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The engineering leaders of the 21st century need to work seamlessly across borders to address pressing and complex global challenges. By enhancing the diverse perspectives within our classrooms and research labs, and strengthening opportunities for our students to think creatively and to study and work around the world, we enable them to better understand their role as catalysts for global change.

Our Centre for Global Engineering (CGEN) is a microcosm of this approach. CGEN's courses, at both the undergraduate and graduate levels, expose students to leading-edge ideas and experts who provide global perspectives. It also offers cross-disciplinary certificates and fellowship programs that support research in sanitation, alternative energy, health care and clean water. In each of these areas, U of T Engineering solutions are specifically designed to meet the unique needs of the local communities in which they will be deployed.

Our robust co-curricular programs provide undergraduate and graduate students with a range of opportunities to develop their cross-cultural fluency. These include international exchanges with partner institutions and Professional Experience Year (PEY) internships with employers around the world. In 2016–2017, nearly one in 10 PEY participants undertook an international placement.

We further strengthen our reputation as a global leader in engineering innovation through research and educational collaborations with partner organizations worldwide. These include companies such as Apple, Intel and General Electric as well as academic partners, including Tianjin University and Shanghai Jiao Tong University. Through all of these initiatives, we are ensuring that the next generation of engineering innovators and entrepreneurs is prepared to lead in the global marketplace.

International Students and Exchanges

The strength and breadth of our programming and outstanding international reputation for excellence in research and teaching continue to attract top students from around the world. In 2016–2017, international student applications rose 10.8%, and international students made up 28% of our overall undergraduate population, up from 11.3% a decade ago. The proportion of international graduate students also increased from 17.4% to 33.7% over the same period.

Through strategic partnerships and initiatives, we provide international students with the opportunity to study at U of T Engineering, including:

- **International Foundations Program (IFP)** – IFP enables academically strong students who do not meet the University’s minimum English proficiency requirements to receive conditional offers of admission as non-degree students. After completing an intensive, eight-month English-language program as well as Engineering Strategies and Practice, these students continue in their second year into a Core 8 engineering program. Fourteen students joined our Faculty through this program in 2016–2017.
- **MasterCard Foundation Scholars Program** – Funded by the MasterCard Foundation, this program provides talented young people from economically disadvantaged communities, primarily in sub-Saharan Africa, with access to quality and relevant education. Eight MasterCard Foundation Scholars joined the entering class at U of T Engineering in 2016–2017, bringing the total number of recipients of these scholarships studying at the Faculty to 23.
- **U of T Engineering International Scholar Award** – Established in 2014, this award supports academically accomplished international undergraduate students with demonstrated leadership involvement.
- **Lester B. Pearson International Scholarship** – Established in 2017, this four-year undergraduate scholarship recognizes exceptional academic achievement, creativity, leadership potential and community involvement.

U of T Engineering also offers numerous opportunities for our students to gain international experience, through such initiatives as:

- **Professional Experience Year (PEY) Internship** – PEY places second- and third-year students in 12- to 16-month professional paid internships with employers in Canada and abroad. In 2016–2017, our students undertook 65 international placements — 49 U.S. placements, 16 other international placements. *(For more information on PEY, see Chapter 4: Cross-Faculty Education & Experiential Learning.)*
- **Summer Research Abroad, Structured Exchange Pathways and other exchange programs** – These

programs are administered by U of T’s Centre for International Experience or coordinated by the Faculty, and enable students to conduct research internships or pursue academic courses at partner institutions abroad. In summer 2017, 71 students participated in these exchange programs.

- **Global Educational Exchange (Globex)** – Hosted each summer by Peking University, Globex brings together students and faculty from engineering schools around the world for a three-week program. The Department of Mechanical & Industrial Engineering became the first Canadian partner in 2012, and four MIE students participated in summer 2016.

International Agreements

International agreements create academic pathways and partnerships that enhance our engagement with peer institutions around the world. Through these relationships, our students gain unique opportunities to increase their global fluency through summer research exchanges and cross-cultural engineering design projects, and by sharing classes with students from partner universities. International agreements also formalize and strengthen collaboration between our faculty members and researchers around the world. As of June 2017, our Faculty had more than 25 active international agreements, with access to other top institutions through University-wide partnerships.

In 2016–2017, U of T Engineering entered into new agreements on academic and research exchanges and student mobility with the following peer institutions:

- University of Brescia (Italy)
- King Mongkut’s University of Technology Thonburi (Thailand)

In addition, UTIAS signed an implementation memorandum of agreement with Shanghai Jiao Tong University for a joint placement PhD program, and MIE established a dual degree program with South China University of Technology’s School of Mechanical & Automotive Engineering (SMAE). This allows outstanding third-year SMAE students to apply to complete their fourth year of undergraduate study as Visiting International Non-degree Students and receive conditional offers of admission to the MEng program in their fifth year.

We also engaged with U of T’s Office of the Vice-President, International, U of T’s School of Graduate Studies and the National University of Singapore (NUS) to develop an International Doctoral Cluster in the area of cybersecurity. Expected to be finalized later in 2017, this will enable faculty from U of T and NUS to co-supervise doctoral students.

Data and highlights in this chapter are presented by academic year (September to August).

Selected International Education and Research Partnerships

ChemE PhD candidate finds breath of fresh air in the Netherlands

To learn more about air pollution in Canada, Kerolyn Shairsingh (ChemE PhD candidate) travelled to the Netherlands in fall 2016. Her exchange at Utrecht University is part of a three-way international research collaboration between the University of Toronto, Utrecht University and the Chinese University of Hong Kong that represents U of T's first-ever tripartite research collaboration. Shairsingh's PhD research is part of the Canadian Urban Environmental Health Research Consortium, which is working to explain the complex relationships between disease and exposure to pollution. Shairsingh's project involves quantifying the amount and type of pollution people are exposed to based on where they live. She develops air pollution concentration maps with Professors Jeffrey Brook (ChemE) and Greg Evans (ChemE) in U of T's Southern Ontario Centre for Atmospheric Aerosol Research, taking models designed to help predict pollutant exposure in specific urban areas and making them transferrable to other areas.

U of T Engineering projects receive Connaught Global Challenge Award funding

Three U of T Engineering teams that are working to resolve globally pressing issues are sharing \$750,000 in funding from the recently relaunched Connaught Global Challenge Award. The internal award, funded by the Connaught Fund, is designed to support new collaborations involving leading U of T researchers and students from multiple disciplines, along with innovators and thought leaders from other sectors. Recipients include:

- **Information Technology, Transparency, and Transformation (IT3) Lab** led by Professor David Lie (ECE); includes U of T researchers from the Faculty of Law and Rotman School of Management, as well as collaborators from Princeton University, Harvard University, Tel Aviv University, Google and the Office of the Privacy Commissioner of Canada;

- **Network for Engineering Education for Sustainable African Cities (NEESAC)** led by Professor Brent Sleep (CivE); includes: U of T researchers from the Ontario Institute for Studies in Education (OISE), Faculty of Arts & Science and the Daniels Faculty of Architecture, Landscape and Design, as well as collaborators from the University of Victoria, University of Ontario Institute of Technology, and a number of African institutions;
- **Urban Genome Project** led by Mark Fox (MIE), U of T's Distinguished Professor of Urban Systems Engineering; includes U of T researchers from the Rotman School of Management, Daniels Faculty of Architecture, Landscape and Design, Faculty of Arts & Science and the University of Toronto Scarborough.

Indo-Canadian partnerships advance research into safer, more sustainable buildings

Two new collaborations between researchers at U of T Engineering and the Indian Institute of Technology Bombay (IIT Bombay) aim to improve the safety, resilience and sustainability of buildings in both countries. The India-Canada Initiative for Resilient Global Urban Shelter is a partnership between Professor Constantin Christopoulos (CivE) and Professor Ravi Sinha (IIT Bombay) that focuses on low-cost seismic isolation platforms to help buildings withstand earthquakes. Smart Sensor Deployment in Buildings: Evacuation Planning and Energy Management is a project led jointly by Professor Mark Fox (MIE) and Professor Krithi Ramamritham (IIT Bombay) that leverages a network of sensors within buildings to optimize energy use and emergency evacuation plans. Both projects received funding from IC-IMPACTS, a Canadian Network Centre of Excellence that brings communities together with academia, industry and government to develop solutions to key challenges in both India and Canada. These projects reflect the goals of India's Smart Cities Mission, a major urban renewal and retrofitting program taking place in more than 100 cities across the subcontinent.

U of T Engineering professor leads international team studying how physical stress turns on genes in stem cells

A new international collaboration led by Professor Penney Gilbert (IBBME) is studying how muscle stem cells turn genes on and off in response to physical stresses that arise in response to tissue injury. Funded by a \$1.4-million grant from the Human Frontier Science Program (HFSP), it brings together Gilbert's expertise in muscle stem cells with advanced methods in biophysics from Professor Timo Betz at the University of Münster, as well as molecular imaging techniques developed by Professor Xavier Darzacq at the University of California, Berkeley. Together the team will comprehensively examine the ways in which muscle stem cells transmit the physical stresses they experience into changes in their DNA and gene expression. The results of the study could provide scientists with new, non-chemical strategies for turning genes on and off, not only in muscle stem cells, but other cell types as well. This in turn could help treat genetic diseases or other conditions caused when genes fail to turn on or off in the right place or the right time.

Professor Christopher Yip to head international partnerships at U of T

Professor Christopher Yip (IBBME), a leading researcher in the field of single-molecule biophysics, has been appointed the University of Toronto's first associate vice-president, international partnerships. He started a five-year term on July 1, 2017 and aims to foster international academic and industry collaborations. Yip brings years of leadership experience within U of T Engineering's Institute of Biomaterials and Biomedical Engineering (IBBME), which includes faculty members from engineering, medicine and dentistry who look for innovative solutions to pressing problems at the intersection of health care and engineering. In recent years, Yip's lab has hosted students from Singapore and Cuba, and sent U of T students to Asia and Europe. He also facilitated a partnership with the U.S. Department of Energy, which led two of his grad students to study at the Sandia National Laboratories in Albuquerque, NM.

Huawei and U of T strengthen strategic partnership

The University of Toronto and multinational telecommunications giant Huawei signed a bilateral research partnership agreement that will see Huawei commit \$3 million to a wide range of projects, in fields from computer hardware and software to bioengineering and materials. The agreement is the product of a longstanding and productive relationship between Huawei and The Edward S. Rogers Sr. Department of Electrical & Computer Engineering, which has now grown to include 19 faculty members in several U of T Engineering departments, as well as the Department of Computer Science. Huawei is active in 170 countries and employs more than 79,000 researchers in 16 R&D centres around the world. The company has also hosted U of T Engineering undergraduate students as part of its Seeds for the Future work experience program, which invites undergraduate students from across the country to enhance their technical expertise and learn about Chinese language and culture during a two-week exchange to Beijing and Shenzhen.

Havelaar EV investment launches new era in electric vehicle research at U of T

In 2016, Havelaar EV signed a five-year, \$10-million partnership agreement with U of T Engineering to establish the U of T Havelaar Electric Vehicle Research Centre (UTHEV). The agreement includes \$7.5 million in collaborative research project funding and \$2.5 million in seed funding for lab space, equipment and administrative needs. UTHEV represents one of the largest industry collaborations undertaken by the Faculty and is led by Professors Olivier Trescases and Peter Lehn (both ECE), with multidisciplinary collaborations with professors from MIE and UTIAS. Research activities will advance power electronics for EV drivetrains, charging infrastructure and energy storage.