

Singapore–MIT Alliance

The Singapore–MIT Alliance (SMA) is a global partnership in graduate education between MIT, the National University of Singapore (NUS), and Nanyang Technological University (NTU). The goals and aims of SMA are threefold:

- To set a new standard for international collaboration in graduate research and education
- To invigorate engineering education in Singapore
- To strengthen MIT through the extension of its global impact, the enhancement of its curriculum, and the improvement of its infrastructure

Partnership

SMA was initiated on January 1, 1999, with the first two of its five programs, Advanced Materials for Micro- and Nano-Systems (AMM&NS) and High Performance Computation for Engineered Systems (HPCES), beginning on July 1, 1999. A third program, Innovation in Manufacturing Systems and Technology, was introduced the following July, and the last two programs, Molecular Engineering of Biological and Chemical Systems and Computer Science, got under way on July 1, 2001.

The academic calendar, course content, and grading method of SMA follow MIT practice and standards to a large extent. Degrees are conferred by the host university (NUS or NTU), along with an MIT cosponsored SMA certificate confirming completion of the program of study.

Each program has a minimum of six SMA faculty fellows from MIT and an equivalent number from either NUS or NTU. Programs also have SMA associates who assist the fellows by giving several lectures each year. In AY2004, 46 MIT faculty participated in SMA.

Subjects are taught primarily by distance education. However, MIT faculty fellows also spend several weeks a year in Singapore, and some faculty have spent (or will spend) eight weeks to an entire semester engaging in face-to-face lectures, discussion, and research collaboration in Singapore.

SMA students spend three weeks at MIT during their matriculation; doctoral students will spend an additional full semester in residence at MIT. In addition, an annual symposium is held in Singapore to evaluate progress and to enable students and faculty to interact with industry.

Research comprises an important aspect of the research master's and doctorate degrees in all five programs. As part of the curriculum, through industry-sponsored research projects, students have the opportunity to work with some of the most technologically

advanced companies in the world . An MIT and a Singaporean faculty member jointly supervise research students' theses.

Management Structure

SMA is governed at three levels. At the top tier is the Governing Board, which comprises academic, government, and industrial leaders in Singapore and members of the faculty and administration at MIT. At the next level down is the Joint Academic Committee, which comprises administration and faculty from both MIT and Singapore. Finally, the individual academic programs are codirected by program chairs, one apiece from MIT and Singapore.

Administratively, SMA is managed by two codirectors and two deputy directors. On the MIT side, Professor Anthony T. Patera serves as director of the MIT Center for the Singapore–MIT Alliance, and Professor Steven R. Lerman serves as deputy director.

Summer Conference

As part of SMA, students spend three weeks at MIT for a summer conference, which is designed to help Singaporean students become immersed in the MIT environment and the SMA program. There are two components to the summer conference: Pre-Immersion and Immersion. The Pre-Immersion component consists of discussions with entrepreneurs in their respective fields, while the Immersion program includes English-language workshops, lectures, and lab sessions taught by MIT faculty, interactions with MIT graduate students, and social gatherings and activities.

Distance Learning

MIT's Academic Media Production Services (AMPS), under the direction of assistant provost Vijay Kumar, has assumed responsibility for the technology and operation of the distance learning aspects of SMA. SMA staff works closely with AMPS staff in selecting modes of operation and necessary equipment through a joint SMA Distance Education Working Group. This group assisted with recommending the distance learning equipment that is currently used in rooms 1-390, 3-370, 8-404, and in the three SMA research interaction rooms.

Entering Class

A total of 951 applications were received for the three programs operating in AY2005. To date, 146 offers have been made and 93 applicants have accepted the offers. Of these, 15% were from Singapore, 38% from China, 21% from India, and the remainder were from other Southeast Asian countries.

Graduate Record Examination (GRE) scores were waived for students from top schools in Singapore. However, those student scores obtained compare favorably with the scores of students being admitted to graduate programs in MIT's departments of Chemical Engineering and Mechanical Engineering and to the Leaders for Manufacturing Program. Both GRE and Test of English as a Foreign Language scores for the Class of 2004 are comparable to last year's SMA class.

The targeted number of students enrolled in each program is 50; approximately 35 professional master's students enrolled in a one-year (12-month) course of study, with the remainder enrolled in research master's or doctorate tracks.

Noteworthy Events in 2003

This year marks the successful conclusion of the first two SMA master's programs, Advanced Materials for Micro- and Nano-Systems and High Performance Computation for Engineered Systems.

SMA is moving forward to the launch of the second phase of SMA, dubbed "SMA-2," later this year. In response to a request for proposal, nine MIT and Singapore teams submitted proposals for participation in SMA-2. SMA-2 will allow for students to obtain a dual (not joint) degree—a master's degree from MIT and a master's degree from either NTU or NUS.

SMA continues to embark on a number of important outreach programs. Specifically, the 2004 Symposium in Singapore was attended by dignitaries such as US ambassador to Singapore Frank Lavin, Provost Brown, Dean Magnanti, and Singapore's acting minister for education, Shanmugaratnam Tharman.

Professor Robert Langer kicked off the SMA/ILP seminar series in the fall of 2003, which was followed by a spring seminar given by Professor Peter Donaldson. These outreach activities serve to share our distance education facilities and capabilities with other departments at MIT, NUS, and NTU.

In July of 2004, 127 SMA students will receive their master's degrees and 5 students will receive their PhD degree.

SMA students and alums continue to receive international recognition. This year AMM&NS PhD student Shirley Meng won a Silver Graduate Student Research Award at the Materials Research Society fall meeting, and HPCES PhD student Karthik NATARAJA received an honorable mention in the George Nicholson Student Paper Competition organized by the Institute for Operations Research and Management Sciences.

Innovation in Manufacturing Systems and Technology

Degree programs in Innovation in Manufacturing Systems and Technology (IMST) include the SM, the MEng, and the PhD. IMST offers highly competitive courses of study that explore the many facets of manufacturing technology. Challenging coursework integrates the process, product, system, and business aspects of this vibrant industry, while focusing on the core of manufacturing systems. Advanced coursework will expose students to innovative theories and methodology, as well as a rigorous investigation of financial, strategic, and global aspects of technology innovation and new business generation.

The SM, MEng, and PhD degree programs all include a core curriculum; the SM degree includes a theme project; the MEng degree includes a master's-level research thesis; the PhD degree includes additional subjects on advanced topics in each of the fundamental areas.

The SM degree program is aimed at practitioners who will use this knowledge to become leaders in existing as well as emerging manufacturing companies. The MEng and PhD degree programs will prepare students for careers in industrial research and development centers, research institutes, or academic departments interested in fundamental research in manufacturing.

The MIT program chair of the IMST program is David E. Hardt. Faculty members involved include Lallit Anand, Duane Boning, Jung-Hoon Chun, Stanley Gershwin, Stephen Graves, and Kamal Youcef-Toumi as faculty fellows, with Jeremie Gallien and David Simchi-Levi as associates.

Molecular Engineering of Biological and Chemical Systems

The Molecular Engineering of Biological and Chemical Systems (MEBCS) program offers two innovative courses of study (SM and PhD) that integrate a molecular understanding of biological and chemical phenomena with advances in process engineering for the life sciences and fine chemical industries. Through a combination of cutting edge research and advanced coursework in molecular engineering sciences, graduates are poised to accept high-level professional or research positions in thriving industries, new start-up companies, academic institutions, and research centers.

The professional master's (SM) degree program prepares graduates for the shaping and solving of complex problems, resource management, teamwork, and leadership. The PhD program prepares graduates for advanced careers in industrial research and development centers, research institutes, or academic departments interested in biological and chemical engineering processes with emphasis on synthesis skills, engineering design, and interdisciplinary approaches.

The SMA program in MEBCS provides a unique and bold educational opportunity for graduate students interested in pursuing careers at the frontiers of life science and fine chemical technologies. Students attending this program have ample opportunity to work with some of the most technologically advanced companies in the world through specific industry projects. The MEBCS program is designed to prepare future leaders for positions in knowledge-driven industries poised for global economic growth in the new millennium.

The MIT program chair of MEBCS is Gregory N. Stephanopoulos. MIT faculty members Robert A. Brown (program advisor), Alan T. Hatton, Paul E. Laibinis, Harvey F. Lodish, Kenneth A. Smith, Daniel I.C. Wang, and Jackie Y. Ying are SMA faculty fellows, while faculty members Subra Suresh and Bernhardt Trout are associates.

Computer Science

The SMA program in Computer Science provides a unique educational experience for graduate students interested in careers in industry and research establishments. The students are exposed to the broad foundations of computer science, encompassing computer architecture, software systems, algorithms, and advanced applications.

The SM in Computer Science is a one-year professional degree program based on coursework that prepares graduates for careers in the development of advanced computer systems. It is aimed at training students to apply their knowledge of computer science to industrial problems, particularly in the development of large software systems and embedded computing. The PhD degree program in Computer Science is a research program that provides the necessary depth to equip graduates for careers in industrial research and development centers, research institutes, or academic departments interested in cutting-edge research in all aspects of computer science.

The MIT program chair of Computer Science is Charles Leiserson. Faculty members Alan Edelman, Leslie Kaelbling, Stuart Madnick, Tomas Lozano-Perez, Martin Rinard are faculty fellows, as is research scientist Larry Rudolph; Fredo Durand and Jeremie Gallien are associates.

Benefits and Goals

Singapore's goals for SMA include invigorating its engineering education, enhancing creativity and entrepreneurship in its educational system, and attracting talented young people to Singapore.

On the MIT side, an important benefit is that this highly focused, well-funded alliance gives us the opportunity to broaden our role as a global university, to define our own style of contact-intensive distance education, and to learn how to bring this global interaction to Cambridge to enhance the undergraduate and graduate education of our own students.

We anticipate strengthened departmental curricula as a result of the SMA-funded course and subject development. We also anticipate enhanced interdepartmental and interschool collaborations as a result of both SMA curriculum development and SMA-funded research projects. In fact, since the inception of SMA, 29 SMA courses—or 70 percent of the total number of the SMA classes offered—have been cross-listed at MIT. To date, approximately 2,200 MIT students have received credit for taking these cross-listed classes. SMA continues to find ways to enhance teaching and research at MIT and at the two universities in Singapore.

Anthony T. Patera
Director
School of Engineering Professor of Teaching Innovation
Professor of Mechanical Engineering

More information about the Singapore–MIT Alliance can be found on the web at <http://web.mit.edu/sma/>.