innovation and Entrepreneurship Initiative (IEI) in early 2010 as a collaboration among the Instituto Superior de Ciências do Trabalho e da Empresa/Instituto Universitário de Lisboa, the MIT Deshpande Center for Technological Innovation, the MIT Entrepreneurship Center, and MIT's School of Engineering. The IEI program will adapt elements of MIT's entrepreneurial ecosystem to the MIT Portugal Program to expose participants to challenges and opportunities associated with technology commercialization, complementing our education initiatives. IEI has three aims: to create new business ventures from emerging technologies; to support the expansion of the iTeams approach across the MIT Portugal Program, from its current implementation in bioengineering; and to design and implement a series of meetings and events to showcase technological innovations in Portugal.

The inaugural Venture Competition received close to 100 submissions by the June 18, 2010, deadline, distributed across the competition's four tracks: sustainable energy and transportation, life sciences (including medical devices), information technology and the web, and products and services. The breadth of technologies indicates entrepreneurial insight and critical translation of university-researched innovations that are needed to build a knowledge-based economy of products and services.

Five semifinalists per track were chosen on the basis of team and innovation strength, clear path to revenue, international scope, and market opportunity. The 20 semifinalists included three 1 billion euro business opportunities. Seventy percent of the semifinalists submitted projects that resulted from university-developed technologies; 50% were from educational partners of MIT Portugal; and 10% were from FCT-funded collaborations that arose as a consequence of the MIT Portugal Program and the Carnegie Mellon University Portugal Program. Forty-five percent of the semifinalists already have market traction or key development partners.

The program continues to build Portuguese capacity for knowledge transfer, following up on the successful March 2009 workshop on the MIT innovation ecosystem in Lisbon that featured key MIT leaders from the Industrial Liaison Program (ILP), the Technology Licensing Office (TLO), and the Office of Foundation Relations. Over a two-week period in late 2009, two key players at Portuguese universities involved in technology transfer had hands-on internships at MIT to arm them with tools for helping to lead the building of the entrepreneurial ecosystem at their home institutions. Maria Oliveira, director of the Innovation Office at the University of Porto, and Ana Teresa Pinto, director of the University of Aveiro's Technology Transfer Office, were hosted by TLO and spent considerable time with leaders of ILP. They also met with other key MIT entrepreneurial staff from the Venture Mentoring Service, iTeams, and the Leaders for Global Operations program. Thanks to their internships, which developed through MIT's partnership with the University Technology Entrepreneurship Network in Portugal, these two leaders have begun to transform and advance their own offices. Their time at MIT helped them establish a network in Boston to which they can turn for help to keep their efforts in Portugal moving forward.

The program concluded the year with the announcement of a three-year, 360,000 euro research and educational partnership with Continental Mabor, the Portuguese subsidiary of the Continental Group of Germany. The Continental agreement will support the research of three doctoral students within the engineering design and advanced manufacturing area of MIT Portugal, with a Continental researcher on each thesis committee. While the agreement is with the Portuguese subsidiary organization, the Continental Group intends to engage with our students and faculty at a group level, with regular involvement in Portugal of senior executives in charge of European and global operations.

The Continental agreement demonstrates the success of the program in providing value to global companies, which was further reinforced this year when engineering design and advanced manufacturing PhD student Carla Pepe, having completed her internship at Rolls-Royce in England, was offered a full-time position with the company at the end of her doctoral studies in 2011.

Events

On July 29–30, 2009, MIT Portugal Program faculty and researchers offered numerous presentations at *Ciência 2009*, an annual event that highlights achievements in science and technology in Portugal. The event, which was held at the Calouste Gulbenkian Foundation in Lisbon and organized by the Council of Associate Laboratories with the support of FCT, gathered researchers from across the Portuguese scientific community. Several of the scientific panels were organized in collaboration with MIT Portugal—those on stem cells, tissue engineering, and regenerative medicine; electric vehicles and new forms of mobility; new materials for new products; and sustainable energy and transportation systems.

Some 500 graduate students, faculty, and researchers made their way to Lisbon on October 21, 2009, for “Meet MIT: A Student-to-Student Workshop on Entrepreneurship.” This intensive, half-day immersion in technology innovation and entrepreneurship

was designed to serve two purposes: to bring together students from the MIT Portugal Program and MIT to learn about entrepreneurship from invited speakers, faculty, and researchers and to challenge teams of these students to think on their feet and arrive at viable “go-to-market” strategies for various technologies. The event was cosponsored by MIT’s Global Startup Workshop.

From February 1–3, 2010, Melanie Parker, executive director of the MIT Global Education and Career Development Center, visited Lisbon to offer a career development workshop for both students in the master’s program in complex transportation infrastructure systems (CTIS) and students who are MIT Portugal PhD candidates in transportation systems. It was the second such workshop given by Parker and her team in the past two years. Also on hand with their input were several CTIS education affiliates, companies that provide annual tuition scholarships for the course—in this case, Alstom, BRISA, Mota-Engil, Odebrecht, and Siemens. In addition, Parker facilitated two career development sessions with just current CTIS students, aided by a web-based career self-assessment she distributed prior to the sessions.

On February 19, 2010, the program’s bioengineering focus area organized the third annual IdeaSpring Conference at Biocant Park in Cantanhede, Portugal. The event launched MIT Portugal students’ BioTeams and their go-to-market innovation projects and provided an opportunity for information sharing with participants from venture capital firms, companies, and other leaders from Portugal’s innovation ecosystem. Representatives of technology licensing offices participated, as did MIT Portugal students. The event featured a visit to Critical Software, a software company that shared insights on technology transfer and innovation.

On June 18, 2010, MIT Portugal, Biocant Park, and the Centre for Neurosciences and Cell Biology of the University of Coimbra organized the fourth annual Workshop on the Business-Government Interface: Personalized Medicine. This event brought about a high-level exchange of information among MIT Portugal faculty, scientists from Portuguese universities and stem cell laboratories, and government officials.

On June 21, 2010, MIT Portugal and Health Cluster Portugal held a workshop, “Medical Devices in Portugal: Turning Knowledge into Products,” in Guimarães, Portugal. Over 60 people attended, including university faculty and researchers, physicians, hospital administrators, representatives of health regulators and other public institutions, CEOs of health care-related companies, and representatives of the Portuguese Ministry of Health. At the conference, significant media attention was paid to the announcement of the findings of professor Ricardo Simões (an MIT Portugal engineering design and advanced manufacturing participating faculty member), in collaboration with a private hospital, in a test of advanced wireless health monitoring systems. The conference participants looked ahead to the potential for Portugal to design and manufacture a greater share of its own medical devices.

Other Developments

The first MIT Portugal Program MITEI postdoctoral fellow, Dr. Christos Ioakemidis of IST–Technical University of Lisbon, arrived in early 2010 to begin a one-year residency

at MIT, thus solidifying Portugal's status as the sole sustaining public member of MITEI through FCT.

Dr. Sebastian Pfotenhauer, who was supported by MIT Portugal during his Technology and Policy Program (TPP) master's studies at MIT, graduated from TPP in June 2010 and presented his thesis, "Integrative University Collaborations as an Innovation Strategy for Catching-Up Countries: A Case Study of the MIT Portugal Program." Dr. Pfotenhauer's thesis builds on his survey of views regarding the internationalization of Portuguese institutions and research networks, which was distributed to all MIT Portugal students and to hundreds of nonprogram graduate students in technology in Portugal, and on personal interviews with 20 faculty from within and outside the program. The main sponsor of MIT Portugal, secretary of state Manuel Heitor, has requested that Dr. Pfotenhauer make available an executive summary and proposed recommendations as to the future of this and other Portuguese international collaboration programs. Dr. Pfotenhauer's work has also received awards at national technology policy conferences and was published in the *Chronicle of Higher Education*.

Personnel

The MIT Portugal focus areas are co-led by MIT faculty and faculty from the eight Portuguese institutions of higher learning that make up the program's research and higher education consortia. The faculty leads from MIT in AY2010 were as follows: bioengineering systems, professor Dava Newman (aeronautical and astronautical engineering and engineering systems) and professor Bruce Tidor (biological engineering and computer science); engineering design and advanced manufacturing, professor Christopher L. Magee (mechanical engineering and engineering systems) and professor Joel P. Clark (materials systems and engineering systems); sustainable energy systems, professor David Hunter Marks (civil engineering and engineering systems) and professor John Fernández (architecture and engineering systems); and transportation systems, professor P. Christopher Zegras (urban studies and planning and engineering systems).

Looking Ahead

The past year has seen strong support of the program by the most senior leaders at MIT and in the Portuguese government as well as the country's universities and companies. The program's leaders look forward to a second program phase that is expected to be announced in the coming months.

Daniel Roos

Director

Japan Steel Industry Professor of Engineering Systems and Civil and Environmental Engineering

More information about the MIT Portugal Program can be found at <http://www.mitportugal.org/>.