

2019

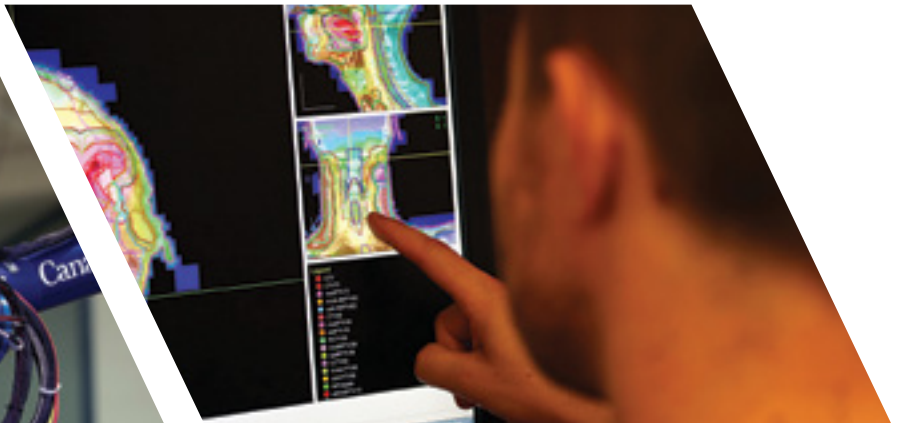


UNIVERSITY OF
TORONTO

Engineering

ANNUAL REPORT

PERFORMANCE INDICATORS



We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

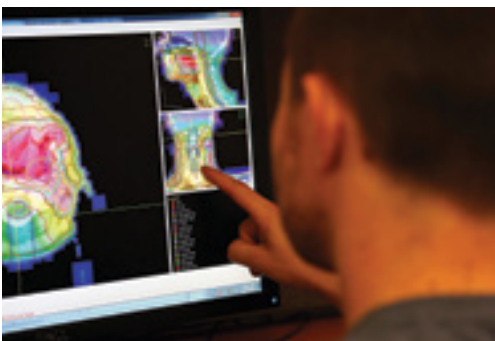
Pictured on the front cover:



Engineering Science student **Sebastien Gajewski** (left) spent more than a year working with experienced engineering staff such as alumna **Lauren Haensel** (right) at MacDonald, Dettwiler and Associates (MDA) after his third year. The placement was one of more than 850 facilitated through the Professional Experience Year Co-op Program, which celebrated its 40th anniversary in 2018–2019. See Chapter 4 for more about the PEY Co-op Program. (Credit: Laura Pedersen)



(Left to right) U of T students **Temisan Iwere**, **Kyra Stephen** and **Ayan Gedleh** (Year 4 IndE) – executives in the U of T chapter of the National Society for Black Engineers – organized the first university student-run Black hackathon in the GTA, held in the Myhal Centre in January 2019. For more on this initiative, see Chapter 10. (Credit: Geoffrey Vendeville)



An AI-enabled tool developed by Professor **Timothy Chan** (MIE) and PhD candidate **Aaron Babier** develops treatment plans for radiation therapy in a fraction of the time required by traditional methods. Chan directs the new Centre for Analytics and Artificial Intelligence Engineering (CARTE). For more on CARTE, see Chapter 3. (Credit: Brian Tran)



A Celebration of Leadership, held in the Myhal Centre on June 26, 2019, honoured the legacy of **Dean Cristina Amon**, the Faculty's longest serving dean in the past half century. Under her guidance, U of T Engineering has risen to preeminence as Canada's top engineering school and among the world's best across all international rankings.

U of T Engineering by the Numbers

2018-2019



146

years since the Faculty was established in 1873

7

degrees offered, including 2 undergraduate and 5 graduate degrees

25+

multidisciplinary research centres

19

buildings make up the Faculty's footprint, including the new Myhal Centre for Engineering Innovation & Entrepreneurship

U of T Engineering Community

5,235

undergraduate students (ch.1)

2,498

graduate students (ch.2)

266

faculty (p.5)

345

administrative and technical staff (p.5)

50,000+

alumni worldwide (ch.7)

100+

countries our students and faculty call home (ch.1)

Research & Innovation

120

chairs and professorships (ch.3)

400+

industrial research partners worldwide (ch.3)

\$36M

in Tri-Agency funding (ch.3)

8

NSERC CREATE grants (ch.3)

150+

spinoff companies since 1976 (appendix F)

34

new projects awarded through Dean's Strategic Fund (ch.11)

Transdisciplinary and Experiential Education

9

undergraduate programs and 8 Engineering Science majors (ch.1)

21

undergraduate minors and certificates (ch.4)

30+

professional competencies courses delivered by ISTEP (ch.4)

10+

MEng emphases (ch.2)

13,272

applicants to undergraduate studies (ch.1)

1,062

undergraduates in first year (ch.1)

40%

women in first year of undergraduate studies (ch.1)

93.6%

mean entering average of incoming Ontario students (ch.1)

160+

partner universities offering study-abroad opportunities (ch.9)

90+

student-run engineering clubs and teams (appendix D)

360+

companies hired 853 undergraduate students through the Professional Experience Year Co-op Program (ch.4)

Faculty Leadership, 2018–2019

Dean

Cristina Amon
Christopher Yip (as of July 1, 2019)

Vice-Dean, Graduate Studies

Julie Audet

Vice-Dean, Undergraduate

Thomas Coyle

Vice-Dean, Research

Ramin Farnood

Associate Dean, Cross-Disciplinary Programs

Bryan Karney

Vice-Dean, First Year

Micah Stickel

**Director, University of Toronto
Institute for Aerospace Studies**

Christopher Damaren

**Director, Institute of Biomaterials
& Biomedical Engineering**

Warren Chan

**Chair, Department of Chemical Engineering
& Applied Chemistry**

Grant Allen

Chair, Department of Civil & Mineral Engineering

Brent Sleep
Heather MacLean (acting) (January 1, 2019
to June 30, 2019)

**Chair, The Edward S. Rogers Sr. Department of
Electrical & Computer Engineering**

Farid Najm
Deepa Kundur (as of July 1, 2019)

Chair, Division of Engineering Science

Deepa Kundur
Will Cluett (interim) (as of July 1, 2019)

**Chair, Department of Materials
Science & Engineering**

Jun Nogami
Glen Hibbard (as of July 1, 2019)

**Chair, Department of Mechanical
& Industrial Engineering**

Markus Bussmann

**Director, Institute for Studies in Transdisciplinary
Engineering Education & Practice**

Greg Evans (interim)

Assistant Dean, Administration

Lisa Camilleri

**Assistant Dean and Director of Diversity,
Inclusion and Professionalism**

Marisa Sterling (as of May 21, 2019)

Chief Financial Officer

Brian Coates

Executive Director, Communications

Catherine Riddell
Marit Mitchell (as of December 1, 2018)

Executive Director, Advancement

Georgette Zinaty (as of October 15, 2018)

Director, Facilities and Infrastructure Planning

Tom Saint-Ivany

Director, Office of the Dean

Emily Meyertholen
Sandy Walker (interim) (September 17, 2018
to November 25, 2018)
Cathy Grilo (as of November 26, 2018)

Faculty Registrar

Don MacMillan

Note: To view the full organizational chart, please visit: www.uoft.me/FASEleadership.

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Message from the Dean



I am pleased to present our 2019 Annual Report of Performance Indicators, highlighting our achievements and initiatives over the 2018–2019 academic year.

In my final year as dean of this remarkable Faculty, it is a privilege to reflect on all we have accomplished together. From major infrastructure investments — including the Myhal Centre for Engineering Innovation & Entrepreneurship — to our expanded suite of research institutes and educational programs, we have strengthened our commitment to preparing the next generation of global engineering leaders. I am proud of the strong and vibrant community we have built, which underpins our position as Canada’s top engineering school and among the world’s best.

U of T Engineering innovations address global challenges and produce entirely new technologies, industries and business paradigms. Innovation and collaboration are at the heart of our approach, facilitated by 29 multidisciplinary centres and institutes — from our recently relaunched Robotics Institute to our new Centre for Analytics and Artificial Intelligence Engineering. We have increased our direct industry support and expanded our network of external partners to include more than 400 companies and organizations worldwide. Through thriving spinoffs, over 70 of which have been founded since 2006, we translate our inventions from the lab to the marketplace. We inspire unparalleled support from our alumni and friends: our recently completed Boundless campaign raised \$246 million over seven years, surpassing our goal by nearly 25%.

Perhaps most importantly, over these past 13 years we have graduated nearly 20,000 engineering leaders who are bringing positive change to sectors from sustainable energy to robotics. Our students customize their degrees and expand their knowledge through 21 minors and certificates and nine Engineering Science Majors. This year, 62% of our graduating class completed at least one minor or certificate, including our newest in Artificial Intelligence Engineering. Over the last decade, we have more than doubled graduate student enrolment, reaching nearly 2,500 and increasing the impact of our world-leading research.

In addition to rigorous technical foundations, we provide boundless opportunities for students to expand their horizons and develop engineering competencies such as leadership, entrepreneurship and global fluency. The Troost Institute for Leadership Education in Engineering, our startup accelerators The Entrepreneurship Hatchery and Start@UTIAS, and our Centre for Global Engineering are among the programs we have introduced in the past decade. Our Institute for Studies in Transdisciplinary Engineering Education and Practice, created in July 2018, consolidates and expands this approach, strengthening our position as an innovator in engineering education. This year, our flagship Professional Experience Year Co-op Program celebrated its 40th anniversary and the largest-ever cohort of 853 engineering students, one in ten of whom worked outside of Canada. Additional opportunities for international experience include research exchanges and collaborative capstone projects with partner universities around the world.

Many of these institutes are now located in the Myhal Centre, and 2018–2019 marks our first full academic year with its flexible, dynamic spaces at the heart of our Skule™ community. The building embodies our commitment to excellence in engineering education, active learning, groundbreaking multidisciplinary research and entrepreneurship. I look forward to witnessing the breakthroughs, startups and innovations it will spark in the years to come.

Diversity deepens the engineering process, enhances creativity and ensures new technologies and processes are designed with inclusion in mind. Our Faculty is committed to fostering an environment in which each member of our community can excel. For the last three years, our incoming first-year undergraduate class has included 40% women — and we are on track to exceed 42% for September 2019. One in four of our undergraduate students and one in three graduate students come from outside of Canada. The number of women professors has almost tripled since 2005–2006, from 21 to 57, and our faculty, staff and students come from more than 100 countries around the world. With inclusion as a core value, we will build on this success to strengthen the connections between our Faculty and other historically underrepresented groups, including Black and Indigenous students.

For the past 13 years, I have had the tremendous honour to collaborate and work alongside you in pursuit of our collective goals. I am grateful for the contributions you have made, and I hope you share my immense pride in our many accomplishments. As I look to the future, I truly believe that the spirit of excellence that has driven our Faculty for nearly 150 years is stronger than ever. Our stellar talent and state-of-the-art resources, along with the vision and dedication of incoming Dean Christopher Yip, position us to achieve even greater heights. Together, we will continue to play a leading role in building a bright future for all.



Cristina Amon, Dean

Comparison of U of T Engineering with Ontario and Canada, 2017–2018

The table below compares U of T Engineering metrics against those of engineering Faculties in Ontario and across Canada for 2017–2018. (Due to recent changes in data gathering at Engineers Canada, this is the most recent year for which complete data is available.) Within Canada, we awarded 7.3% of all undergraduate engineering degrees, 10.0% of all engineering master’s degrees and 10.7% of all engineering doctoral degrees.

Our internationally renowned scholars received the single largest proportion of major awards (21.3%) and Natural Sciences and Engineering Research Council (NSERC) engineering funding (10.0%) in 2017–2018, despite comprising only 6.2% of Canada’s tenured and tenure-stream engineering professors.

| | U of T Engineering | Ontario | U of T % of Ontario | Canada | U of T % of Canada |
|---------------------------------------|-----------------------|----------|---------------------------|----------|--------------------------|
| Undergraduate | | | | | |
| Enrolment (FTE) | 4,553 | 36,521 | 12.5% | 81,172 | 5.6% |
| % Women | 32.0% | 22.7% | | 23.9% | |
| Degrees Awarded | 1,116 | 7,127 | 15.7% | 15,283 | 7.3% |
| % Women | 25.1% | 21.4% | | 20.6% | |
| Master's (MEng, MAsC and MHSc) | | | | | |
| Enrolment (FTE) | 1,246 | 7,319 | 17.0% | 16,926 | 7.4% |
| Degrees Awarded | 676 | 3,494 | 19.3% | 6,781 | 10.0% |
| % Women | 25.6% | 25.0% | | 25.4% | |
| Doctoral (PhD) | | | | | |
| Enrolment (FTE) | 840 | 3,718 | 22.6% | 10,576 | 7.9% |
| Degrees Awarded | 178 | 796 | 22.4% | 1,660 | 10.7% |
| % Women | 26.4% | 23.0% | | 23.4% | |
| Faculty | | | | | |
| Tenured and Tenure-Stream | 234 | 1,593 | 14.7% | 3,760 | 6.2% |
| % Women | 20.1% | 15.5% | | 14.8% | |
| Major Awards | | | | | |
| Major Awards Received | 16 | 33 | 48.5% | 75 | 21.3% |
| Research Funding | | | | | |
| NSERC Funding for Engineering | \$32.3M | \$136.4M | 23.7% | \$321.4M | 10.0% |

Note: Unlike data contained in the rest of this report, enrolment (Full-time Equivalent, or FTE) and degrees awarded are based on the 2017 calendar year. Faculty data is current as of November 2017. NSERC research funding is based on the 2017–2018 grant year (April to March).

Comparison of U of T Engineering with St. George Campus and University of Toronto, 2018–2019

The following chart compares U of T Engineering with the University of Toronto based on key metrics for 2018–2019. Since our activities are concentrated on the St. George campus, we also present our relative metrics where available.

| | U of T Engineering | St. George Campus | Engineering % of Campus | University of Toronto | Engineering % of U of T |
|---------------------------------------|-----------------------|----------------------|----------------------------|--------------------------|----------------------------|
| Student Enrolment | | | | | |
| Undergraduate | 5,235 | 38,229 | 13.7% | 66,410 | 7.9% |
| Professional Master's (MEng and MHSc) | 911 | 8,568 | 10.6% | 9,189 | 9.9% |
| Research Master's (MAsc) | 676 | 3,099 | 21.8% | 3,249 | 20.8% |
| Doctoral (PhD) | 911 | 6,194 | 14.7% | 6,560 | 13.9% |
| All Students | 7,733 | 56,090 | 13.8% | 85,408 | 9.1% |
| Degrees Awarded | | | | | |
| Undergraduate | 1,100 | 8,353 | 13.2% | 13,098 | 8.4% |
| Professional Master's (MEng and MHSc) | 484 | 3,911 | 12.4% | 4,276 | 11.3% |
| Research Master's (MAsc) | 229 | 1,377 | 16.6% | 1,450 | 15.8% |
| Doctoral (PhD) | 167 | 863 | 19.4% | 905 | 18.5% |
| Total Degrees | 1,980 | 14,504 | 13.7% | 19,729 | 10.0% |
| Faculty and Staff | | | | | |
| Professoriate | 266 | | | 3,137 | 8.5% |
| Administrative and Technical Staff | 345 | | | 7,353 | 4.7% |
| Research Funding | | | | | |
| Sponsored Research Funding | \$80.3M | | | \$459.3M | 17.5% |
| Industry Research Funding | \$12.7M | | | \$26.2M | 48.6% |
| Space | | | | | |
| Space (NASMs) | 70,330 | 645,643 | 10.9% | 857,665 | 8.2% |
| Revenue | | | | | |
| University-wide Costs | \$75.7M | | | \$594.1M | 12.7% |
| Total Operating Revenue | \$225.6M | | | \$2,278.7M | 9.9% |

Note: Student enrolment is shown as of November 1. Degrees awarded are based on the 2018–2019 academic year. Professoriate includes tenured, tenure-stream and teaching-stream faculty members. Administrative and technical staff includes full- and part-time staff. Research funding is based on the 2017–2018 grant year (April to March). Space is measured in Net Assignable Square Metres (NASMs). Revenue is based on the 2018–2019 U of T fiscal year (May to April).

A Celebration of Leadership

2006-2007 to 2018-2019

Cristina Amon is Alumni Distinguished Professor in Bioengineering in the Department of Mechanical & Industrial Engineering at the University of Toronto's Faculty of Applied Science & Engineering, and the longest serving dean (2006 to 2019) in our Faculty's last half century. Under her visionary leadership, U of T Engineering has risen to preeminence as Canada's top engineering school and among the world's best across all international rankings.

The past 13 years have been characterized by remarkable advances in multidisciplinary research, transformative innovations in engineering education, an elevated presence for the Faculty on U of T's downtown St. George Campus, and the enrichment of our vibrant Skule™ community that values inclusivity and diversity in all its forms.

As we reflect on Dean Amon's tremendous contributions, our community — including alumni, donors, Chairs & Directors, faculty members, staff, students and University leadership — is united in celebrating her legacy through the creation of the Decanal Chair in Innovation, which will be renamed in honour of Cristina Amon upon her retirement in accordance with University policy. →





Dean's Town Hall gatherings provide an opportunity for students to give feedback on relevant issues.

2006-2007



Created first MEng emphasis in Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE)

Received Alan Blizzard Award for first-year design course Engineering Strategies & Practice

Enrolled first students in the Faculty's inaugural cross-disciplinary minor in Bioengineering

Established role of Vice-Dean, Graduate Studies

Created Faculty Committee on Nominations for Honours & Awards

2007-2008



Initiated the Dean's Town Hall as a forum for Faculty and Engineering Society leaders to engage with students

Launched graduate-level Prospective Professors in Training (PPIT) program

Welcomed first cohort of TrackOne students

Launched Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR)

Distributed first issue of *The Engineering Newsletter* for staff and faculty

Hosted first Celebrating Engineering Excellence reception



Launched minors in Sustainable Energy and Environmental Engineering, and EngSci major in Energy Systems

2008-2009

Established the Task Force on Globalization in Engineering

Launched Centre for Research in Healthcare Engineering (now Centre for Healthcare Engineering)

Published the first *Annual Report of Performance Indicators*

Prioritized physical space improvement after Comprehensive Divisional Space Review



BOTTOM LEFT: Professor Susan McCahan is part of the teaching team that developed *Engineering Strategies & Practice*

BOTTOM RIGHT: Professor Michael Carter (left) was the inaugural director of the Centre for Research in Healthcare Engineering



The Lassonde Mining Building with an exterior view of the transformed fifth-floor addition.

2009-2010

2010-2011

2011-2012

2012-2013

- Created Cross-Disciplinary Programs Office to administer engineering minors

- Launched First Year Office to support incoming undergraduates

- Established Centre for Global Engineering (CGEN)

- Created BioZone and the Identity, Privacy & Security Institute (IPSI)

- Established Engineering Outreach Office to coordinate pre-university STEM programs with a focus on engaging underrepresented communities

- Created in-house communications team, Engineering Strategic Communications

- Introduced MEng emphases in energy, health care and robotics and welcomed first cohort of Clinical Engineering PhD students

- Launched Engineering Business minor and EngSci major in Engineering Mathematics, Statistics and Finance

- Established Institute for Leadership Education in Engineering (ILead), later renamed Troost ILead in 2018

- Launched Institute for Robotics & Mechatronics, later evolved into the U of T Robotics Institute in 2019

- Earned Canadian Green Building Award for the Lassonde Mining Building's Goldcorp Mining Innovation Suite

- Created Dean's Strategic Fund to provide seed funding for new initiatives across the Faculty

- Launched The Entrepreneurship Hatchery

- Established U of T Institute for Multidisciplinary Design & Innovation (UT-IMDI)

- Created Centre for Research in Sustainable Aviation (CRSA)

- Held first Faculty-wide industry partners' reception

- Set \$200M fundraising goal as part of U of T's Boundless campaign

- Launched Engineering Instructional Innovation Program (EIIP)

- Opened new space flight laboratory for microsatellite research at UTIAS

- Developed and hosted first U of T-wide educational technology (EdTech) conference

- Hosted inaugural Girls' Leadership in Engineering Experience (GLEE) event for top female applicants

- U of T allocated Site 10 to build the Centre for Engineering Innovation & Entrepreneurship (CEIE)

- Implemented new budget allocation model

Top left: ChemE Chair Grant Allen, Dean Cristina Amon and Director Elizabeth Edwards officially open the renovated BioZone facilities.
 Top right: Co-founded by an engineering graduate student, teaBOT received support from Start@UTIAS.



2013-2014

2014-2015

2015-2016



First cohort of students completed multidisciplinary capstone projects with industry clients through UT-IMDI

Formed strategic partnerships with five Canadian engineering schools to promote graduate studies

Institute for Sustainable Energy (ISE) expanded to cross-Faculty unit

Completed construction of new floor in Wallberg Building to house BioZone



Launched EngSci major in Robotics

Established Collaborative Program in Engineering Education in partnership with OISE

Piloted broad-based undergraduate admissions process

Launched Toronto Institute for Advanced Manufacturing (TIAM) and U of T Transportation Research Institute (UTTRI)

Hosted inaugural Young Women in Engineering Symposium (YWIES)

Opened pilot Technology Enhanced Active Learning (TEAL) room

Launched Start@UTIAS entrepreneurship incubator program

Hosted top domestic prospective graduate students at first Faculty-wide Graduate Research Days event

Established Medicine by Design, supported by largest research grant in U of T history



Launched Translational Biology and Engineering Program (TBEP) at the Ted Rogers Centre for Heart Research in partnership with the Faculties of Medicine and Dentistry

Established Institute for Water Innovation (IWI)

Partnered with Google Canada and Actua to host Innovate U — later renamed Go North — Canada's largest youth STEM event



Broke ground on the CEIE and received \$15M investment from Ontario government

- Education
- Research
- Outreach
- Resource

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Pilot TEAL room in the Sandford Fleming Building

MIE graduate student Xinyi Zhang interacts with Pepper, an AI robot that will help to reduce wait times in hospitals.



Welcomed 40% women into first year undergraduate class

Launched MEng program in biomedical engineering

Launched EngSci major in Machine Intelligence, minors in Music Performance and Artificial Intelligence, and the Music Technology certificate

Surpassed 35% women undergraduates across all years of study, and welcomed 40% women into first year for the third consecutive year

2016-2017

2017-2018

2018-2019

Established the Percy Edward Hart and Erwin Edward Hart Professorships and Hart Teaching Innovation Professorships from a \$20M endowment

Formed Eagles' Longhouse Indigenous Initiatives Steering Committee and appointed a Dean's Advisor on Indigenous Initiatives

Expanded CONNECT networking platform across all departments

Began upgrades on 89 lab spaces through the Lab Innovation For Toronto (LIFT) fund

Launched minor in Advanced Manufacturing and certificate in Forensic Engineering

Launched Cross-Faculty Collaborative Master's Specialization in Psychology and Engineering (PsychEng) and MEng emphases in Forensic Engineering and Analytics

Established Institute for Studies in Transdisciplinary Engineering Education & Practice (ISTEP)

Eagles' Longhouse completed Faculty's *Blueprint for Action* report

Created role of Dean's Advisor on Black Inclusivity Initiatives and Student Inclusion Mentor

Formed Engineering Equity, Diversity and Inclusion Action Group (EEDIAG)

Officially opened newly named Myhal Centre for Engineering Innovation & Entrepreneurship

Appointed 27 faculty to early-career professorships: Dean's Spark Professor, Catalyst Professor and Emerging Innovation in Teaching Professor

Refocused U of T Robotics Institute on three pillars: Autonomous Vehicles and Field Robotics, Robotics in Health Care and Advanced Manufacturing

Created Centre for Analytics and Artificial Intelligence Engineering (CARTE)

Celebrated PEY Co-op's 40th anniversary

Participated in Scotiabank CONTACT Photography Festival and Doors Open Toronto to publicly showcase a decade of engineering excellence

Concluded U of T's Boundless campaign, fundraising a total of \$246M, surpassing original goal of \$200M



U of T Engineering: Then & Now

| | THEN (2006-07) | NOW (2018-19) |
|---|-----------------|-------------------|
| Applications to undergraduate programs | 6,829 | 13,272 |
| Entering average of first-year students | 85.5% | 93.6% |
| Enrolment of undergraduate students | 4,222 | 5,236 |
| Proportion of students who move from first to second year (retention rate) | 87.5% | 92.2% |
| Participation in Professional Experience Year Co-op Program | 458 | 853 |
| Undergraduate minors and certificates offered | 1 | 21 |
| Undergraduate degrees awarded annually | 960 | 1,100 |
| Proportion of graduates with at least one minor or certificate | 0% | 53% |
| Applications to graduate programs | 2,443 | 5,309 |
| Enrolment of MEng and MSc students | 265 | 911 |
| Enrolment of MAsc and PhD students | 1,021 | 1,587 |
| PhD degrees awarded annually | 84 | 167 |
| MEng emphases offered | 0 | 12 |
| Proportion of graduate students (among all students) | 22.3% | 35.6% |
| Tenure- and teaching-stream faculty | 225 | 266 |
| Research centres and institutes | 9 | 29 |
| Chairholders and Professorships | 52 | 120 |
| Engineering citations (AAU, indexed by Thomson Reuters, five-year cumulative) | 4,149 (2003-07) | 34,927 (2012-16) |
| Number of NSERC CREATE grants held | 0 | 8 |
| Industry research funding | \$6.5M | \$12.7M |
| Sponsored research funding | \$54.5M | \$80.3M (2017-18) |
| Proportion of international undergraduate students | 9.8% | 27.5% |
| Proportion of undergraduate women in first year | 20.2% | 39.8% |
| Proportion of women undergraduate students | 21.6% | 35.4% |
| Proportion of international graduate students | 20.0% | 36.5% |
| Proportion of women in graduate programs | 25.0% | 27.1% |
| Proportion of women faculty | 11.6% | 21.4% |
| Faculty footprint (NASMs) across U of T | 61,840 | 70,933 |
| Total operating budget | \$59.8M | \$148.4M |
| Total revenue | \$118.8M | \$238.0M |
| Philanthropic support generated | \$11.5M | \$21.6M |

1

Our reputation for excellence in engineering education enables us to attract talented and diverse students from around the world. We received the highest recorded number of applications in 2018, more than 13 for each place in our programs. Women made up approximately 40% of our first-year incoming classes for the last three years, and now represent more than 35% of undergraduate students across all years of study. Approximately one in four of our undergraduates come from countries outside of Canada.

We continue to enhance our culture of inclusion through groups such as our Equity, Diversity & Inclusion Action Group and the Eagles' Longhouse, our Indigenous initiatives steering committee. Our Dean's Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor plays a key role in creating a more inclusive learning environment, and chairs our Anti-Black Racism Committee.

In September 2018, we welcomed the first students in our new Engineering Science major in Machine Intelligence, as well as our new minor in Music Performance and certificate in Music Technology. In January 2019, we launched another new certificate and minor in Artificial Intelligence Engineering. These programs further enrich the suite of options available to our students and enable them to customize their degrees.

We have built active learning and experiential education into our physical spaces, such as the flexible design studios, technology enhanced active learning spaces and prototyping facilities in the Myhal Centre. The Myhal Centre is also home to several centres that enable students to complement their technical knowledge with core engineering competencies, such as our Institute for Multidisciplinary Design & Innovation, our Troost Institute for Leadership Education in Engineering and our Centre for Global Engineering.

Our newly created Institute for Studies in Transdisciplinary Engineering Education & Practice (ISTEP) consolidates and expands our programming in technical communication, leadership, business and engineering education. We continue to strengthen our support for thought leadership in engineering education through our Dean's Emerging Innovation in Teaching Professorships (DEIP), as well as our Hart Teaching Innovation Professorships.

Admissions and First-Year Students

We received a record 13,272 applications to our undergraduate programs in 2018, an increase of 3.0% from 12,880 the previous year. The increase was driven primarily by international applications, which rose by 10.8% over 2017–2018. Domestic applications declined slightly, likely a reflection of a broad demographic trend across Canada that has resulted in fewer prospective university students than in previous years.

Figure 1.1a Applications, Offers, Registrations, Selectivity and Yield of First-Year Undergraduates, 2009 to 2018

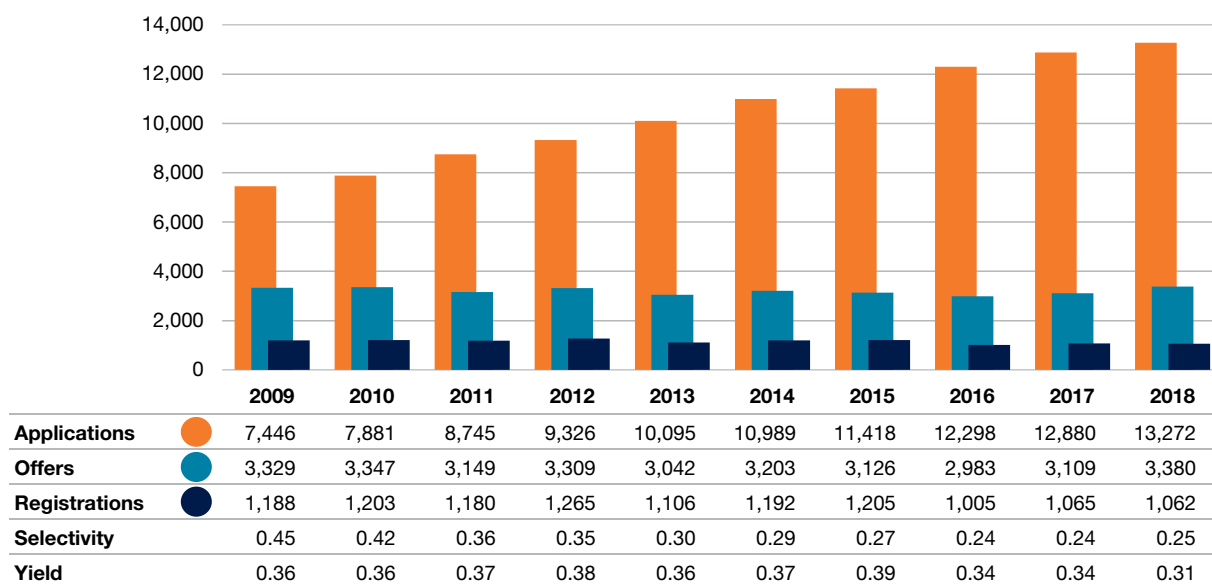
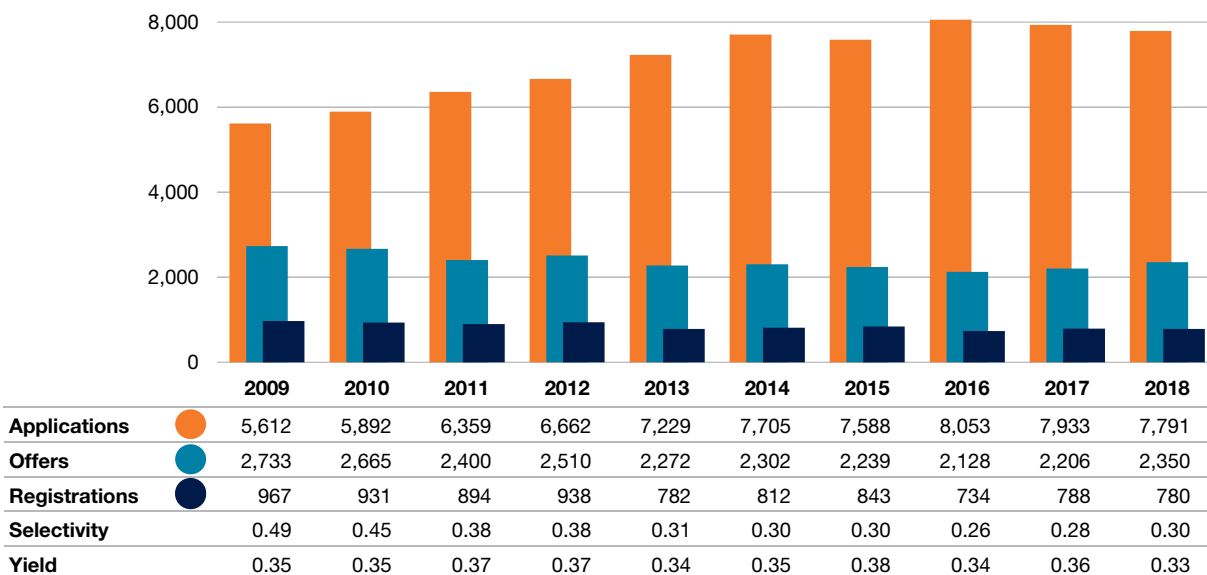


Figure 1.1b Applications, Offers, Registrations, Selectivity and Yield of Domestic First-Year Undergraduates, 2009 to 2018



Data in this chapter are presented by academic year (September to August) unless otherwise noted. Highlights are from June 2018 to June 2019.

Note 1.1a, b, c: Student counts are shown as of November 1. Applications and offers are for the fall admissions cycle. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

This year, for the first time, domestic students who applied through the Ontario Universities Application Centre (OUAC) were able to indicate their interest in participating in the Professional Experience Year Co-op (PEY Co-op) Program. The proportion of students who indicated their intention to participate in PEY Co-op was 86% (1,214 students).

Our selectivity is high, with offers being made to 25% of students who applied for 2018 admission, compared with 45% a decade earlier. Our yield for 2018 offers of admission was 31%, in the same range as it has been for the past several years.

Figure 1.1c Applications, Offers, Registrations, Selectivity and Yield of International First-Year Undergraduates, 2009 to 2018

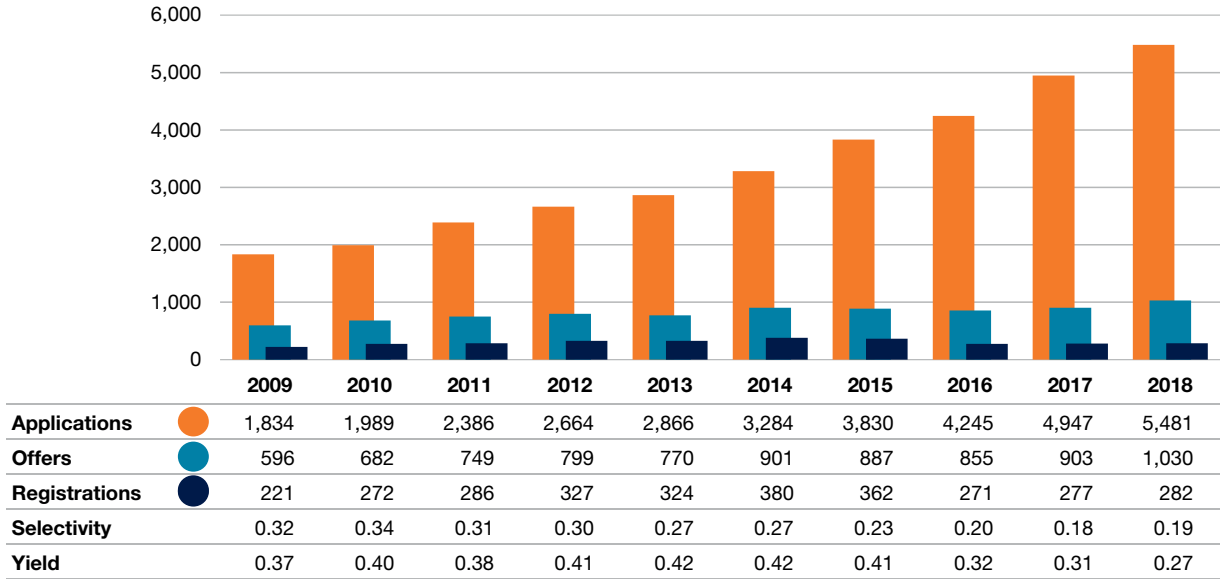
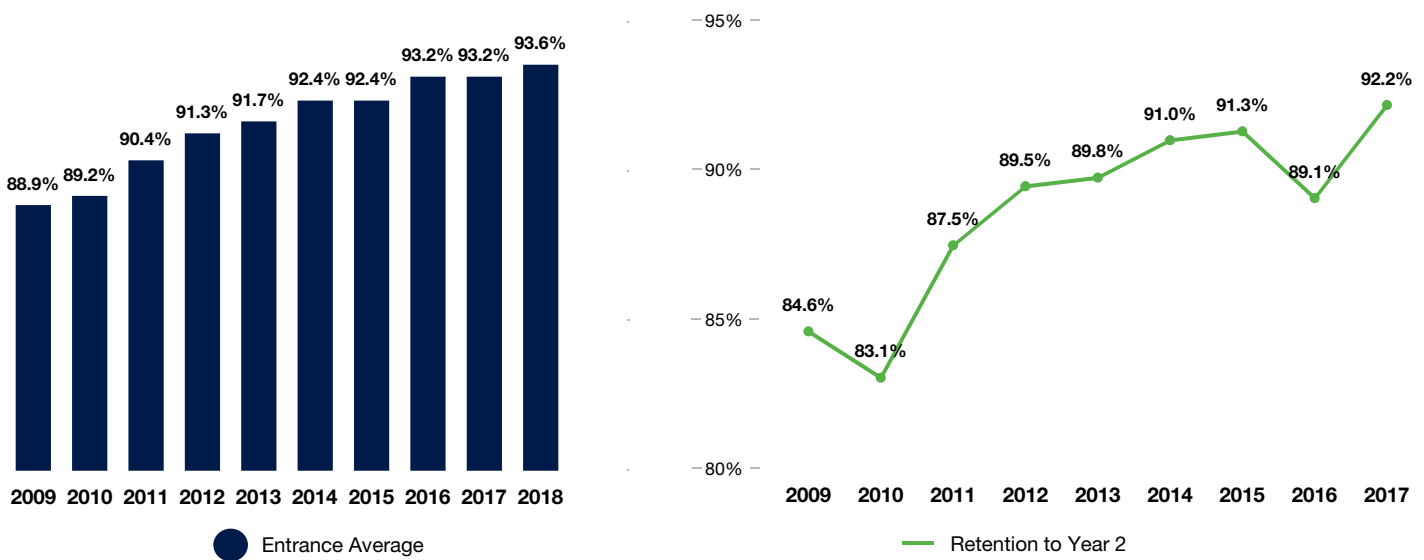


Figure 1.2 Ontario Secondary School Averages of Incoming First-Year Undergraduates and Retention Rate Between First and Second Year, 2009 to 2018



Our admitted students are of the highest calibre, with approximately 60% earning merit-based scholarships, both internal and external. These include prestigious accolades such as the Schulich Leader Scholarships, C. David Naylor University Scholarships, Lester B. Pearson International Scholarships and International Engineering Scholar Awards. The mean entering average of Ontario secondary school students has reached a new record level of 93.6%. More than 90% of our incoming students proceed to second year on schedule, reflecting our rich suite of supports and programs focused on student advising and success.

We recognize that grades alone do not provide a complete view of each applicant’s candidacy, and for the last five years we have implemented a broad-based admissions process to account for key engineering qualities such as logical thinking, communication skills, adaptability and perseverance. The process includes submission of online videos and written, timed responses that are evaluated by more than 70 trained alumni screeners both within and outside of the Toronto region.

Our first-year class included 39.8% women, the highest proportion of any engineering school in Canada. International students made up 26.6% of our incoming cohort. A further 47 students (4.4% of the domestic cohort) completed their secondary education outside of Canada, but are Canadian citizens and therefore are considered domestic students (See Fig. 1.4).

We attract accomplished candidates from across Canada and around the world through strategic recruitment events and activities. For the 2018 admissions cycle, key activities included:

- National recruitment:** We distributed 14,033 *Discover Engineering* viewbooks at the Ontario Universities Fair at the Metro Toronto Convention Centre. We also increased the number of school visits in the Greater Toronto Area to 90 in 2018, up from 72 in 2017. Schools were selected on the basis of historic admission data, with an eye to our enrolment priorities. We continued our traditional recruitment drives in Vancouver and Calgary, as well as our participation in U of T’s Fall Campus Day, where we received 682 visitors.

Note 1.2: Entrance average is calculated based on Ontario secondary school students. Retention rate is the proportion of students who successfully move on to second year in the fall semester following their first year.

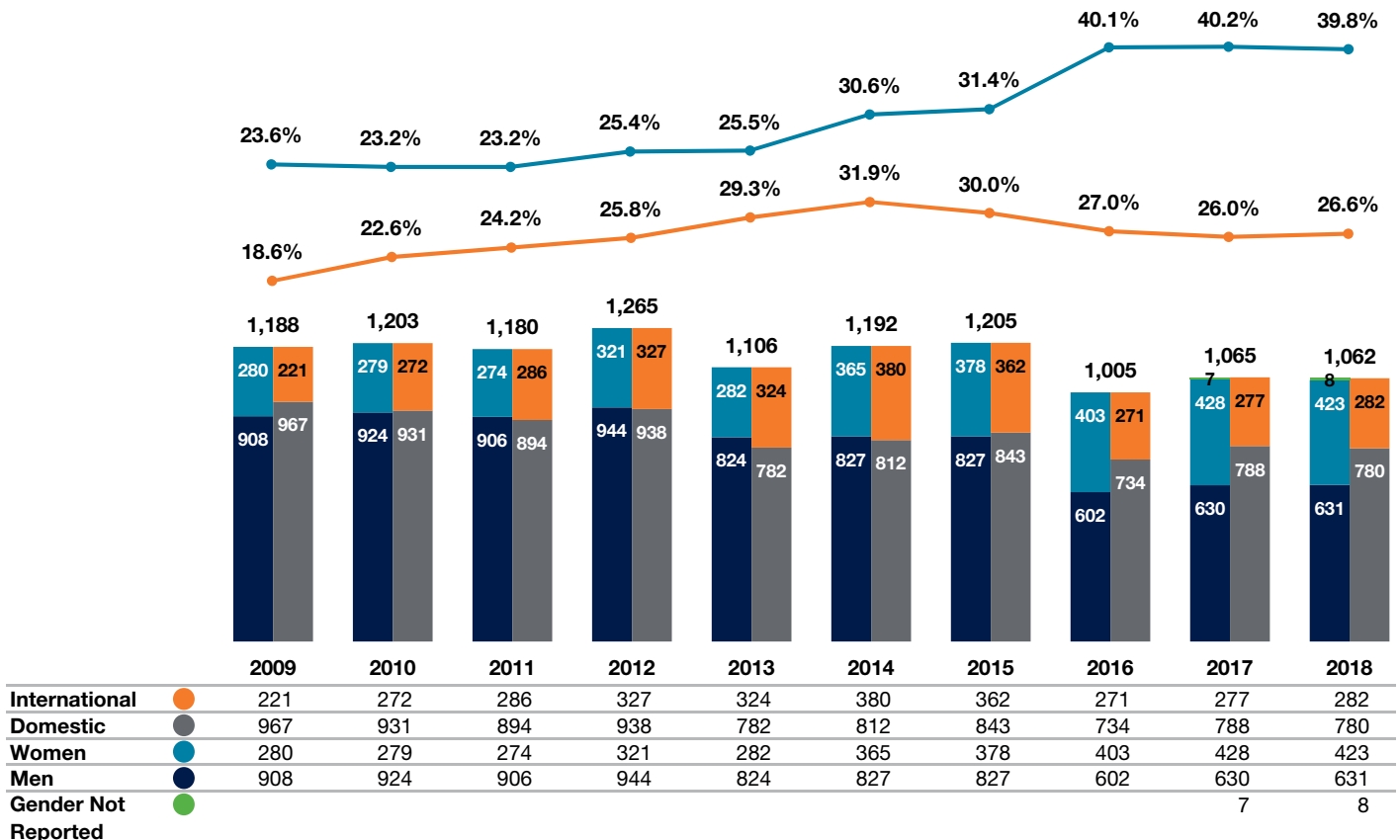
- **International recruitment:** We conducted school visits, applicant events and information sessions in 10 countries — Brazil, Colombia, Dubai (UAE), Ecuador, Indonesia, Panama, Singapore, Trinidad and Tobago, Turkey and the U.S.
- **Engineering for Educators:** Thirty-three STEM educators from across the GTA attended this professional development session, which addressed barriers to education and gaps between the high school and first-year curriculum. The goal of this annual event is to smooth the transition between secondary and post-secondary studies in engineering.
- **Girls' Leadership in Engineering Experience (GLEE):** This annual, weekend-long program inspires and empowers women who have received offers of admission to our programs by connecting them with women faculty members, students and alumnae. It includes a dinner and reception hosted by the Dean as well as a keynote address from one of our women professors. Of the 117 students who attended GLEE in May 2018, 91 accepted their offers, a yield of 78%. In 2019, GLEE was split into two events, one for students from Ontario and one

for students from elsewhere, including other Canadian provinces, the U.S. and Latin America. In April, 24 out-of-province students participated in GLEE, with a further 86 Ontario students attending in May.

- **Young Women in Engineering Symposium (YWIES):** YWIES invites talented Grade 11 students from across the GTA to U of T where they learn more about engineering, participate in design workshops and meet current students, faculty and alumni. The event enables us to connect with these promising applicants earlier in their decision-making process. We attracted 84 students to our fifth annual symposium in May 2018, with 54 more joining us in May 2019.

We are committed to equity, diversity and inclusion, and to fostering an environment in which each member of our community can excel, contribute and benefit from different perspectives. Over the past several years, we have created a number of bodies that seek to recognize and challenge power dynamics that lead to exclusion and discrimination, and to increase the representation of students from minority groups — including Black

Figure 1.3 Incoming First-Year Undergraduates with Percentage of Women and International Students, 2009 to 2018



Note 1.3: Student counts are shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada. Data on student gender comes from the U of T Enrolment Reporting Cube; the option not to report gender was added in 2017.

students and Indigenous students – within our community. Examples include:

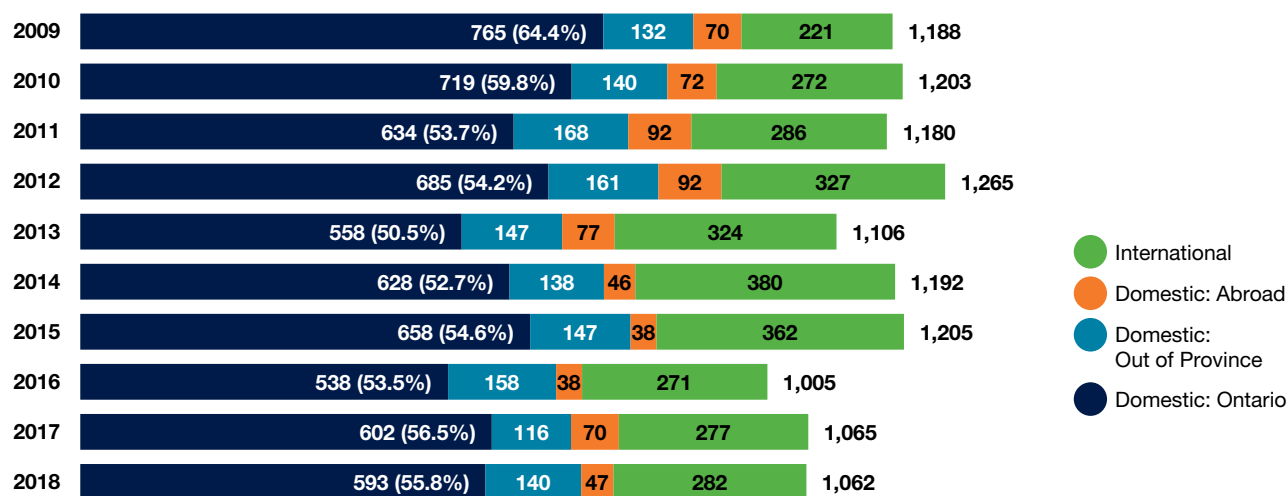
- **Eagles’ Longhouse:** Engineering Indigenous Initiatives Steering Committee: This group was created in 2017 and includes members from across our Faculty and the Oneida Nation. In 2018 it released a *Blueprint for Action*, which outlines steps toward ensuring a welcoming and supportive environment and to intensify engineering outreach to Indigenous students. The Eagles’ Longhouse is involved in a number of outreach programs in communities such as Northern Ontario and Labrador.
- **Anti-Black Racism Committee (ABRC):** Created in September 2018, the ABRC takes meaningful action to raise awareness of anti-Black biases in our Faculty and improve the experience of community members – students, staff, faculty and alumni – who identify as Black. ABRC coordinates its actions through the Dean’s Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor. ABRC chose to launch its first campaign during Black History Month in February, capitalizing on the enhanced attention to achieve

two goals: creating a sense of empowerment, community and support among Black students, and highlighting unconscious bias as a barrier to advancing anti-racism. (For more details on this campaign and the ABRC in general, see Chapter 10 – Equity, Diversity and Inclusion.)

- **Engineering Equity, Diversity, and Inclusion Action Group (EEDIAG):** EEDIAG was created in 2018 to advance our Faculty’s commitment to fostering an environment in which each member of our community can excel, contribute and benefit from the diverse range of backgrounds and perspectives that co-exist here. Through monthly open conversations as well as workshops and seminars on EDI issues in engineering education, EEDIAG works to identify barriers to access and inclusion of underrepresented groups in engineering, as well as to build more inclusive spaces within our Faculty.

For more information on our efforts with regard to equity, diversity and inclusion, see Chapter 10 – Equity, Diversity and Inclusion.

Figure 1.4 Incoming First-Year Domestic and International Undergraduates, 2009 to 2018



Enrolment

In 2018–2019, the undergraduate student population was 5,235. We are progressing toward our goal of a stable undergraduate population of approximately 5,000 students. The proportion of women across all years of study reached 35.4%, up from 33.0% in 2017–2018. We continue to collaborate with Engineers

Canada and our peer institutions across the country to achieve the “30 by 30” goal of reaching 30% women among newly licensed engineers by 2030. Our international student population now stands at 27.5% of all undergraduates.

Note 1.4: Student counts are shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada.

Figure 1.5a Undergraduate Enrolment with Percentage of Women and International Students, 2009–2010 to 2018–2019

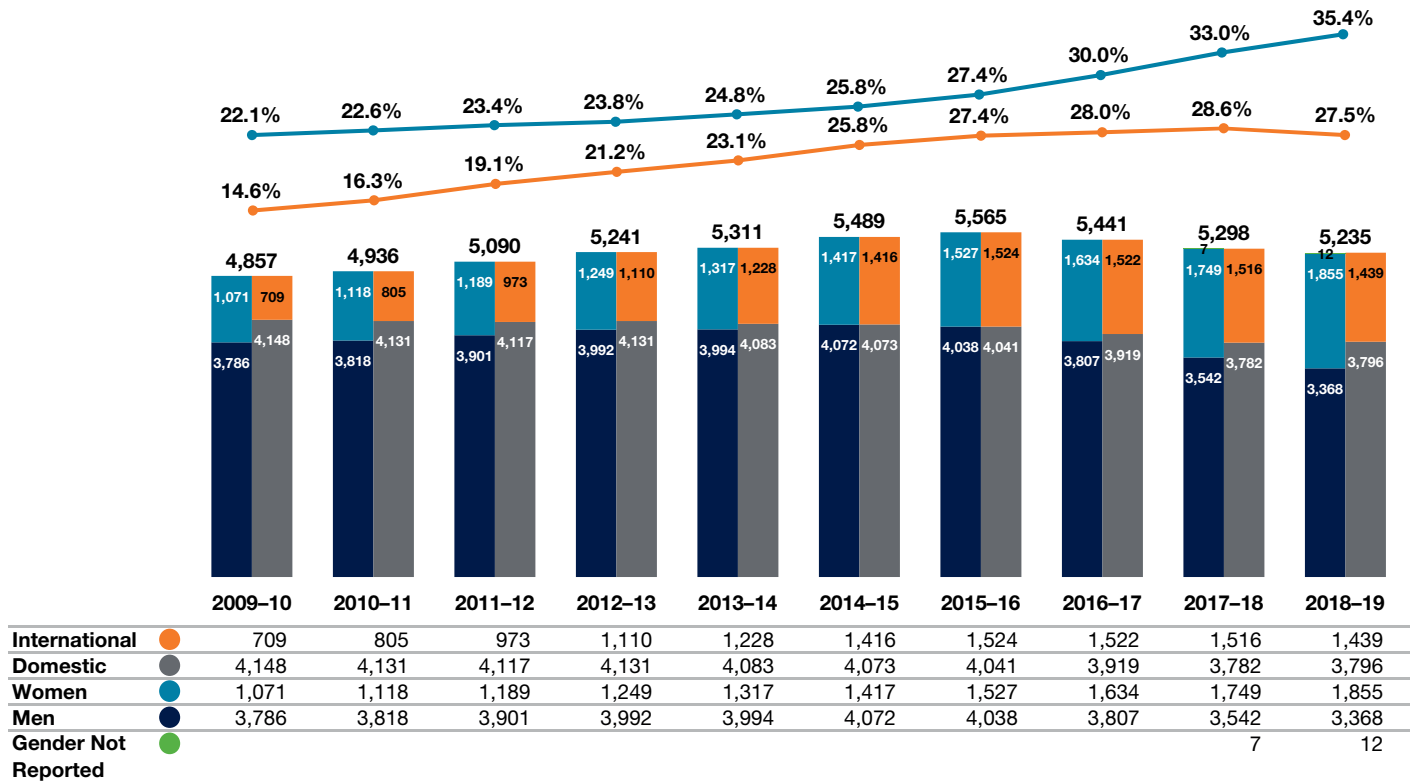
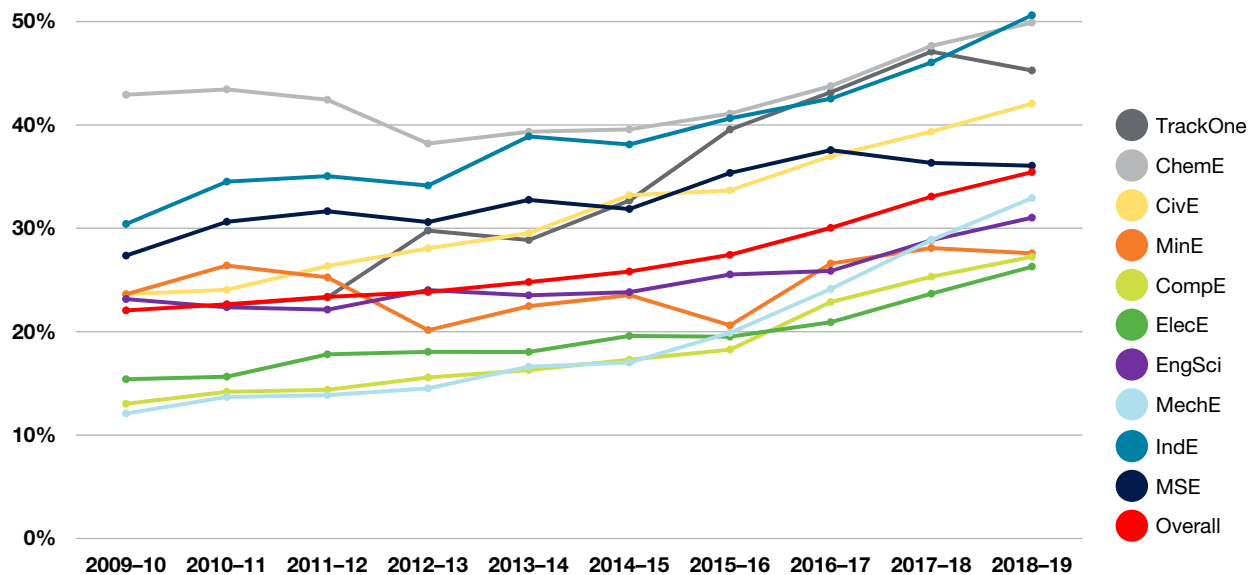


Figure 1.5b Percentage of Women by Undergraduate Program, 2009–2010 to 2018–2019



Note 1.5a: Includes full- and part-time students and those working full time through the Professional Experience Year Co-op Program (PEY Co-op). Does not count students with special (non-degree) status. Student counts shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada. Data on student gender comes from the U of T Enrolment Reporting Cube; the option not to report gender was added in 2017.

Figure 1.6 Undergraduates by Program, Year of Study and Professional Experience Year Co-op, 2018–2019

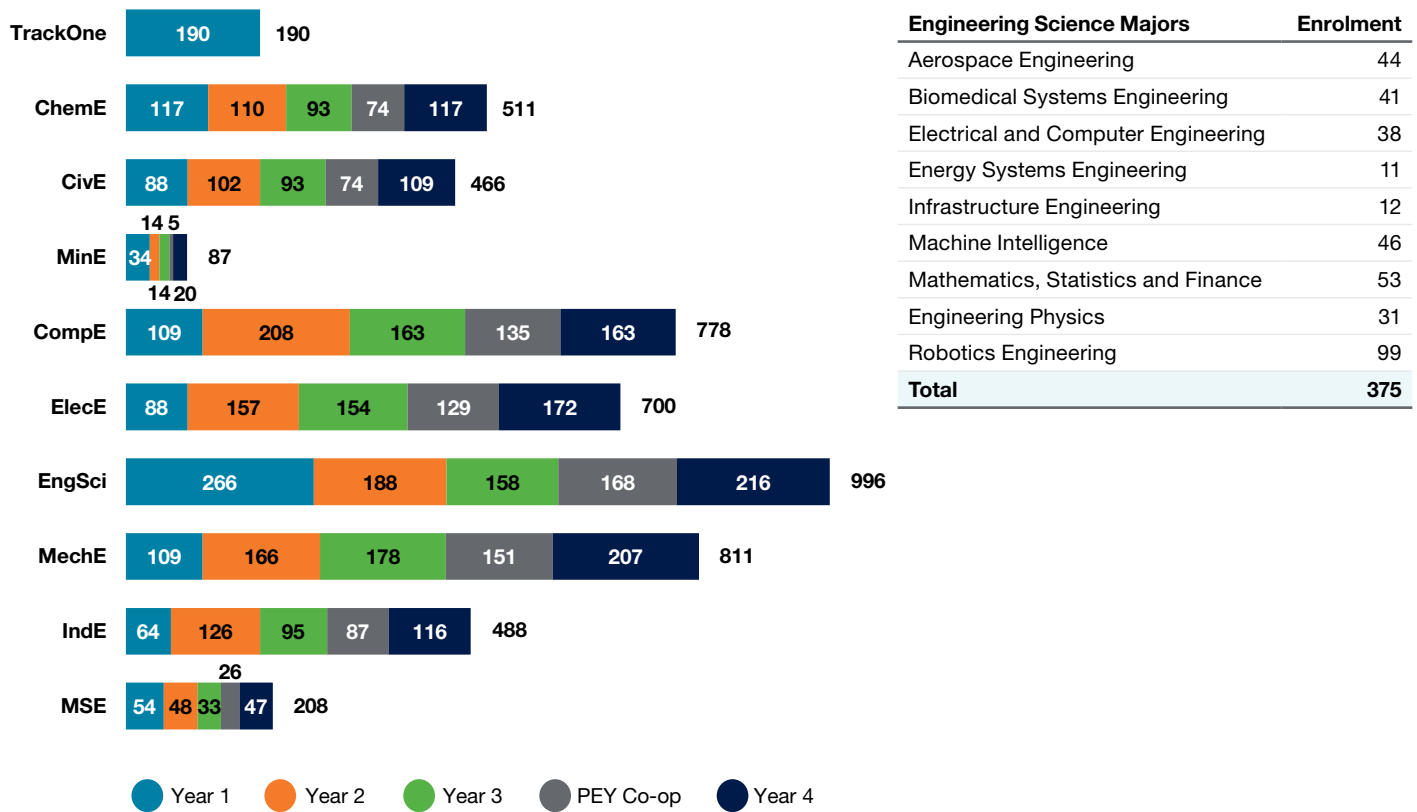
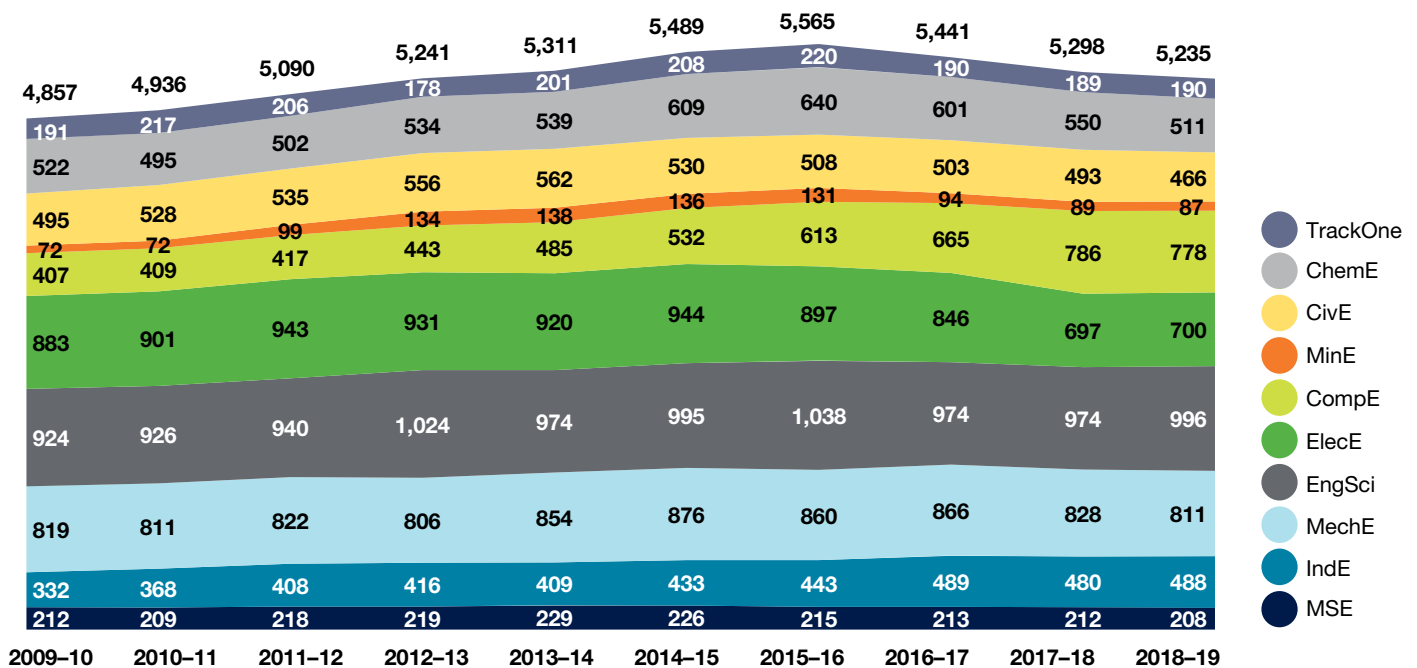


Figure 1.7 Undergraduates by Program, 2009–2010 to 2018–2019



Note 1.6: Student counts are shown as of November 1, 2018. Engineering Science Majors show only students in Year 3 and Year 4 and do not count students on PEY Co-op.

Note 1.7: Student counts are shown as of November 1.

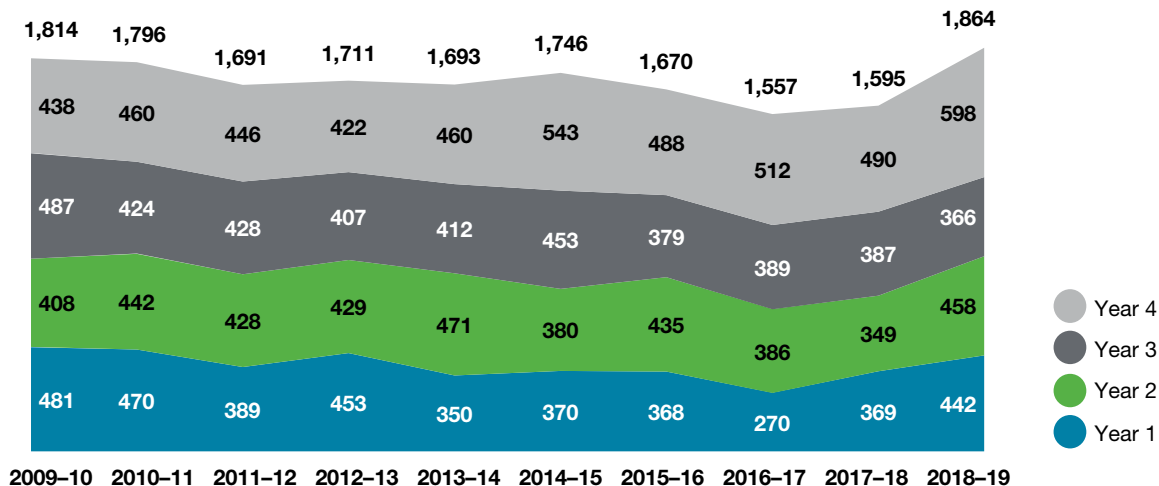
Need-Based Funding

Our Faculty is committed to the University of Toronto’s Policy on Student Financial Support, which states that no student offered admission to a program at the University of Toronto should be unable to enter or complete the program due to lack of financial means.

We offer a wide range of student aid options — including scholarships, bursaries and other awards based on merit and need — funded by donors and the University of Toronto Advanced Planning for Students (UTAPS) program. Our financial aid officer helps students prepare personal budgets, learn about funding sources and manage appeals through the Ontario Student Assistance Program (OSAP) process.

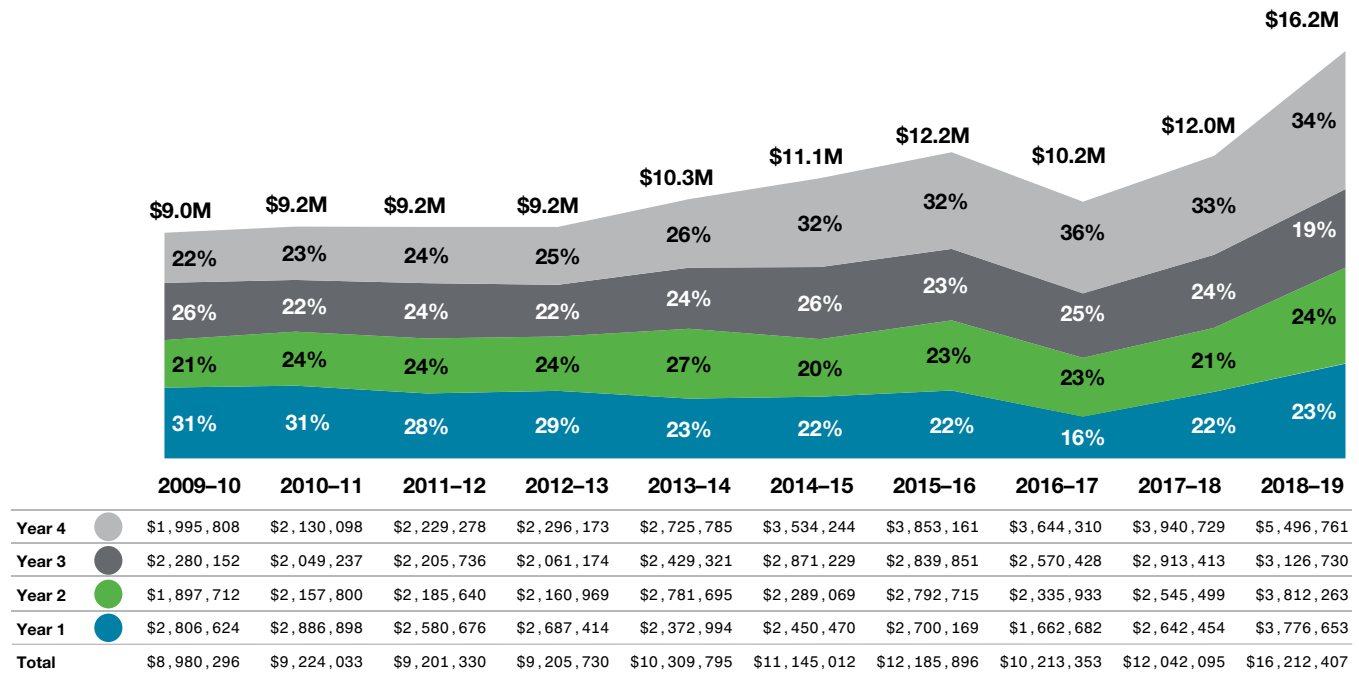
The number of undergraduate students receiving need-based awards in 2018–2019 was 1,864, with the total amount of student support reaching \$16.2 million. This funding is distributed proportionally across all years of study, and represents an 80% increase over the last 10 years. The amounts reported in Figures 1.8a and 1.8b do not include external merit-based scholarships or awards, or funding from provincial assistance programs, including OSAP.

Figure 1.8a Number of Awards Received by Cohort with Total Number of Undergraduate Need-Based Award Recipients, 2009–2010 to 2018–2019



Note 1.8a: Data comes from the Student Accounts Reporting Cube.

Figure 1.8b Total Value of Undergraduate Financial Assistance and Percentage Distributed by Year of Study, 2009–2010 to 2018–2019



Note 1.8b: Data comes from the Student Accounts Reporting Cube.

Degrees Awarded

U of T Engineering students earn either a Bachelor of Applied Science (BASc) or Bachelor of Applied Science in Engineering Science (BASc EngSci). Both degrees can be completed in four years. Many of our second- and third-year students choose to augment their degrees with a 12- to 16-month job through

the Professional Experience Year Co-op (PEY Co-op) Program, which adds one year to their time to completion. *(For more information on PEY Co-op, please refer to Chapter 4: Cross-Faculty Education and Experiential Learning.)*

Figure 1.9a Undergraduate Degrees Awarded by Program, 2009–2010 to 2018–2019

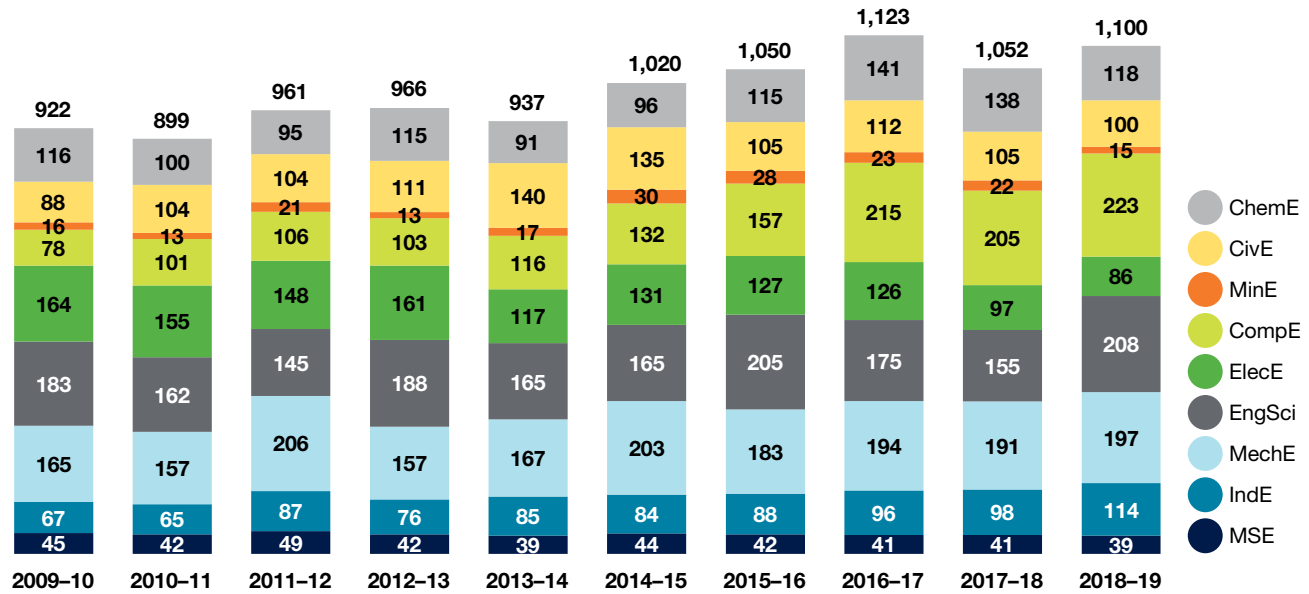
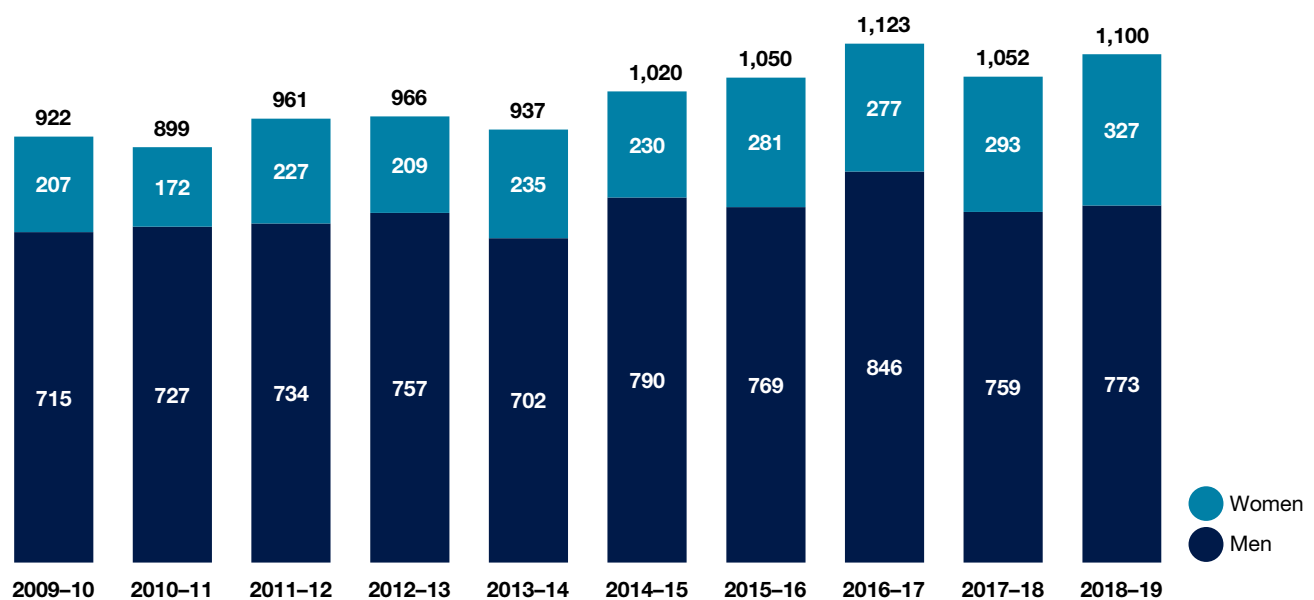
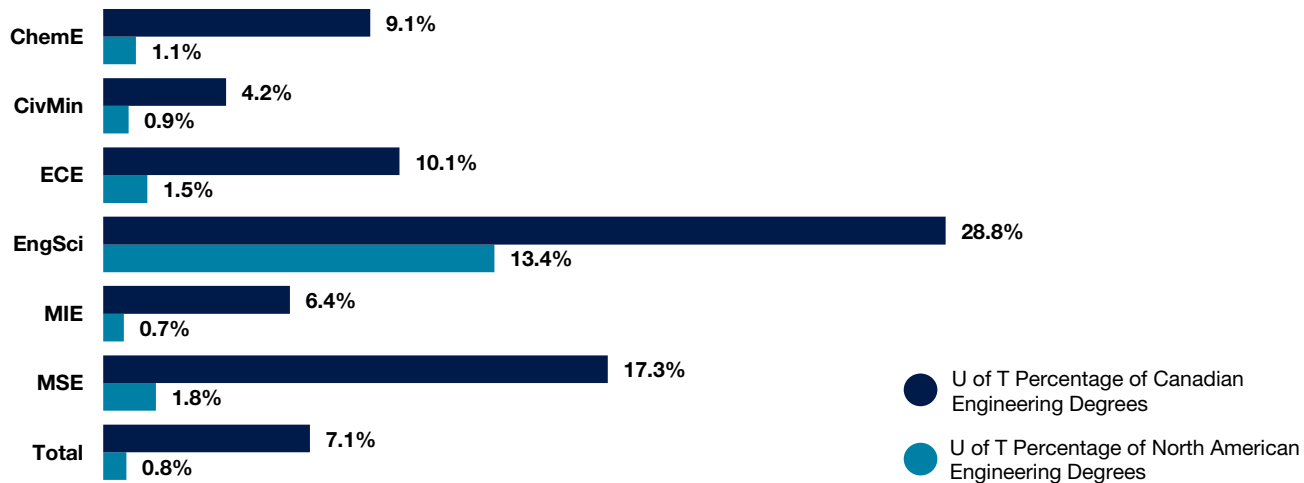


Figure 1.9b Undergraduate Degrees Awarded by Gender, 2009–2010 to 2018–2019



Note 1.9a, b: Data reported by academic year (September to August).

Figure 1.9c U of T Engineering Degrees Awarded by Academic Area Compared with Canadian and North American Degree Totals, 2017

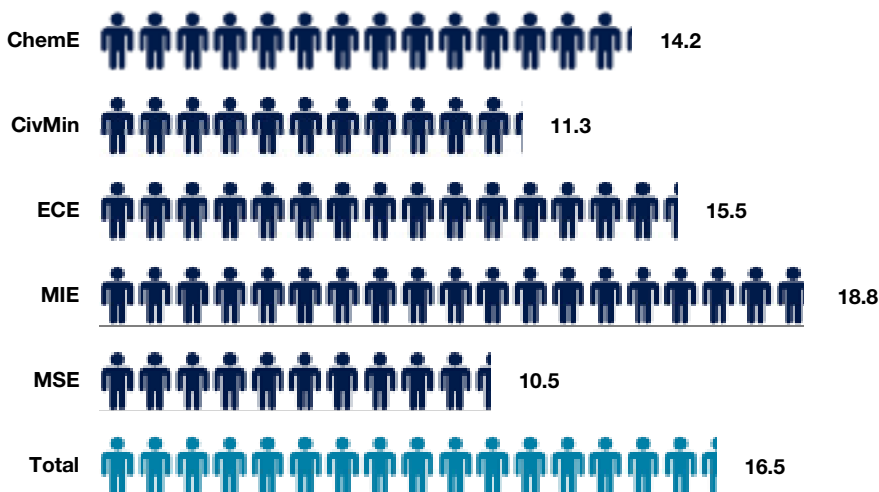


Student-to-Faculty Ratios

Figure 1.10a shows the number of undergraduates relative to the number of faculty members in each department. Students in programs that employ a cross-Faculty approach to instruction, such as Engineering Science and TrackOne, are included only in the “Total” bar.

Figure 1.10b shows that the overall undergraduate student-to-faculty ratio has decreased to 16.5, our lowest value in the last decade. Lower undergraduate student-to-faculty ratios allow for smaller class sizes and enhanced interaction between professors and students. *(For more information on student-to-faculty ratios at the graduate level, see Figure 2.2a.)*

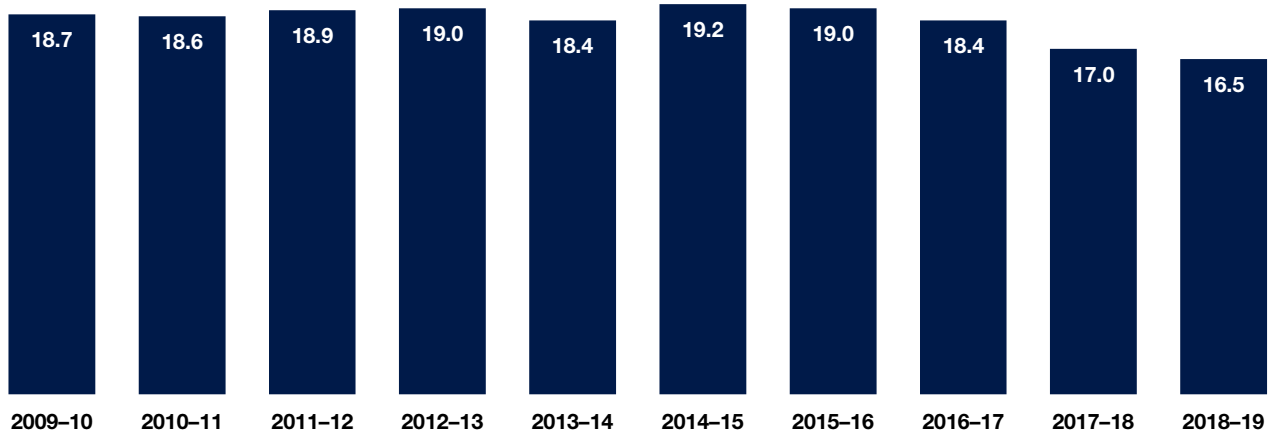
Figure 1.10a Undergraduate Full-Time Equivalent Student-to-Faculty Ratios by Academic Area, 2018–2019



Note 1.9c: Data sourced from reports produced by Engineers Canada and the American Society for Engineering Education; 2017 is the most recent year for which reports from both these institutions have been published. Total percentages show U of T as a proportion of all engineering degrees in North America, including those awarded in fields for which U of T does not have a specific degree program (e.g. Biomedical, Environmental, Software, etc.).

Note 1.10a, b: Student and faculty counts are shown as of November 1, 2018. For full-time equivalency (FTE), each part-time student is counted as 0.3 FTE. Students with special (non-degree) status or on PEY Co-op are not included. Faculty counts include tenure-stream and teaching-stream faculty.

Figure 1.10b Undergraduate Full-Time Equivalent Student-Faculty Ratios, 2009–2010 to 2018–2019



Dean's Honour List

To graduate with Honours, a full-time student must achieve a cumulative average of higher than 79.5% across second, third and fourth years and a weighted sessional fourth-year average of 74.5% or higher. The designation of High Honours, created in June 2015, distinguishes students who obtain a cumulative average of 87.5% or higher and a weighted sessional fourth-year average of 82.5% or higher. Both designations provide a measure of the outstanding academic achievement of our students.

In 2019, 1,057 of our students achieved Honours or High Honours, representing 45.7% of the graduating class (Figure 1.11a). This is our highest-ever proportion and reflects the high calibre of our students and the success of our many programs designed to support students throughout all years of study.

Figure 1.11a Number of Students and Percentage of Class Graduating with Honours, 2010 to 2019

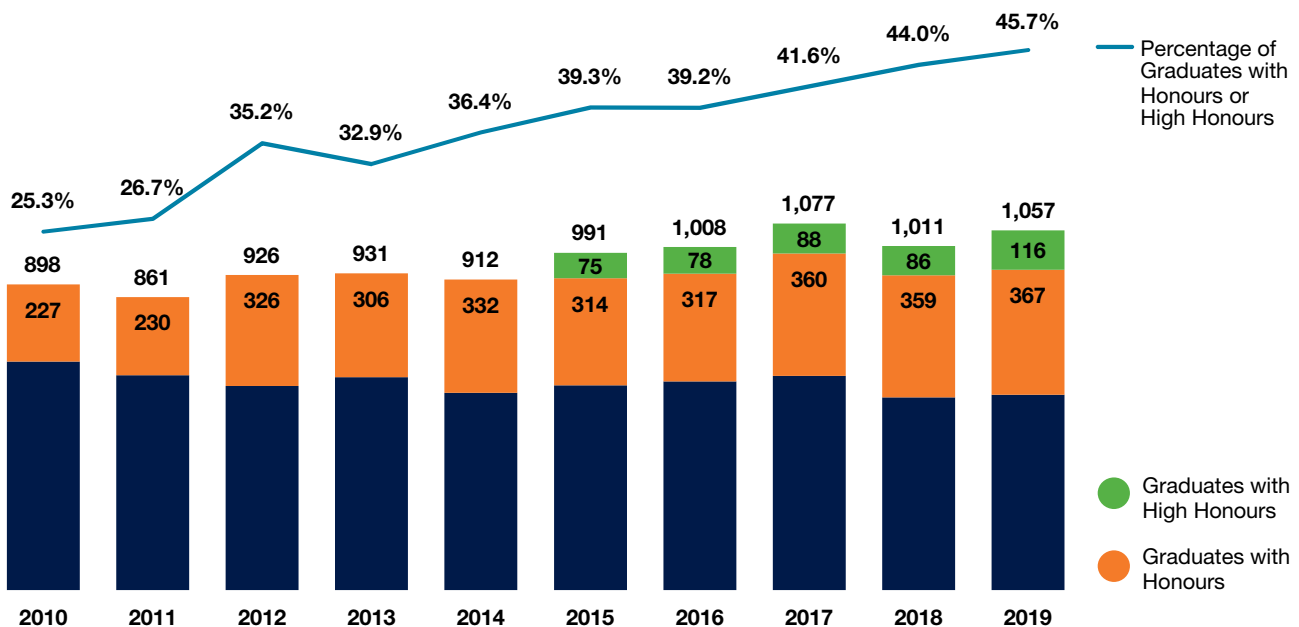
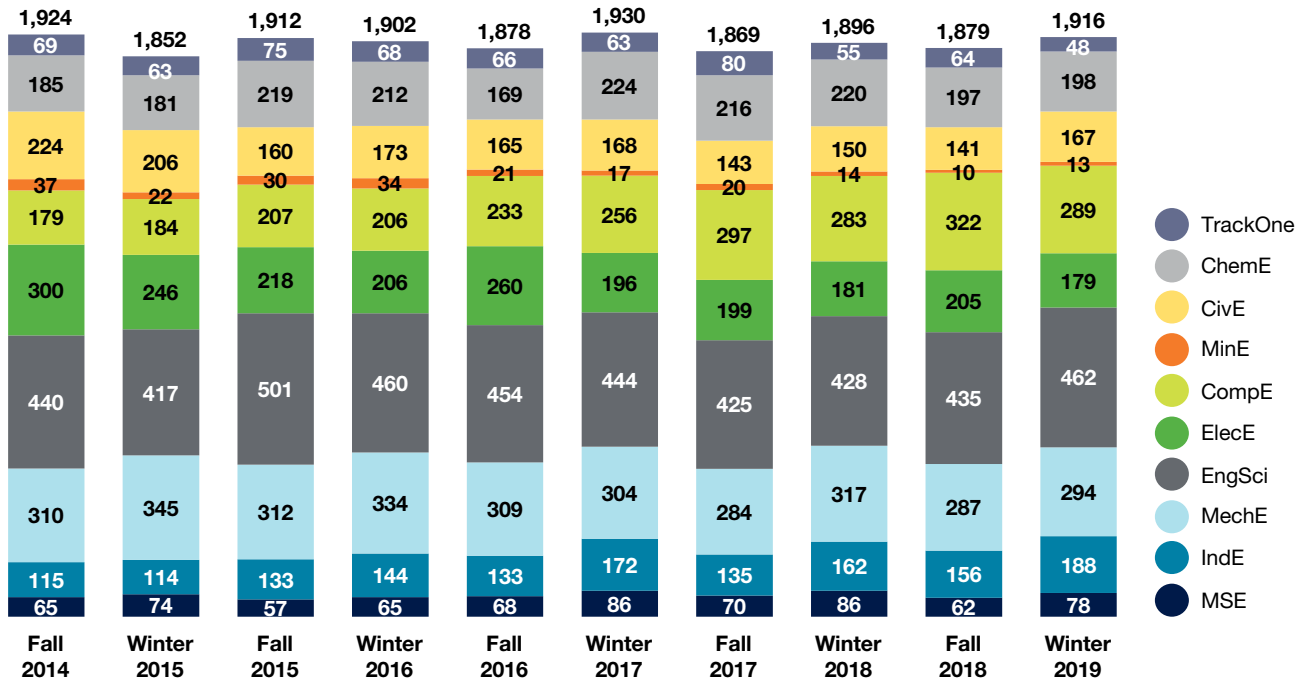


Figure 1.11b Number of Students on the Dean's Honour List by Term and Academic Area, Fall 2014 to Winter 2019



Enriching the Undergraduate Engineering Experience

We continually expand our suite of curricular and co-curricular activities, enabling our students to collaborate across disciplines, customize their degrees and develop rich and diverse engineering competencies. In 2018–2019 we added several new programs and initiatives focused on emerging areas and student success.

New programs, courses, and learning opportunities

In September 2018, we welcomed the first students into our new cross-disciplinary minor in Music Performance and a certificate in Music Technology, created in partnership with the Faculty of Music. *(For more information on cross-disciplinary minors, see Chapter 4, Cross-Faculty Education and Experiential Learning.)*

We also launched an Engineering Science major in Machine Intelligence, the first engineering undergraduate program of its kind in Canada. The new major provides students with a world-class education in the concepts and tools that underlie this rapidly developing field. Students receive a strong theoretical background in machine learning, artificial intelligence and data analytics, and learn to apply algorithms that can make decisions based

on data. In its first year, the Machine Intelligence major is already the largest of all the Engineering Science majors in terms of Year 3 enrolment with 44 students. For comparison, the next largest major is Robotics, which launched in September 2015 and has a Year 3 enrolment of 35 students.

In January 2019, we created a new minor and certificate in Artificial Intelligence Engineering for students in the Core 8 disciplines. These add to a growing list of AI-focused initiatives and experiential learning opportunities at U of T Engineering, in anticipation of the complex challenges that lie ahead.

We created 16 new undergraduate courses in 2017–2018, including several related to our new EngSci major and our new minor and certificate. These courses were:

- CHE334H1: Team Strategies for Engineering Design
- ECE444H1: Software Engineering
- ESC195H1: Calculus II
- ESC204H1: Praxis III
- ESC384H1 Partial Differential Equations
- ECE364H1: Introduction to Machine Intelligence
- MIE429H1: Machine Intelligence Capstone Design

Note 1.11b: Students are normally eligible to be considered for Honours standing only if they are carrying a full academic load (2.5 credits per session, excluding extra courses) and if the session is not being repeated. During fourth year, a student may reduce their course load in either semester (but not both) and still be eligible for Honours standing, provided the other conditions are met.

- MIE424H1: Optimization in Machine Learning
- BME445H1: Neural Bioelectricity
- CHE441H1: Engineering Materials
- ESC194H1: Calculus I
- MIE368H1: Analytics in Action
- APS327H1: Special Topics in Creative Writing
- APS511H1: Engineering and Law
- JRE500H1: Negotiations in an Engineering Context
- CHE399H1: Professional Engineering Consultancy

Our First-Year Summer Research Fellowships launched in summer 2016 with an inaugural cohort of eight research fellows. The program provides support to students seeking to gain research experience immediately after their first year of study, and is open to all students enrolled in first-year programs. Ten students were awarded fellowships of \$6,000 in summer 2018. In 2019, we increased the amount offered to \$7,000, again funding 10 successful applicants.

Student support

In April 2019, we appointed the Joint Task Force on Academic Advising and Mental Health. This task force builds on previous work, including that of the Decanal Task Force on Academic Advising (2016) and the Decanal Task Force on Mental Health (2017). The Joint Task Force will review the reports of these previous task forces as well as actions undertaken to date to make both short-term and long-term recommendations for the Faculty. Areas of focus include:

- Reviewing academic advising resources, staff complement and training
- Strengthening mental health and wellness training for students, staff, faculty and teaching assistants
- Studying faculty policies and resources with a mental health and wellness lens
- Consulting with Health & Wellness Services, Accessibility Services and other service providers and make recommendations for existing or new partnerships
- Considering a permanent committee structure to ensure student experience, wellness and mental health issues are continuously prioritized by the Faculty

In 2018–2019, we further strengthened our on-location supports by adding a full-time Accessibility Advisor to augment the work of our existing student support team. Our online advising portal, launched in 2017–2018, improves records management for advisors. This year, we added a new function that enables students to book appointments with their academic advisors through the portal. The portal serves as a central repository for data related to academic well-being, such as advising notes and resources for advisors.

In partnership with U of T's Health & Wellness Centre, we promote the online 'Identify, Assist and Refer' training to all faculty and staff. This training helps staff and faculty

learn what to look for, say and do when responding to a student in distress. We also provide complementary training for staff and faculty through the Engineering Engagement & Development Network. These initiatives reflect the January 2017 recommendations of the Decanal Task Force on Mental Health.

In May 2019, we hosted the fourth EdTech Workshop in the Myhal Centre. Through this biennial event, faculty members and staff engaged with new technologies designed to enhance students' learning inside and outside the classroom. The theme of EdTech 2019 was *Beyond Hammers: Building a Technology Enhanced Active Learning (TEAL) Toolkit*. We provided a combination of practical and theory-based sessions in three streams:

- **Content Management** – Strategies for introducing active learning activities into a demanding curriculum.
- **Teaching Team Management** – Encouraging collaboration among instructors, TAs, and other stakeholders in active learning classrooms
- **Activity Management** – Selecting the right learning activities for a given course or seminar.

Each year, we offer a robust suite of programs to support our students as they make the transition from secondary school to university. These include:

- **Success 101:** This one-day event is part of the First Year Foundations program that includes courses on engineering design and computer programming. Designed for incoming students, Success 101 runs four times over the summer, providing guidance on time management, effective note taking and effective teamwork strategies.
- **T-Program:** The Transition Program, or T-Program, enables first-year students faced with academic challenges to redistribute their course load, defer courses to the summer session and re-take up to three fall courses in the winter term.
- **GEARS:** Guided Engineering Academic Review Sessions (GEARS) are weekly drop-in sessions led by upper-year students. They provide guidance on both course material and specific strategies for academic success, including study habits and time management skills.
- **Support personnel:** The Faculty's full-time Learning Strategist develops academic programming and workshops to assess and enhance students' academic competencies related to task prioritization, note taking, critical thinking, problem solving, exam preparation, and coping with stress and anxiety. In addition, students are able to seek support from our on-location staff team including an embedded Health & Wellness Counsellor, a full-time Accessibility Advisor and a part-time International Transition Advisor.
- **Online courses:** We offer four courses online to enhance the flexibility of the first-year course schedule, including one (APS162: Calculus for Engineers I) held over the summer before first year begins. Enrolment in online courses in the summer of 2018 was 190 in total.

Pre-University Engineering Outreach

For more than a decade, our Engineering Outreach Office has designed and delivered a rich variety of pre-university programs that enable students in Grades 3 to 12 to experience science, technology, engineering and mathematics (STEM) in a way that is tactile and inspiring. Through these programs, we give children the opportunity to experience first-hand the promise and excitement of pursuing studies, and eventually careers, in science and engineering. Our Outreach programs foster positive relationships between the University and the community, and provide a first touch-point in recruiting potential future undergraduate students. In 2018–2019, we reached more than 7,600 pre-university students through our outreach programs. *(See Appendix A for a full list of these programs.)*

The undergraduate and graduate students who instruct and execute these programs develop valuable competencies in leadership, communications, project management and team building, while deepening their understanding of engineering principles and their application in daily life. We have also implemented a number of programs that seek to share the knowledge we have accumulated about STEM education with teachers at both the elementary and secondary levels.

Every summer, our Da Vinci Engineering Enrichment Program (DEEP) Summer Academy draws talented high school students from around the world to week-long courses, where they explore a variety of engineering, business and science disciplines. We also offer March Break and summer camps, Saturday programs and in-school workshops that inspire elementary school students to explore topics such as aerospace engineering, coding and regenerative medicine. We are particularly proud that our programs successfully connect girls and youth from underrepresented communities — including Black and Indigenous youth — with STEM.

On May 10, 2019, we hosted Go North Youth — the largest STEM event in Canada for pre-university students — for the fourth consecutive year. This year's theme of artificial intelligence (AI) gave students the opportunity to learn more about how machine learning and AI algorithms are built, as well as to explore the impact that this fast-growing field will have on their future careers. Go North Youth was created in partnership with Google Canada and Actua, a national STEM charity, and attracted more than 1,100 students in Grades 2 through 8 from across the Greater Toronto Area.

Selected Undergraduate Student Highlights

Two first-year students earn prestigious Schulich Leader Scholarships

First-year Engineering Science students **Eli Scott** and **Markus Kunej** were among four U of T students to receive the prestigious Schulich Leader Scholarships for 2018–2019. Created by business leader and philanthropist Seymour Schulich, the program recognizes 50 high school graduates across Canada and empowers recipients to make great contributions to society, both on a national and global scale. Scott was an outstanding student at Renfrew Collegiate Institute, where she played hockey and basketball and supported special education programs, including the Special Olympics and a peer-interaction program. She is considering a focus in biomedical engineering. Kunej has developed a smart belt, which he called the Echo Belt, that helps people with low vision navigate obstacles in 360 degrees using sonar. He has tested the device at a school for the visually impaired in his hometown of Brantford, Ont. He plans to specialize in either robotics, aerospace or machine intelligence.

Seven first-year students earn Pearson scholarships

Seven U of T Engineering students arrived from outside of Canada to take up their Pearson scholarships in September 2018. Named after Canada's 14th prime minister, Nobel Peace Prize laureate and U of T graduate Lester Bowles Pearson, the awards recognize exceptional academic achievement, creativity, leadership potential and community involvement. A total of 40 scholars from 24 countries received these scholarships. The 2019 U of T Engineering recipients, along with their home countries are:

Atom Arce, Year 1 TrackOne, United States
Alana Bailey, Year 1 CivMin, Jamaica
Adriana Díaz Lozano Patiño, Year 1 EngSci, Mexico
Camilo Dugand, Year 1 CivE, Colombia
Munachi Jachike Ernest-Eze, Year 1 EngSci, Nigeria
Devansh Khare, Year 1 MechE, India
Mikel Rajiv Rajkumar, Year 1 EngSci, Trinidad and Tobago

Eleven U of T Engineering students have received the Pearson Scholarship since its creation in 2017.

High performance: Two elite student athletes choose U of T Engineering

Mehdi Essoussi (ECE Year 1) and **Kirti Saxena** (MechE Year 1) are two elite athletes who compete on the world stage, and who have chosen U of T Engineering for their undergraduate degree programs. Essoussi is a midfielder with the Toronto Football Club feeder team TFC III. Before being recruited by Toronto FC Academy, he played for Team Ontario. He plans to continue playing while he studies at U of T Engineering. Saxena is a seasoned wrestler who has represented Team Canada at several world championships, including the Cadet World Championships in Tbilisi, Georgia, where she was ranked fifth in the world and received the award for “Best Cadet Wrestler” in all of Canada. She is currently training for a spot at the Olympic trials in either 2020 or 2024.



2

We attract talented graduate students from around the world to our professional- and research-stream programs. We continue to expand both the size of our graduate cohort and the variety of rich learning opportunities we offer our students. Through academic, co-curricular and experiential programs, we empower our graduate students to become leaders in their chosen fields.

Over the past decade, we have significantly increased our graduate student population, leading to larger lab group sizes with the potential for increased research impact. Our current total of 2,498 is the highest in our history, and represents 35.6% of all students, up from 22.1% in 2006–2007. By growing the number of students more quickly than the number of professors, we have increased the ratio of research-stream students per faculty member from 5.8 to 6.8 over last 10 years. When professional students are included, the increase is even greater, rising from 7.1 to 10.2 over the same period. We have more than doubled MEng enrolment over the last 10 years, including a 14-fold increase in the number of international MEng students. Graduate students across our Faculty continue to win prestigious awards such as the Vanier Canada Graduate Scholarships.

As of September 2018, international PhD tuition is the same as domestic tuition, further enhancing our ability to support PhD students. Domestic PhD enrolment remains strong, and we are leveraging initiatives such as our annual Graduate Research Days event and our membership in the Canadian Graduate Engineering Consortium to continue to attract domestic students into our programs.

In 2018–2019, we offered our Opportunities for PhDs: Transitions, Industry Options, Networking and Skills (OPTIONS) program for the second year. OPTIONS builds on the success of our Prospective Professors in Training (PPIT) program and our Graduate Career Fair, enabling students to explore professional opportunities in a variety of sectors.

Through our campus-linked accelerators such as the Hatchery Launch Lab and Start@UTIAS, we provide opportunities for our graduate students to translate their innovations into market-ready solutions. Mentorship, seed funding and infrastructure provided by U of T Engineering has helped launch companies such as Amber Molecular, Pliant Power Devices and Phycus Biotechnologies.

Enrolment

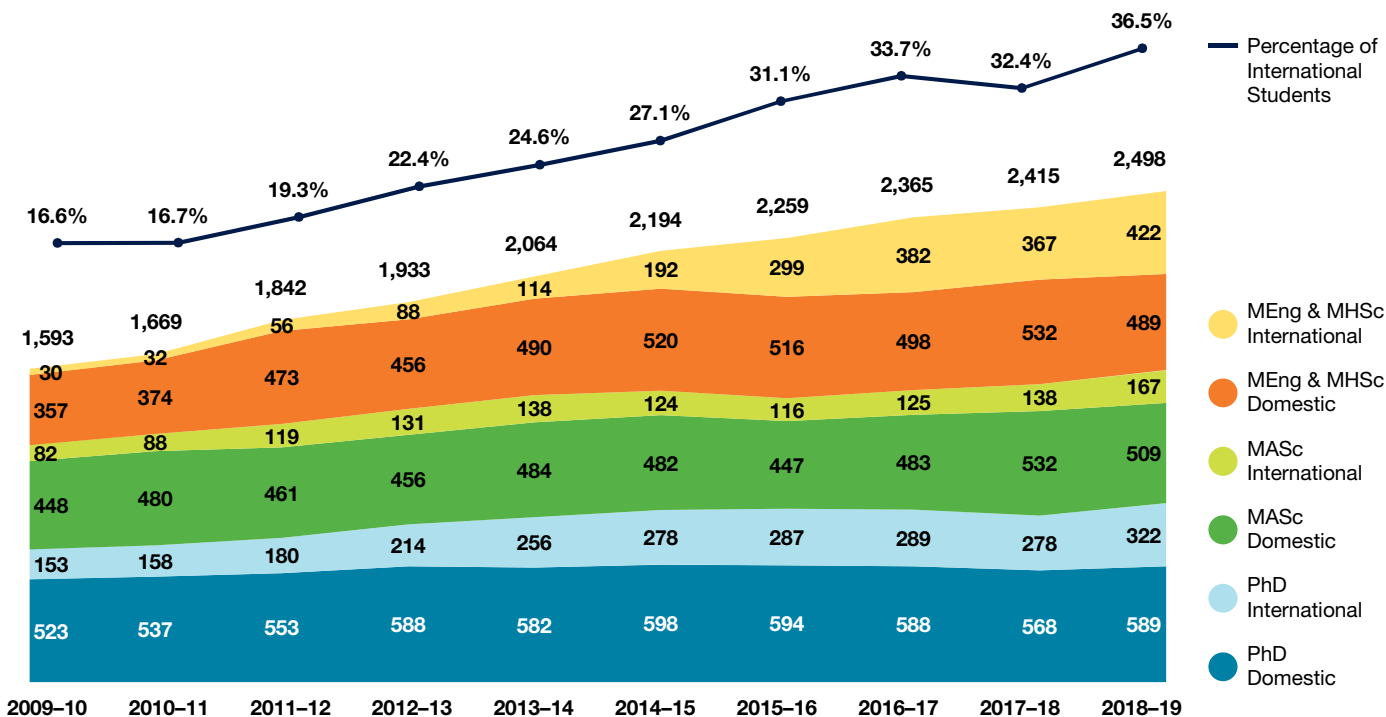
We continue to increase our educational impact by growing the number of students in both our research-stream and professional-stream programs. Total enrolment is 911 for MEng and MHSc programs, 676 for MASC programs and 911 for PhD programs — all three of these totals are the highest yet recorded. Total graduate enrolment is 2,498, a 56.8% increase over the last 10 years. Graduate students now account for 35.6% of our entire student body on a full-time equivalent basis, a significant increase from the level of 22.1% in 2006–2007. We are now closer than ever to our long-term target of 40% graduate students.

International students account for 36.5% of total enrolment, demonstrating strong demand for our programs from around the world. International PhD enrolment is up 15.8% over the previous year, while domestic enrolment

has remained strong, increasing 3.7% over 2017–2018. We continue to recruit talented graduate students both domestically and internationally through a number of initiatives, which are outlined in more detail in the *Admissions and Recruitment* section of this chapter.

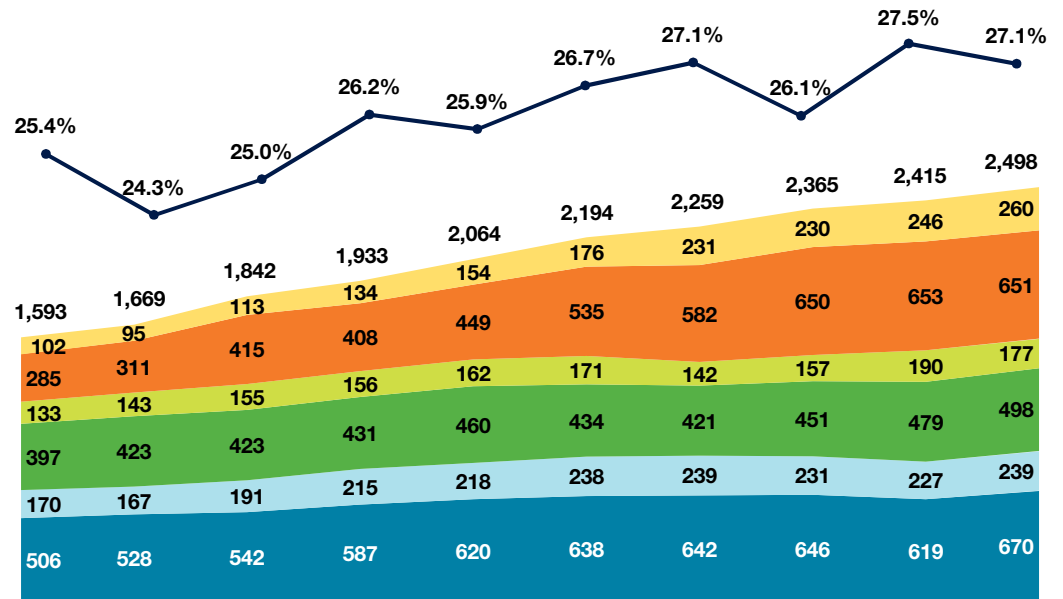
The proportion of women graduate students is 27.1%, and we expect this proportion to grow as the number of women graduating from undergraduate programs increases.

Figure 2.1a International and Domestic Graduate Students by Degree Type, with Percentage of International Students, 2009–2010 to 2018–2019



Data in this chapter are presented by academic year (September to August) unless otherwise noted. Highlights are from June 2018 to June 2019.
Note 2.1a: Student counts are shown as of November 1, 2018.

Figure 2.1b Graduate Students by Degree Type and Gender with Percentage of Women Students, 2009–2010 to 2018–2019



| | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|--------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| MEng & MSc Women | 102 | 95 | 113 | 134 | 154 | 176 | 231 | 230 | 246 | 260 |
| MEng & MSc Men | 285 | 311 | 415 | 408 | 449 | 535 | 582 | 650 | 653 | 651 |
| MEng & MSc Gender Not Reported | | | 1 | 2 | 1 | 1 | 2 | | | |
| MASc Women | 133 | 143 | 155 | 156 | 162 | 171 | 142 | 157 | 190 | 177 |
| MASc Men | 397 | 423 | 423 | 431 | 460 | 434 | 421 | 451 | 479 | 498 |
| MASc Gender Not Reported | | 2 | 2 | | | 1 | | | 1 | 1 |
| PhD Women | 170 | 167 | 191 | 215 | 218 | 238 | 239 | 231 | 227 | 239 |
| PhD Men | 506 | 528 | 542 | 587 | 620 | 638 | 642 | 646 | 619 | 670 |
| PhD Gender Not Reported | | | | | | | | | | 2 |

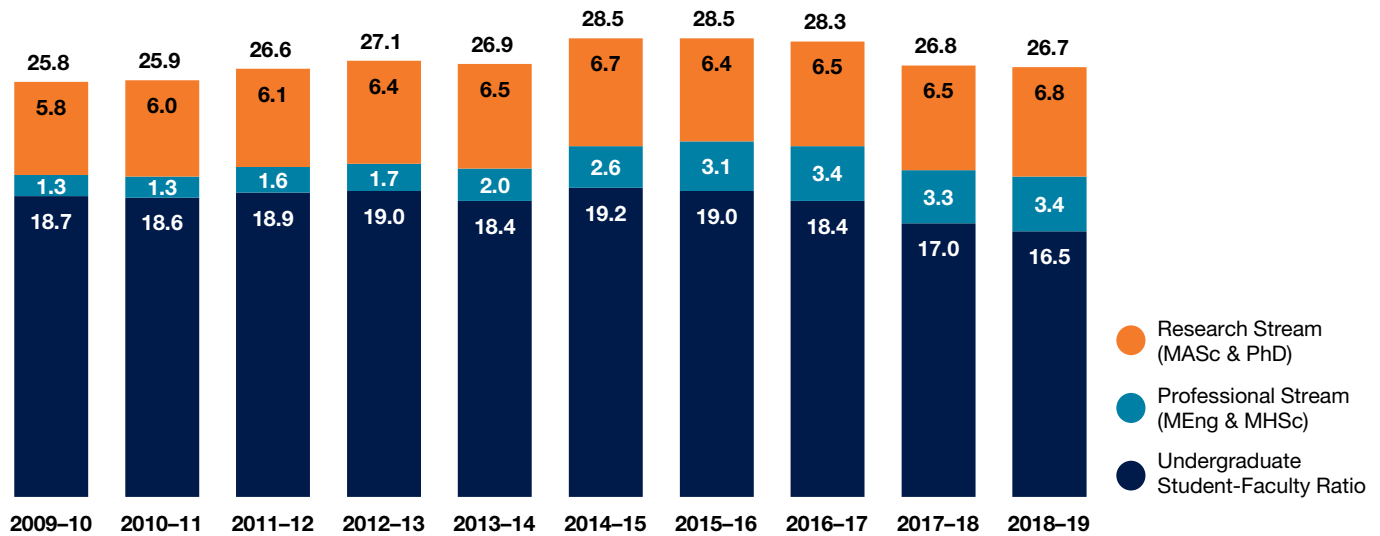
Note 2.1b: Student counts are shown as of November 1. Data on gender comes from the School of Graduate Studies' student enrolment cube, where gender is an optional category. Students who opted not to report their gender appear in the data table, but are not visible in the graph presented above.

Figure 2.1c Graduate Student Enrolment by Full-Time Equivalent (FTE) and Headcount (HC) by Academic Area, 2009–2010 to 2018–2019

| | | UTIAS | IBBME | ChemE | CivMin | ECE | MIE | MSE | Total |
|------------------|------------|--------------|--------------|--------------|---------------|------------|------------|------------|----------------|
| 2009–2010 | FTE | 130.6 | 153.0 | 209.1 | 200.2 | 421.5 | 284.3 | 70.4 | 1,469.1 |
| | HC | 132 | 153 | 221 | 238 | 453 | 320 | 76 | 1,593 |
| 2010–2011 | FTE | 140.9 | 168.0 | 195.4 | 212.6 | 403.0 | 339.2 | 68.5 | 1,527.6 |
| | HC | 143 | 168 | 208 | 256 | 431 | 391 | 72 | 1,669 |
| 2011–2012 | FTE | 143.2 | 199.0 | 202.3 | 229.8 | 437.7 | 382.6 | 68.2 | 1,662.8 |
| | HC | 146 | 199 | 217 | 276 | 479 | 454 | 71 | 1,842 |
| 2012–2013 | FTE | 146.7 | 208.3 | 193.2 | 243.3 | 504.8 | 387.2 | 68.2 | 1,751.7 |
| | HC | 153 | 209 | 203 | 279 | 565 | 453 | 71 | 1,933 |
| 2013–2014 | FTE | 162.1 | 219.0 | 209.9 | 290.5 | 509.8 | 436.2 | 90.9 | 1,918.4 |
| | HC | 167 | 219 | 219 | 322 | 556 | 488 | 93 | 2,064 |
| 2014–2015 | FTE | 182.4 | 228.0 | 238.0 | 293.1 | 531.5 | 511.2 | 80.3 | 2,064.5 |
| | HC | 188 | 228 | 245 | 312 | 577 | 563 | 81 | 2,194 |
| 2015–2016 | FTE | 143.2 | 241.0 | 253.0 | 299.4 | 591.5 | 532.9 | 79.0 | 2,140.0 |
| | HC | 146 | 241 | 260 | 326 | 637 | 570 | 79 | 2,259 |
| 2016–2017 | FTE | 178.2 | 269.0 | 245.0 | 306.3 | 577.0 | 580.3 | 92.3 | 2,248.1 |
| | HC | 181 | 269 | 252 | 335 | 619 | 616 | 93 | 2,365 |
| 2017–2018 | FTE | 170.1 | 296.0 | 246.7 | 313.0 | 551.5 | 602.8 | 94.9 | 2,275.0 |
| | HC | 175 | 303 | 253 | 348 | 597 | 642 | 97 | 2,415 |
| 2018–2019 | FTE | 191.4 | 283.3 | 219.5 | 304.0 | 618.8 | 658.0 | 94.9 | 2,369.9 |
| | HC | 197 | 291 | 223 | 332 | 658 | 700 | 97 | 2,498 |

Note 2.1c: A difference between FTE and HC exists only when discussing part-time students. At U of T Engineering, MEng candidates are the only graduate students who can pursue their studies on a part-time basis.

Figure 2.2a Undergraduate and Graduate Full-Time Equivalent Student-to-Faculty Ratios, 2009–2010 to 2018–2019



As our complement of faculty members has grown over the past decade, we have strategically managed our student-to-faculty ratios to both strengthen our multidisciplinary research and enhance the quality of our educational programs. By growing the number of graduate students more quickly than the number of professors, we have raised the ratio of research stream students (MAsc & PhD) to faculty members from 5.8 to 6.8 over the past 10 years. This increase reflects larger lab groups sizes with the potential for increased research impact. When professional students (MEng and MHSc) are included, the increase is even higher, rising from 7.1 to 10.2, the highest in our history. At the same time, our undergraduate student-to-faculty ratio is at its lowest level in 10 years, providing for smaller class sizes and enhanced interaction between professors and students.

Note 2.2a: To allow more accurate comparisons, undergraduate FTEs are determined by counting each part-time student as 0.3 FTE.

Figure 2.2b Ratio of Undergraduate to Graduate Full-Time Equivalent Students, 2009–2010 to 2018–2019

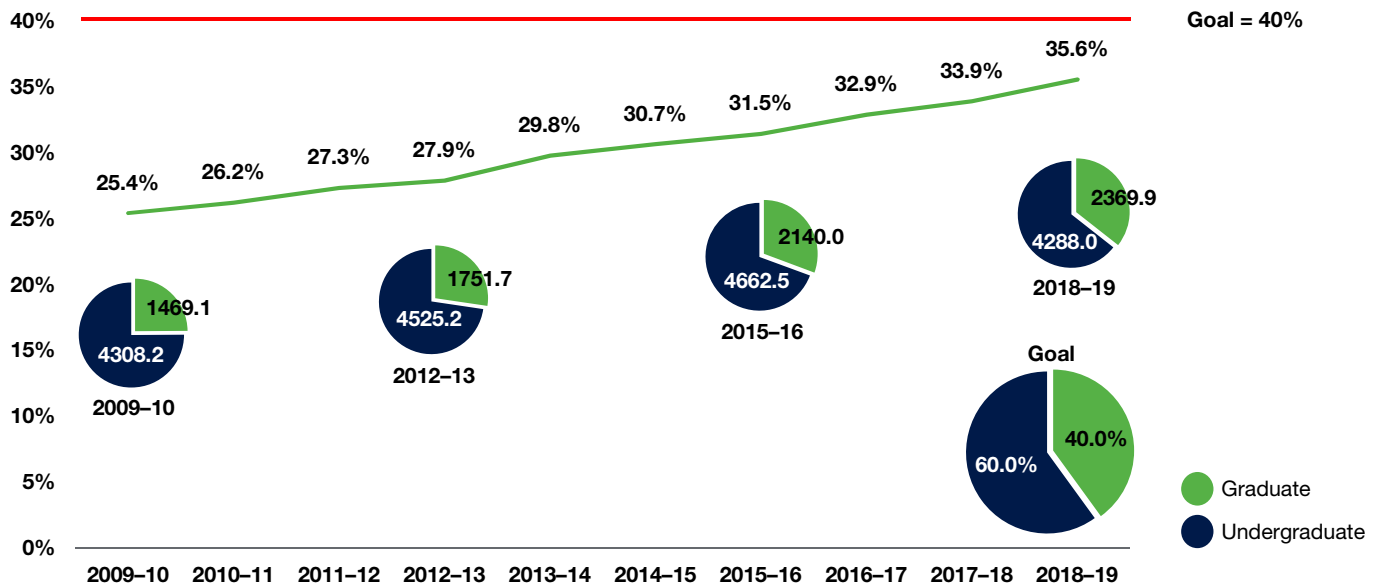
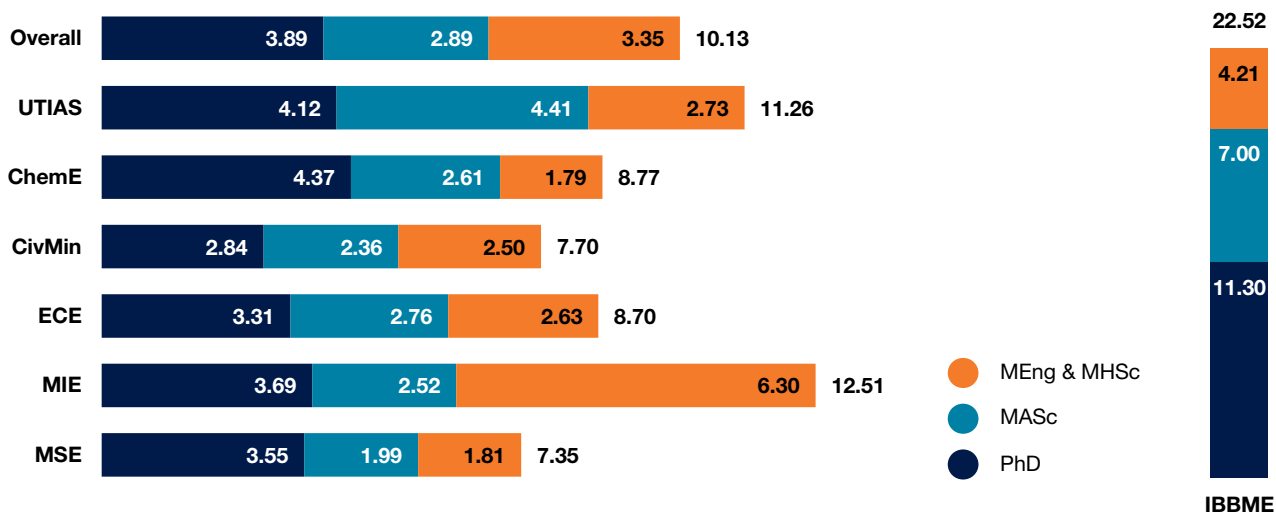


Figure 2.2c Full-time Equivalent Graduate Student-to-Faculty Ratios by Academic Area and Degree Type, 2018–2019



Note 2.2b: Students on PEY Co-op are not included in this count.

Note 2.2c: Some students in IBBME are supervised by faculty members from the Faculties of Medicine and Dentistry and affiliated hospitals, as well as from other departments within U of T Engineering. Because the ratio includes only faculty with a budgetary appointment in IBBME, comparisons with other Engineering departments are not possible. For that reason, this figure shows IBBME in a visually distinct way. In cases of inter-departmental supervision within the Faculty, PhD and MAsc students are assigned 100% to their primary supervisor's department.

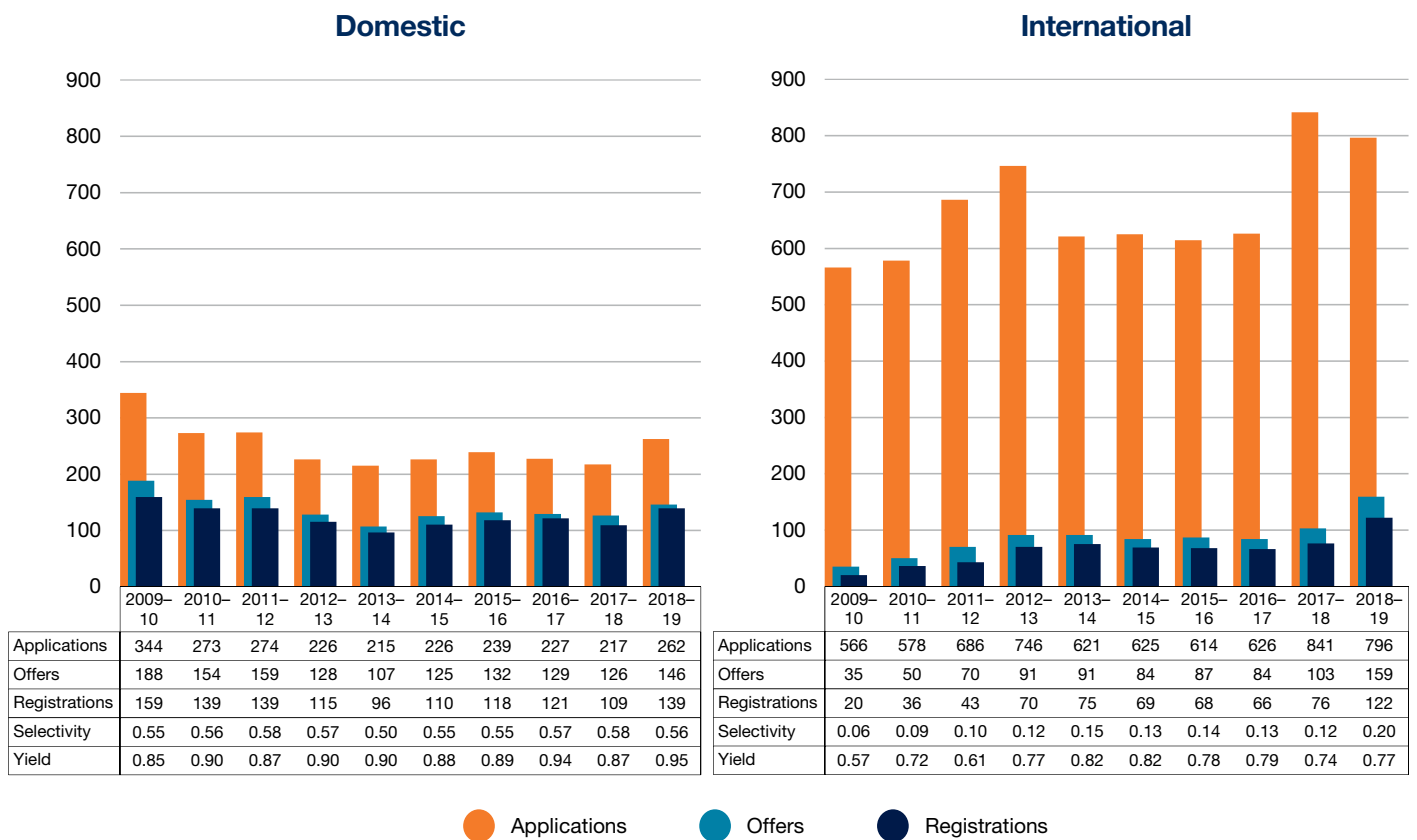
Admissions and Recruitment

We continue to strategically recruit talented domestic students into our graduate programs. Through an ongoing digital marketing campaign, we advertise to top students at engineering schools across the country, driving them to our graduate studies website for further admissions and program information.

We are also a founding member of the Canadian Graduate Engineering Consortium (CGEC). Through CGEC, we hosted the U of T Graduate Engineering Fair on September 25, 2018, with 473 students in attendance, a 46.0% increase from the previous year. We conducted similar events in Vancouver, Edmonton, Calgary, Hamilton, Waterloo, Kingston and Montreal throughout the fall of 2018.

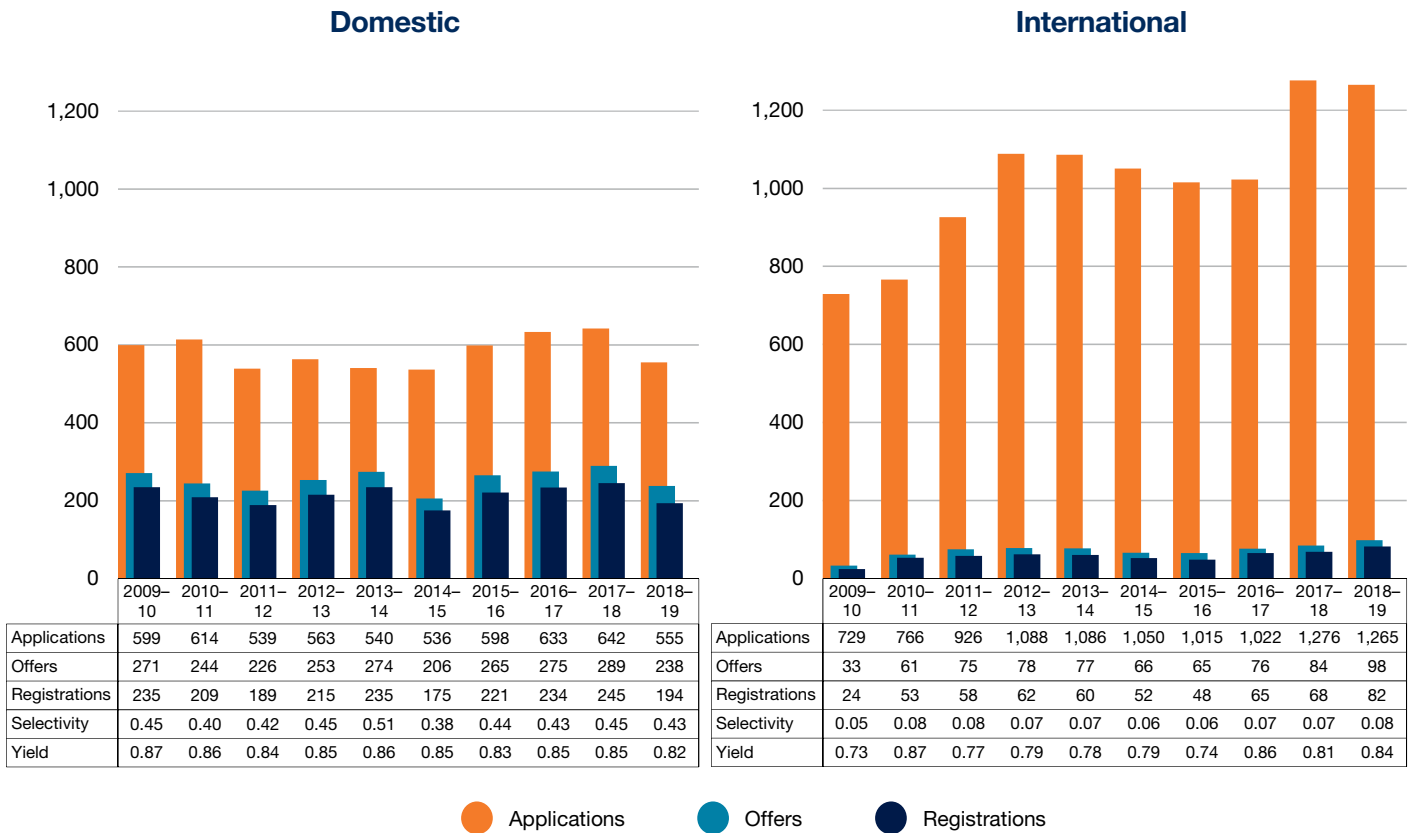
We held our fifth annual Graduate Research Days event from February 21 to 23, 2019, inviting talented students to learn more about our innovative research projects and meet with professors and current students. We hosted 142 prospective graduate students from eight Canadian provinces as well as the U.S., Iran, India and the U.K.

Figure 2.3 Domestic and International PhD Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019



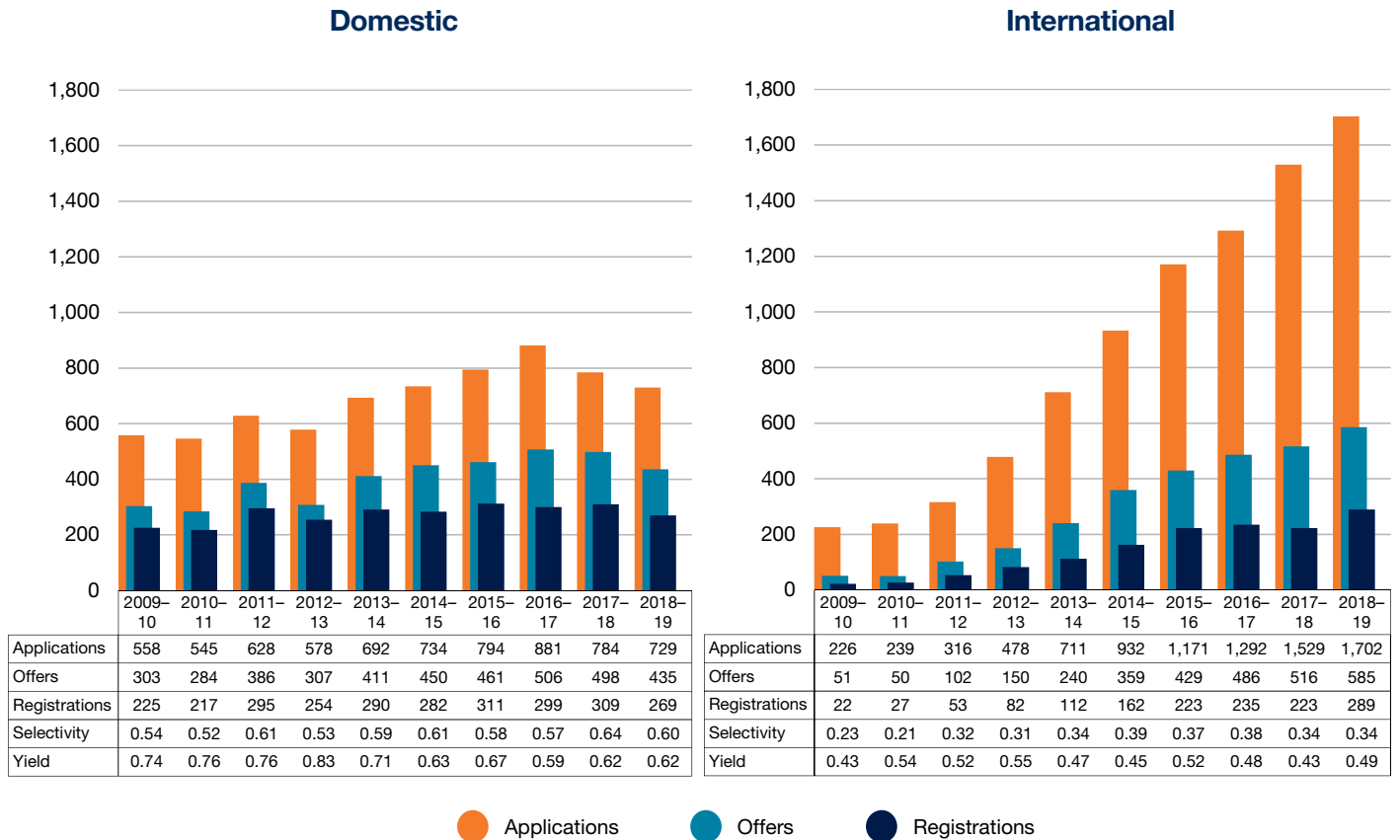
Note 2.3: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada. Students who have fast-tracked from MAsc programs into PhD programs are counted in this figure as applications, offers and admissions.

Figure 2.4 Domestic and International MASc Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019



Note 2.4: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

Figure 2.5 Domestic and International MEng and MHSc Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019



Note 2.5: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

Funding

In 2017–2018, the most recent year for which data is available, total graduate funding reached an historic high of \$50.9 million, a 5.2% increase over the previous year.

As of September 2018, all programs offer a minimum funding amount sufficient to cover tuition and fees and provide an additional annual stipend of at least \$17,000 per year for PhD students, and \$16,000 per year for MASc students. Most students earn more than this minimum as a result of scholarships and teaching assistantships, bringing the average engineering graduate student stipend for those in the funded cohort to approximately \$25,000 per year.

As of September 2018, international PhD students across the entire University now pay the same tuition fees as domestic students. The new fee structure affects students in all years of a PhD program. It excludes students in research master’s programs.

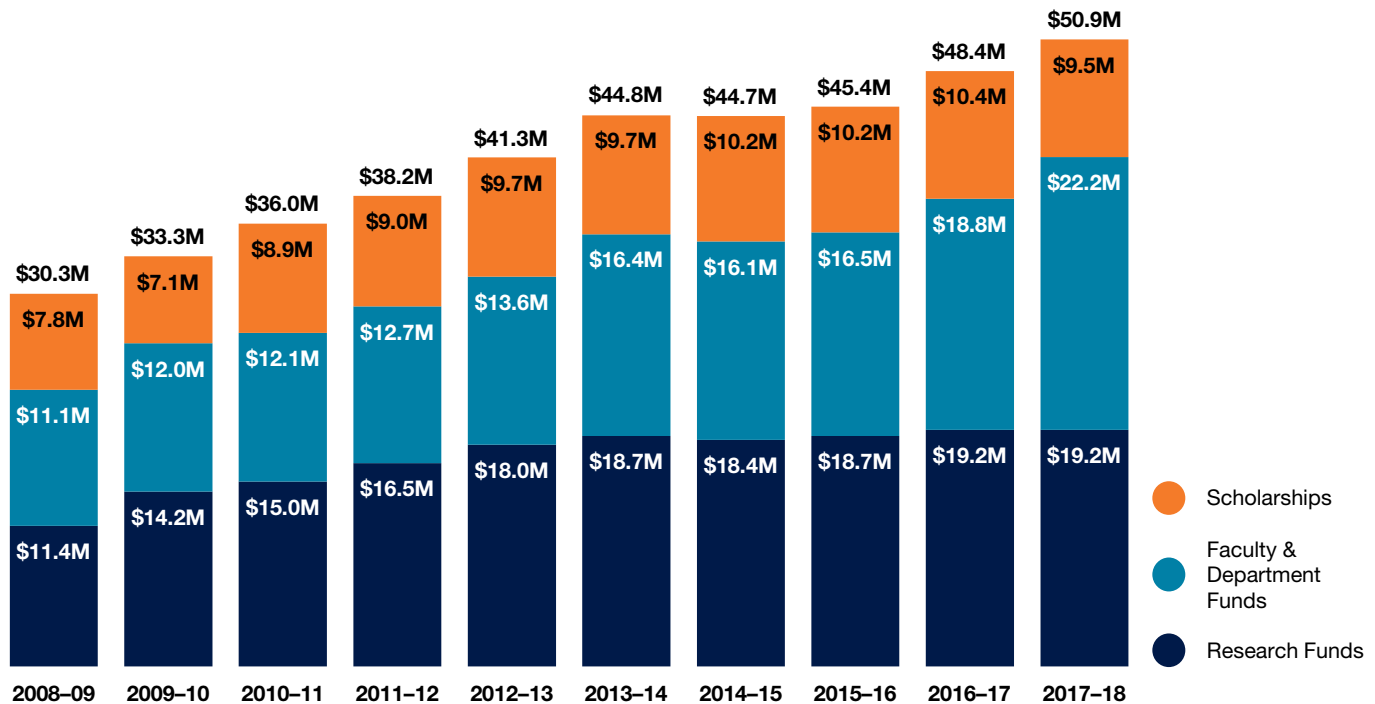
The total amount of graduate student scholarships decreased from \$10.4 million in 2016–2017 to \$9.5 million in 2017–2018 (Fig. 2.6a). These scholarships come from a wide range of sources, both external to

U of T Engineering (e.g., Ontario Graduate Scholarships, NSERC) and internal (including donor-supported scholarships). However, this total does not include University-level scholarships, such as the Vector Institute Scholarships (see *Selected Graduate Student Highlights* below).

While the total from the provincial level (Ontario Graduate Scholarships, OGS) grew over the previous year, the amounts in the other categories (federal-NSERC, External-Other, Internal) were smaller than the previous year. This change has a number of possible causes:

- Canada Graduate Scholarships for master’s students (CGSM) are allocated to universities based on a formula that is recalculated every two years. The allocation for the University of Toronto was 110 in 2016–2017, but decreased to 74 for 2017–2018.
- If CGSM scholarships are offered to prospective students who then choose to study at other institutions, the declined scholarship is not necessarily offered to another U of T Engineering student, and may go to a student in another area of the University.

Figure 2.6a Graduate Student Funding by Category, 2008–2009 to 2017–2018



Note 2.6a: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

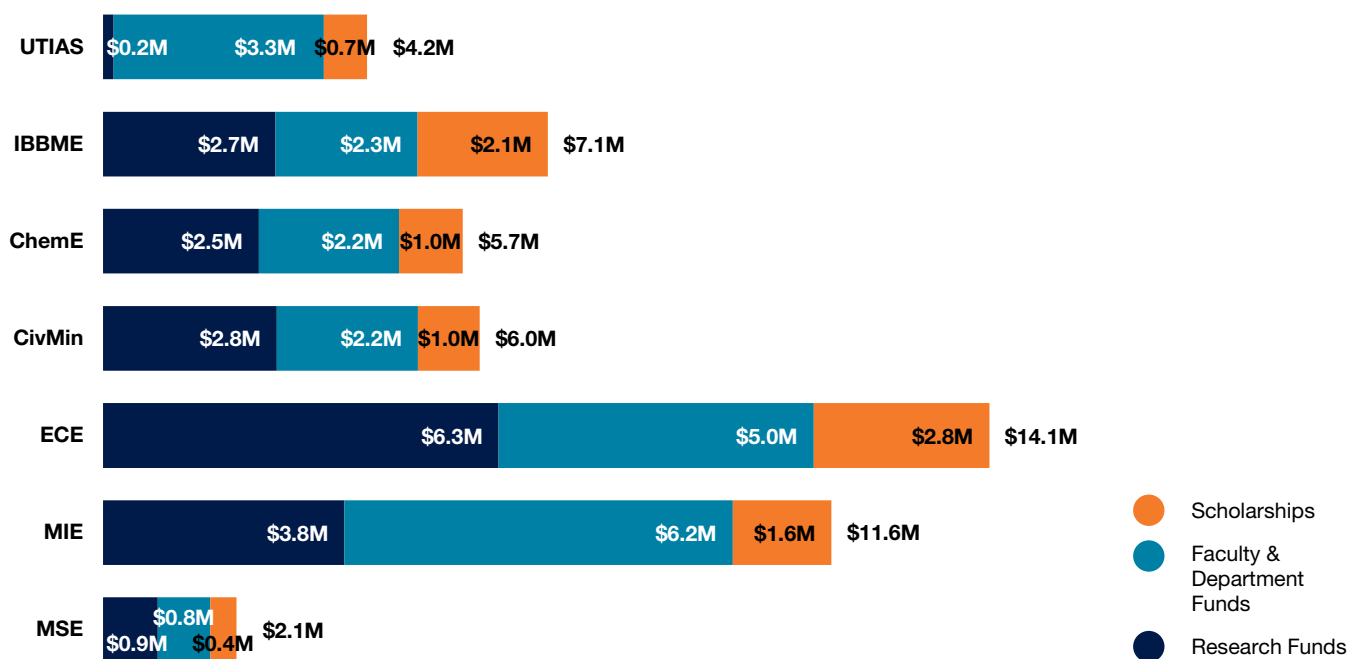
- PhD students may be receiving more two-year scholarships than three-year ones as a result of either applying later or being more successful later in their program. We will analyze this data in future reports.
- Undergraduate students may be taking more industry-related jobs (including work terms through PEY Co-op) rather than summer research placements that would qualify them for these scholarships.

We continue to work with the School of Graduate Studies to increase the number of successful scholarship applications among our graduate students. One recent example of success is the NSERC/CIHR/SSHRC Banting Postdoctoral Fellowship, which aims to attract and retain top-tier postdoctoral talent, both nationally and internationally. Dr. Mengfei Wu (ECE) earned this award in 2019–2020, which provides a total of \$140,000 in support over two years.

Over the past 10 years, we have also increased the number of internal awards, including donor-supported scholarships, which now represent 46.9% of total graduate student funding compared to 39.5% in 2008–2009. This reflects the dedication of our diverse community of donors and our ability to attract support for engineering research.

Future opportunities include increased governmental funding for industrial internships and research exchanges abroad. We continue to promote these opportunities to our graduate students and encourage them to apply for external scholarships. In parallel, we continue to work with the provincial and federal governments to increase the amount of funding available in direct support.

Figure 2.6b Graduate Student Funding by Category and Academic Area, 2017–2018

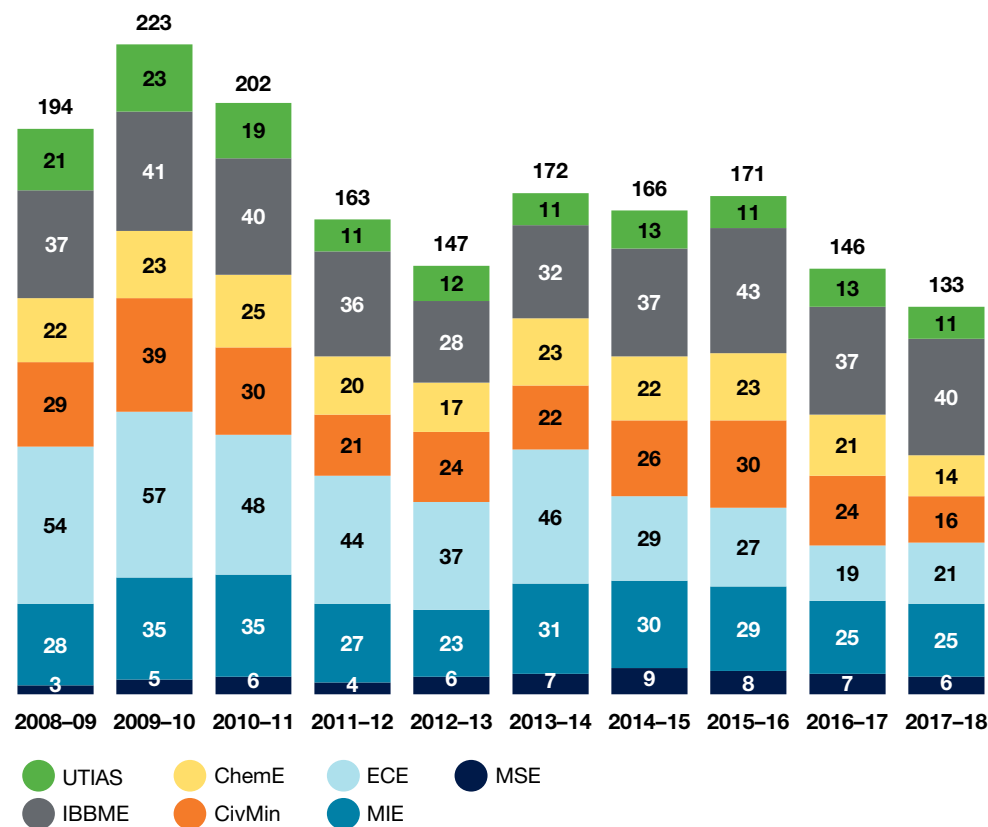


Note 2.6b: Data were obtained from the new Student Accounts Reporting Cube. Data for previous annual reports were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Figure 2.7a Total External Graduate Student Scholarships by Source, 2008–2009 to 2017–2018

| | NSERC | OGS | External-Other | Internal | Total |
|---------|-------------|-------------|----------------|-------------|--------------|
| 2008–09 | \$3,737,157 | \$868,332 | \$111,770 | \$3,075,758 | \$7,793,017 |
| 2009–10 | \$4,393,513 | \$853,334 | \$203,167 | \$1,613,187 | \$7,063,201 |
| 2010–11 | \$4,396,617 | \$1,036,675 | \$179,580 | \$3,280,401 | \$8,893,273 |
| 2011–12 | \$3,765,883 | \$1,593,328 | \$256,860 | \$3,381,086 | \$8,997,157 |
| 2012–13 | \$3,374,183 | \$1,583,333 | \$285,501 | \$4,445,430 | \$9,688,448 |
| 2013–14 | \$3,759,671 | \$1,236,666 | \$582,170 | \$4,088,309 | \$9,666,816 |
| 2014–15 | \$3,488,447 | \$1,336,670 | \$877,587 | \$4,487,866 | \$10,190,570 |
| 2015–16 | \$3,315,223 | \$1,223,331 | \$926,787 | \$4,748,300 | \$10,213,641 |
| 2016–17 | \$3,315,223 | \$1,223,331 | \$926,787 | \$5,157,619 | \$10,381,390 |
| 2017–18 | \$2,779,055 | \$1,525,000 | \$762,281 | \$4,479,707 | \$9,546,043 |

Figure 2.7b Number of NSERC Graduate Student Award Recipients by Academic Area, 2008–2009 to 2017–2018



Note 2.7a, b: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Graduate Studies Completion

We continue to encourage students to maximize their research impact by fast-tracking from MASc programs into PhD programs, and to apply for PhD programs directly from their undergraduate degrees. In 2018-2019, 45 students fast-tracked, our highest total to date, and 27 students started direct-entry PhD programs, our highest total to date.

Figure 2.8a **Number of Students Fast-Tracked from MASc to PhD by Academic Area, 2009–2010 to 2018–2019**

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| UTIAS | 6 | 5 | 2 | 5 | 6 | 10 | 1 | 3 | 10 | 5 |
| IBBME | 12 | 8 | 5 | 8 | 8 | 12 | 14 | 8 | 10 | 14 |
| ChemE | 11 | 4 | 8 | 7 | 14 | 8 | 5 | 7 | 5 | 6 |
| CivMin | 3 | 2 | 5 | 2 | 3 | 1 | 5 | 5 | 7 | 3 |
| ECE | 1 | 6 | 4 | 2 | 4 | 5 | 4 | 3 | 6 | 14 |
| MIE | 7 | 6 | 6 | 6 | 5 | 2 | 8 | 13 | 6 | 3 |
| MSE | 1 | 3 | 7 | 1 | 3 | 4 | 2 | 2 | 0 | 0 |
| Total | 41 | 34 | 37 | 31 | 43 | 42 | 39 | 41 | 44 | 45 |

Figure 2.8b **Number of Direct-Entry PhD Students by Academic Area, 2009–2010 to 2018–2019**

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|---------------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| IBBME | 6 | 6 | 5 | 5 | 7 | 3 | 5 | 7 | 11 | 9 |
| ChemE | | | 1 | | | | 5 | 1 | | 12 |
| CivMin | | | | | | | | 1 | | 2 |
| ECE | | | | | | 2 | 2 | 2 | 2 | 2 |
| MIE | | | 1 | 1 | | | | 4 | | 2 |
| Total | 6 | 6 | 7 | 6 | 7 | 5 | 12 | 15 | 13 | 27 |

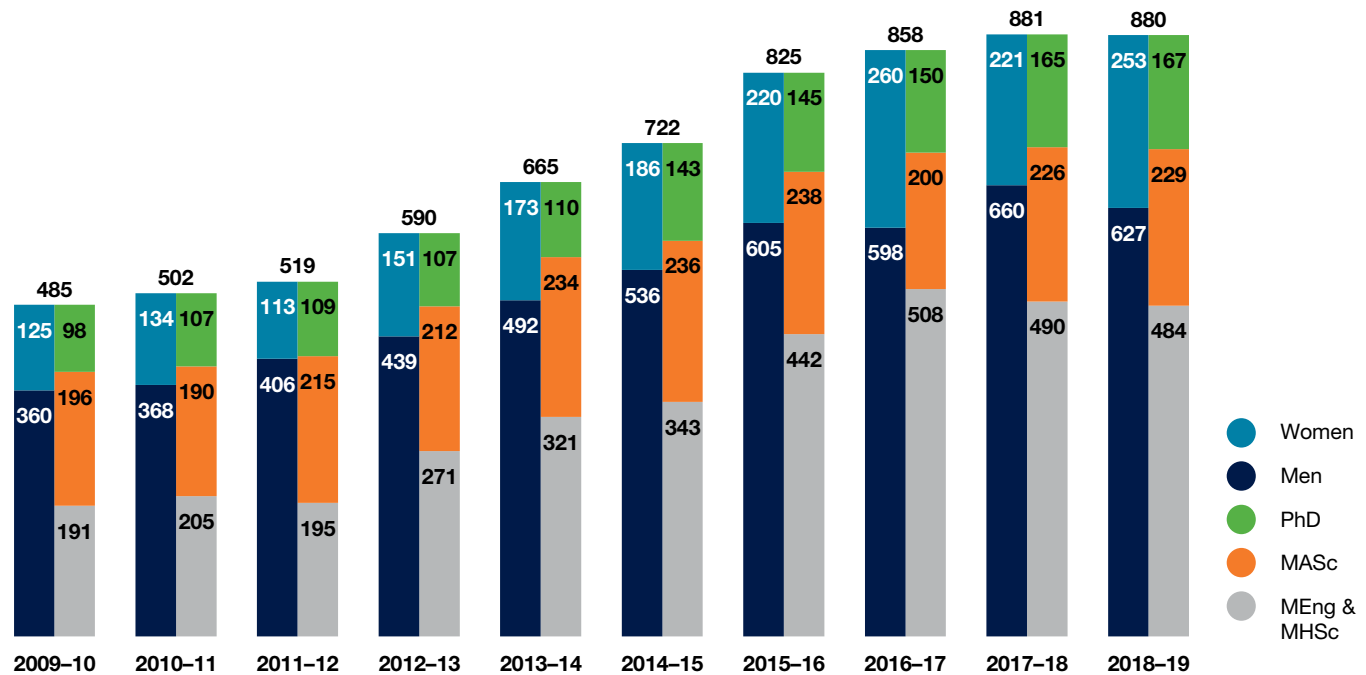
Note 2.8a and b: For counting purposes, the academic year is from May to April.

Figure 2.9 Time to Completion for PhD, MASc, MEng and MHSc Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 4.7 | 5.3 | 5.0 | 5.3 | 5.2 | 5.3 | 5.3 | 5.3 | 5.0 | 5.3 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| MEng & MHSc (FT) | 1.0 | 1.0 | 1.0 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (ExtFT) | | | | | | 1.3 | 1.7 | 1.7 | 1.7 | 1.7 |
| MEng (PT) | 2.3 | 2.3 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.3 | 2.0 | 2.0 |

In 2018–2019, women made up 28.8% of our graduating class. The number of women receiving degrees has more than doubled over the past decade. The number of PhDs awarded in 2018–2019 was 167, representing a 70.4% increase over the past 10 years.

Figure 2.10 Graduate Degrees Awarded by Degree Type and Gender, 2009–2010 to 2018–2019



Note 2.9: For a complete breakdown of time to completion for PhD, MASc, MEng and MHSc students by department, please see Appendix B.

Enriching the Graduate Student Experience

Graduates of our master's and doctoral programs represent the next generation of leaders in academia, industry and government, as well as in entrepreneurship. We continue to expand and enrich our curricular and co-curricular programs to further enhance opportunities for them to develop competencies that enable lifelong career success.

Our professional master's programs enable students to advance their technical knowledge, develop professional competencies and specialize in emerging areas, from Analytics to Forensic Engineering. One of our most popular emphases is the Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE), which integrates advanced instruction on emerging technical topics such as blockchain and AI with courses on management consulting, portfolio management, business strategy and leadership. In 2017–2018, 109 students completed an ELITE emphasis. We also expanded our ELITE curriculum to include new courses in emerging areas, such as:

- APS1050H: Blockchain Technologies and Cryptocurrencies
- APS1051H: Portfolio Management Praxis Under Real Market Constraints
- APS1052H: AI in Finance

Our newest MEng emphasis in Analytics launched in January 2018, and draws on the Faculty's expertise in areas such as operations research, computational genomics and intelligent mechatronic systems. It provides students with techniques and strategies focused around three themes: descriptive analytics (e.g. data mining), predictive analytics (e.g. machine learning) and prescriptive analytics (e.g. system optimization). Using these tools, students gain new competencies in translating large data sets into useful insights for sectors such as manufacturing, transportation, banking and health care. New courses, including the ones listed above, have been developed to support this emphasis.

Figure 2.11 ELITE Emphases Awarded, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|---------------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|
| AeroE | 1 | 2 | | 7 | 2 | 4 | 11 | 1 | 17 | 3 |
| ChemE | 2 | 12 | 11 | 17 | 8 | 20 | 20 | 18 | 13 | 15 |
| CivMin | 11 | 13 | 11 | 9 | 12 | 12 | 24 | 22 | 16 | 21 |
| ECE | 3 | 3 | 3 | 22 | 32 | 22 | 14 | 28 | 30 | 15 |
| MIE | 7 | 19 | 20 | 26 | 36 | 39 | 50 | 53 | 41 | 48 |
| MSE | | 1 | 1 | 4 | 6 | 11 | 5 | 15 | 1 | 7 |
| Total | 24 | 50 | 46 | 85 | 96 | 108 | 124 | 137 | 118 | 109 |

Professional Development

Several of our co-curricular programs focus on enabling graduate students — especially those in the research streams — to develop their professional competencies and gain industry exposure. They include:

- **Prospective Professors In Training (PPIT):** For more than a decade, PPIT has prepared doctoral students for the rigors of an academic position. The program includes seminars on applying for academic positions and grants, managing a classroom, starting research programs, and best practices in teaching and learning. In 2018–2019, more than 30 PhD candidates were enrolled in PPIT.
- **Opportunities for PhDs — Transitions, Industry Options, Networking and Skills (OPTIONS):** Transitions, Industry Options, Networking and Skills (OPTIONS): Now in its second year, OPTIONS builds on the format of PPIT, exploring non-academic careers in industry research and development, government policy and entrepreneurship. Through a series of workshops, panel discussions and networking events, OPTIONS participants learn about labour market information, career planning, resumé building and fostering productive team dynamics. Through the Fall 2018 semester, 30 students completed all the requirements of OPTIONS, and a total of 229 participated in complementary events associated with the program.
- **Graduate Engineering Council of Students (GECoS):** This new student body meets regularly with the Vice-Dean, Graduate Studies to advise on academic policy and programs. A new initiative this year was the creation of the Graduate Engineering Networking Series, in which U of T Engineering alumni offered insider perspectives on how to stand out in a competitive marketplace, and advice on developing competencies that are valued in their respective fields. Events focused on Data Analytics & Artificial Intelligence, Advanced Manufacturing and Sustainability were held throughout the fall of 2018 and winter of 2019.
- **Graduate Career Fair:** Since 2017, we have hosted a Graduate Career Fair, bringing together a diverse array of employers seeking to recruit U of T Engineering graduate students and alumni with graduate degrees. At the event's third iteration in May 2019, GECoS partnered with the Engineering Career Centre to broaden the range of company partnerships. The career fair attracted 41 companies, from Intel Programmable Solutions Group to U of T Engineering startup Kepler Communications. Attendees also had the opportunity to participate in a speed networking event, which enabled career-seekers to build connections with industry. A total of 430 graduate students and engineering professionals with graduate degrees attended.
- **Graduate Peer and Career Support (Grad PACS):** A new initiative for 2018–2019, Grad PACS supports new graduate students as they identify career pathways and launch their career planning early in their degree. The program is facilitated by Grad PACS Guides, who are experienced PhD students that are trained as mentors. The first three mentors — Chaim Katz (IBBME), Ezzat Jaroudi (ChemE) and Darya Maedeh Amirmaleki (MIE) — began as Grad PACS Guides in January 2019.

Selected Graduate Student Highlights

Six U of T Engineering graduate students awarded Vanier Scholarships

The Vanier Canada Graduate Scholarships recognizes and supports PhD students who demonstrate excellence in academics, research impact and leadership. This year, six U of T Engineering students received these prestigious awards, including:

- **Amin Kamaledin Ezabadi (IBBME PhD candidate)** — Ezabadi is identifying drug targets at a molecular level to develop clinically effective treatments for chronic pain.
- **Surath Gomis (ECE PhD candidate)** — Gomis focuses on designing microfluidic devices to characterize and sort retinal stem cells — a rare cell type with promising therapeutic applications of reversing blindness due to degenerative eye disease.
- **Chaim Katz (IBBME PhD candidate)** — Katz is investigating deep brain stimulation — the process by which electrical pulses are delivered to the brain to regulate its activity — to learn how the process can be used to improve memory and alleviate the cognitive effects of, and lend insight to, memory modification for other neurodegenerative diseases.
- **Hannah Kozlowski (IBBME MD/PhD candidate)** — Kozlowski aims to improve current diagnostic tests for infectious diseases such as HIV, hepatitis and influenza by creating an algorithm that looks at changes in microorganisms and uses that information to predict whether a test will provide a true diagnosis.
- **Shane Saunderson (MIE PhD candidate)** — Saunderson's research anticipates a future where social robots become nearly ubiquitous and are required to take on a variety of roles that collaborate with humans. He is currently investigating how interactions with robots influence and affect humans, particularly in roles involving trust, persuasion and empathy.
- **Trevor Stirling (ECE PhD candidate)** — Stirling works on the design and implementation of entangled photon lasers on silicon-based computer chips. These devices will be used to interconnect quantum bits on chip to help realize scalable quantum computing, as well as provide a platform for further research into the applications of quantum light.

Nine U of T Engineering graduate students awarded Vector Institute Scholarships in Artificial Intelligence

Nine U of T Engineering master's students were among 66 recipients from across Ontario to receive Vector Scholarships in Artificial Intelligence (VSAI) from the Vector Institute. The Vector Institute supports Ontario's growing artificial

intelligence (AI) ecosystem through a number of initiatives, including scholarships to increase the number of graduates from AI-related master's programs. Vector scholars are invited to various networking and professional development events at the Institute throughout the year.

The U of T Engineering Vector scholars are:

- **Matthew Crowson (MIE)**
- **Ke Dong (UTIAS)**
- **Daniel Dworakowski (MIE)**
- **Salma Emara (ECE)**
- **Yan Fu (ECE)**
- **Adam Hall (UTIAS)**
- **Sepehr Samavi (UTIAS)**
- **Xiaodan (Serina) Tan (ECE)**
- **Jeremy Wong (UTIAS)**

aUToronto wins AutoDrive Challenge™ for second year in a row

For the second year in a row, the U of T Engineering team aUToronto placed first overall in the AutoDrive Challenge™, beating out teams from seven other universities across North America. During the three-year competition, undergraduate and graduate students from engineering and computer science work together to convert an electric Chevrolet Bolt into a fully self-driving car. The team is led by **Keenan Burnett** (EngSci 1T6+PEY, UTIAS MASc candidate) and is advised by several U of T Engineering professors with expertise in autonomous vehicles. The second leg of the competition took place at MCity, a simulated town for self-driving vehicle testing built at the University of Michigan in Ann Arbor. aUToronto and their vehicle, dubbed "Zeus", placed first in nearly every category, from concept design to social responsibility. The third leg of the competition will take place in the spring of 2020.



3

U of T Engineering research is defined by multidisciplinary excellence in innovation and collaboration. We produce high-impact publications and — through our rich entrepreneurial ecosystem and global network of collaborators, including many industry leaders — we ensure that new technologies are translated from the lab to the marketplace to improve the lives of people around the world.

Our faculty members and graduate students are world leaders in our strategic research foci: advanced materials and manufacturing; analytics and artificial intelligence; human health; robotics; sustainability; and water. U of T Engineering is home to 120 research chairs and professorships, as well as 29 multidisciplinary research institutes, the newest of which, the Centre for Analytics and Artificial Intelligence Engineering (CARTE), launched in July 2019. We have also evolved the structure of the University of Toronto Robotics Institute to focus on three pillars: autonomous vehicles and field robotics, health care robotics and robotics in advanced manufacturing.

In 2017–2018, the most recent year for which complete data is available, we attracted research operating funds of \$77.0 million from a wide variety of sources. We have increased the proportion of our funding that comes from direct partnerships with industry to \$12.7 million, a 41.1% increase over the previous year, and more than double the value from five years ago. Our more than 400 industry partners include local startups and major multinationals. The Fujitsu Co-Creation Research Laboratory, housed on the top floor of the Myhal Centre, is one example of our innovative collaborations.

We continue to make strategic investments to foster multidisciplinary collaboration initiatives. XSeed, a seed funding program that supports partnerships between professors at U of T Engineering and other Faculties across the University, was launched in January 2018. Eight projects were supported by XSeed, and 11 more were funded in the 2019 cohort, including partnerships with the Faculty of Arts & Science, University of Toronto Mississauga, University of Toronto Scarborough and the Faculty of Kinesiology & Physical Education.

In the past year, our faculty and students have developed innovations with applications in fields from medicine to energy — including miniature robots that can probe the inside of cancer cells, and low-cost catalysts for producing sustainable fuels. Companies founded on U of T Engineering research, such as AmacaThera, TARA Biosystems and Peraso Technologies, continue to generate significant investment and make powerful contributions to their respective sectors.

Selected Highlights Organized by Innovation Cluster

Advanced Manufacturing

Startup based on U of T Engineering research raises US\$42 million to alleviate congested wireless networks

A Canadian semiconductor startup based on technology developed in the lab of Professor Sorin Voinigescu (ECE) has raised US\$42 million to ease the strain on increasingly congested wireless networks. Founded in 2009, Toronto-based Peraso Technologies develops chips for the 60 gigahertz (GHz) band, enabling more data to be pushed through wireless hotspots for applications such as streamed 4K television or virtual reality. The technology could be used in 5G wireless data networks, as well as the emerging Wi-Gig standard, an ultra-fast type of Wi-Fi. While Voinigescu is no longer involved with the company, it was founded by his former graduate students, and his team fabricated and tested the initial prototypes.

Toward a future quantum Internet

U of T Engineering researchers have demonstrated proof-of-principle for a device that could serve as the backbone of a future quantum Internet. Professor Hoi-Kwong Lo (ECE, Physics) and his collaborators have developed a prototype for a key element for all-photonic quantum repeaters, a critical step in long-distance quantum communication. Existing repeaters for quantum information require storage of the quantum state at the repeater sites. They are error prone, difficult to build and, because they operate at cryogenic temperatures, energy-intensive. All-photonic quantum repeaters would eliminate or reduce many of these shortcomings. With collaborators at Osaka University, Toyama University and NTT Corporation in Japan, Lo and his team demonstrated proof-of-concept of their work in a paper published in *Nature Communications*.

Data Analytics and Artificial Intelligence

U of T Engineering launches new AI research centre

A new multidisciplinary research centre at U of T Engineering will leverage the power of AI to address challenges in a wide range of fields, including human health, sustainability and advanced manufacturing. The Centre for Analytics and Artificial Intelligence Engineering (CARTE), launched July 1, 2019, fosters collaborations between researchers who study analytics and AI directly and those in domains where AI could be a useful tool. It brings together more than 30 professors with expertise in optimization, analytics and AI, energy, transportation, and life sciences, among many others. Together, they will catalyze translation

of analytics and AI techniques and algorithms to practical challenges, and provide boundless opportunities to prepare the next generation of AI leaders. CARTE has deep ties to the Engineering Science major in Machine Intelligence — the first undergraduate engineering program of its kind in Canada — as well as the undergraduate minor and certificate in Artificial Intelligence Engineering.

EngSci student holds companies accountable for biased AI facial recognition technology

A study by Engineering Science student Deb Raji (Year 4 + PEY) and researchers at the Massachusetts Institute of Technology (MIT) underscores the racial and gender biases found in facial-recognition services. Raji spent the summer of 2018 conducting research at MIT's Media Lab, where she audited commercial facial recognition technologies made by leading companies such as Microsoft, IBM and Amazon. The researchers discovered that all of them had a tendency to mistake darker-skinned women for men, but that one service in particular — Amazon's Rekognition — showed a higher level of bias than the rest. Rekognition was recently piloted by police in Orlando, Fla., using the service in policing scenarios such as scanning faces on cameras and matching them against those in criminal databases. The researchers suggest that the bias within the algorithm could lead to misidentification of suspects. The work was presented at the Association for the Advancement of Artificial Intelligence Conference on AI Ethics and Society, held January 27-28, 2019 in Honolulu, Hawaii.

Smarter cancer treatment: AI tool automates radiation therapy planning

MIE researchers have developed automation software that aims to greatly reduce the time required to generate radiation therapy plans. PhD candidates Aaron Babier and Justin Boutilier, along with their supervisor Timothy Chan (MIE), and Professor Andrea McNiven (Faculty of Medicine) looked at radiation therapy design as an intricate — but solvable — optimization problem. They created software that uses AI to mine historical radiation therapy data, then applies it to an optimization engine to develop individualized maps that help doctors determine where to blast tumours. They applied the tool in a study of 217 patients with throat cancer, who also received treatments developed using conventional methods. The therapies generated by the AI achieved comparable results to patients' conventionally planned treatments — and did so within 20 minutes, compared with days required using conventional methods. The researchers published their findings in *Medical Physics*.

Data in this chapter are presented for the 2017–2018 grant year (April to March). This is the most recent year for which complete data are available. Highlights are from July 2018 to June 2019.

Human Health

U of T Engineering startup raises \$3.25 million to eliminate prescription opioids after surgery

A startup built on gel-based technology developed in the lab of Professor Molly Shoichet (ChemE, IBBME) has raised \$3.25 million to develop a drug delivery system that could eliminate the need to give patients powerful painkillers following surgery — a key source of the current opioid crisis. AmacaThera uses Shoichet's gel technology to dramatically extend the duration of anesthetics injected at the site of a surgical incision, thus reducing the need for powerful, and potentially addictive, painkillers such as OxyContin. The biocompatible gel is similar to ones previously developed by Shoichet for stem cell injection. It can be easily stored and injected at room temperature, but firms up once it enters the body. It has been formulated to deliver commonly used anesthetic drugs to surgical sites and keep them there for two to three days.

A 'training gym' for lab-grown heart cells

A new device designed by Milica Radisic (IBBME, ChemE) and her team uses a rigorous training regimen to grow small amounts of cardiac tissue in the lab — and measure how strongly they beat. The device builds on the group's previous work, such as the Biowire, a platform in which heart cells grow around a silk suture. By pulsing electricity through the cells, the device causes them to elongate and become more like mature human heart cells. The Biowire II, described in a paper published in *Cell*, contains two wires made of elastic polymers and positioned three millimetres apart. The heart cells form a small band of tissue between the wires, and bend them each time they contract. By measuring the amount of deflection in the wires, the researchers can determine the force of the contraction. Biowire II is already finding commercial application through TARA Biosystems, a spinoff co-founded by Radisic. The company uses its lab-grown heart tissues to carry out cardiac drug testing studies for pharmaceutical companies. Ultimately, lab-grown tissues such as those incubated in the Biowire II may one day be implanted back into humans to repair damaged organs.

U of T Engineering researchers create nano-bot to probe inside human cells

U of T Engineering researchers have built a set of magnetic 'tweezers' that can position a nano-scale bead inside a human cell in three dimensions with unprecedented

precision. The nano-bot has already been used to study the properties of cancer cells, and could point the way toward enhanced diagnosis and treatment. Professor Yu Sun (MIE, IBBME, ECE) and his team have been building robots that can manipulate individual cells for two decades. Their latest study, published in *Science Robotics*, describes a system of six magnetic coils placed in different planes around a microscope coverslip seeded with live cancer cells. A magnetic iron bead about 700 nanometres in diameter is placed on the coverslip, where the cancer cells easily take it up inside their membranes. Once the bead is inside, PhD candidate Xian Wang used a computer-controlled algorithm to vary the electrical current through each of the coils, shaping the magnetic field in three dimensions and coaxing the bead into any desired position within the cell. He tracked its position using real-time feedback from confocal microscopy imaging. In collaboration with researchers from Mount Sinai Hospital and The Hospital for Sick Children (SickKids), the team used their robotic system to study early-stage and later-stage bladder cancer cells, including the stiffness of their nuclei. In the future, Sun imagines using the technique to starve a tumour by blocking the blood vessels that feed it, or destroying it directly via mechanical ablation.

Robotics

What makes robots 'persuasive' to humans?

A new study at U of T Engineering is exploring how robots persuade and build trust with humans. This research could guide the development of AI in the next generation of socially assistive robots to aid in health care and other fields. Under the supervision of Goldie Nejat (MIE), Canada Research Chair in Robots for Society, PhD candidate Shane Saunderson conducted an exploratory study of persuasion strategies to observe which methods would most influence a human's decision. Two hundred human participants were asked to write down their best estimate of how many jelly beans were in a jar, taking into consideration the two differing suggestions provided by a pair of commercial robots, Luke and Leia. The robots attempted to influence the participants' guess using one of 10 randomly selected persuasion strategies. The top two strategies to emerge were an "emotional" approach and a "logical" one. The findings were published in *IEEE Robotics and Automation Letters* and presented at the IEEE International Conference on Robotics and Automation in May 2019.

National robotics consortium receives \$5.5M NSERC Strategic Partnership Grant

Professors Angela Schoellig and Steven Waslander are representing the University of Toronto Institute for Aerospace Studies (UTIAS) in the NSERC Canadian Robotics Network (NCRN), a consortium of leading robotics researchers from across Canada that includes members from universities, industry and government. The NCRN earned \$5.5-million in funding from NSERC's Strategic Partnership Grants for Networks competition. Its goal is to strengthen the growing robotics and AI communities in Canada through a wide range of collaborative research activities, including annual demonstrations and conferences, student exchanges between top Canadian labs and multi-university collaborative research programs.

Automated microrobotic assembly

U of T Engineering researchers have developed a method of assembling robots the size of a pin more quickly and easily than previous methods. These robots are small enough to travel through fluid-filled vessels and organs within the human body, and can be controlled wirelessly using magnetic fields. Some can travel with worm-like motion through fluid channels, while others can close tiny mechanical 'jaws' to take a tissue sample. Assembling these microrobots is currently done by hand and can take more than eight hours per device. By using a 3D printer to precisely arrange microscopic sections of magnetic needles atop a flat, flexible material, Professor Eric Diller and his team have reduced the assembly time to only about 20 minutes. The new method enables the team to iterate much more quickly on robot designs. In the future, they plan to develop more complex microrobots for applications such as targeted drug delivery, assisted fertilization, or biopsies. The research is published in *Science Robotics*.

Sustainability

Smart Freight Centre aims to deliver the goods – faster and greener

Leading experts from U of T Engineering, McMaster University and York University are working together to improve – and future-proof – how goods are delivered across the Greater Toronto Hamilton Area (GTHA) through the newly established Smart Freight Centre (SFC). Professor Matt Roorda (CivMin), of the U of T Transportation Research Institute, is the centre's inaugural chair. SFC will study ways to improve the transportation of goods throughout the region, taking into account issues such as traffic, population growth and the environment. One project will involve industry partners including Walmart, Loblaws and LCBO stores shifting key deliveries from

distribution centres to retail locations to the late evening, from 7 to 11 p.m. Roorda and his research group will examine how the time shift affects emission levels, as well as examining cost mitigation for companies, and considering the issue of late-evening noise levels for residents along freight delivery routes. SFC's five-year plan will include research projects on automated trucks and innovative alternatives to last-mile deliveries.

Low-cost catalyst boosts hydrogen production from water

A new catalyst developed at U of T Engineering gives a boost to a number of clean energy technologies that depend on producing hydrogen from water. In a paper published in *Nature Energy*, Professor Ted Sargent (ECE) and his team describe a catalyst that can lower the amount of electricity needed to split water into hydrogen and oxygen. Currently, the best-performing catalysts for this reaction rely on platinum, a high-cost material, and operate under acidic conditions. The new catalyst is made of low-cost copper, nickel and chromium, and is able to perform under pH-neutral conditions. This could enable the use of seawater as a feedstock for hydrogen, as well as the use of microorganisms to make chemicals such as methanol and ethanol from hydrogen and waste CO₂. A team from Sargent's lab is among the five finalists in the international NRG COSIA Carbon XPrize, a \$7.5-million competition to use renewable energy to convert waste CO₂ into fuels or other value-added products.

Large trucks are biggest culprits of near-road air pollution: U of T Engineering study

A two-year U of T Engineering study has revealed large trucks to be the greatest contributors to black carbon emissions close to major roadways. The study also indicated that for the 30% of Canadians who live within 500 metres of a major roadway, the type of vehicles rolling past their homes can matter more than total traffic volume in determining the amount of air pollution they breathe. The comprehensive study – led by Professor Greg Evans (ChemE) and collaborators at Environment and Climate Change Canada, and the Ontario Ministry of the Environment, Conservation and Parks, as well as the Metro Vancouver Regional District – involved measuring vehicle emissions near roads in Vancouver and Toronto, including the 401, North America's busiest highway. The difference between emission levels across the sites was more closely correlated with the number of large trucks on the road rather than the number of cars. The data also revealed a significant drop in emissions on the 401 on the weekends, when personal vehicle traffic is still very high, but the volume of large truck traffic is low. The study was published in the journal *Environmental Science & Technology*.

Water

Reinventing the toilet: U of T Engineering team presents sustainable prototype in Beijing

A team led by Professor Yu-Ling Cheng (ChemE) was one of a select group invited to present in Beijing to prospective industry partners, government officials, international agencies, and leadership from the Bill & Melinda Gates Foundation as part of the 2018 Reinvented Toilet Expo. They showcased their prototype for a sustainable toilet designed for the billions of people worldwide who lack access to effective sanitation or waste management systems. Cheng, who was the founding director of the Centre for Global Engineering, has been working on the challenge since 2011, and placed third at the first World Toilet Expo in 2012. Through a spinoff company, Sankoya Technologies, Cheng is actively looking for partners who can help adapt the device for mass production and to reach target markets.

Multidisciplinary collaboration to analyze microplastics in drinking water

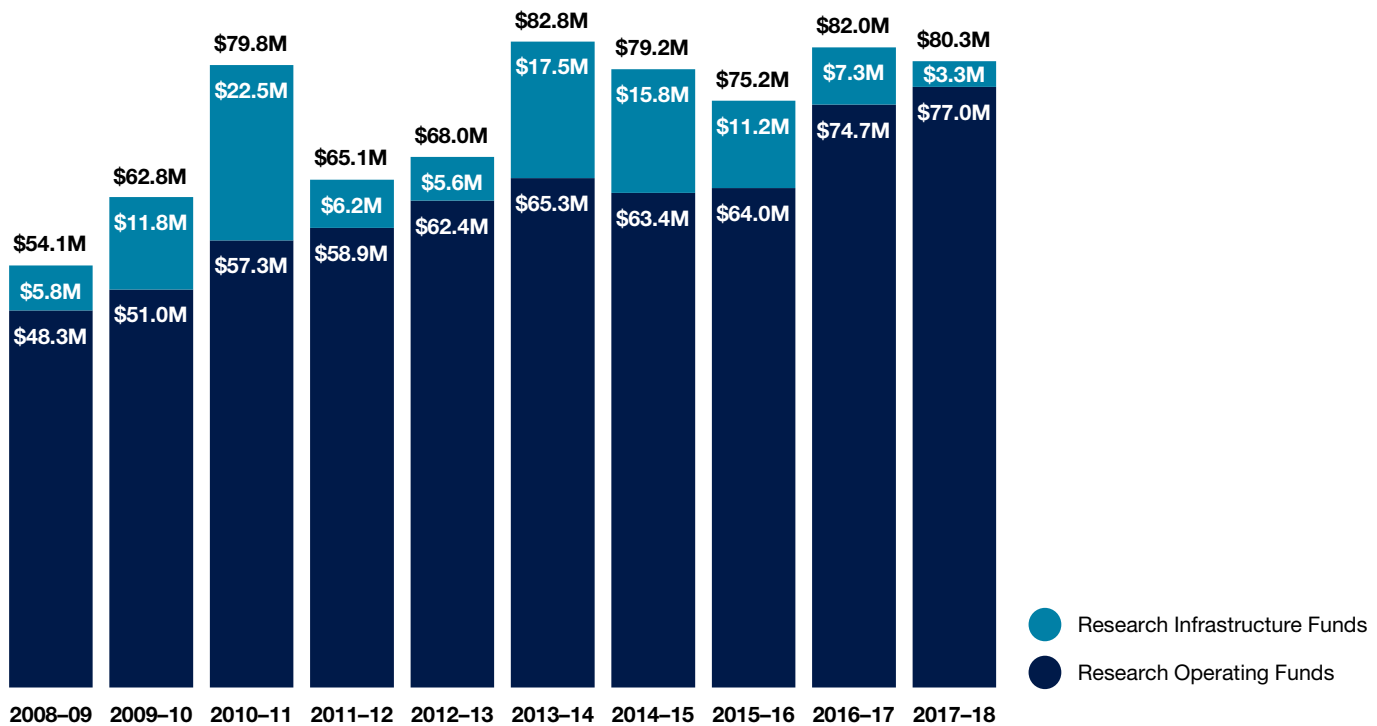
Microplastics — particles anywhere from a few millimetres to a few micrometres in size — have been found in drinking water around the world, but little is known about their effects on human health. One of the challenges is that there are currently no standardized methods for testing levels of microplastics in drinking water, making it hard to compare scientific studies conducted by different groups. Professor Bob Andrews (CivMin) is collaborating with Professor Chelsea Rochman (Ecology and Evolutionary Biology) to develop such methods. One strategy the team is considering is pyrolysis-gas chromatography-mass spectrometry, in which microplastics would be filtered from water, volatilized with heat, and then analyzed at the molecular level to determine which varieties of plastic are the biggest sources. The collaboration is funded in part by XSeed, an interdivisional funding program designed to promote multidisciplinary research.

Research Funding and Tri-Agency Grants

Our collaborative, multidisciplinary approach to research leverages our strong international reputation and our network of partnerships with companies, hospitals and peer institutions around the world. In 2017–2018, the most recent year for which complete data is available, we earned research operating funds of \$77.0 million. This is our highest level to date, equivalent to \$328,912 per faculty member, representing a 59.1% increase since 2008–2009.

Research infrastructure funding was lower in 2017–2018 than in previous years, due to fewer grants from organizations such as the Canada Foundation for Innovation. However, this total does not include multidisciplinary research facilities funded by private donations, such as those located in the Myhal Centre.

Figure 3.1a Research Infrastructure Funding and Research Operating Funding, 2008–2009 to 2017–2018



Our Tri-Agency funding total was the highest yet, and we continue to grow the proportion of funding from agencies other than NSERC. Funding from CIHR was \$4.2 million in 2017–2018, a 23.5% increase over the previous year. CIHR now accounts for 11.7% of Tri-Agency funding. In 2017–2018 we also received the Faculty’s first sole-PI grant from the Social Sciences and Humanities Research Council. Professor Li Shu (MIE) will lead a project on combining social psychology and engineering interventions to reduce automobile idling.

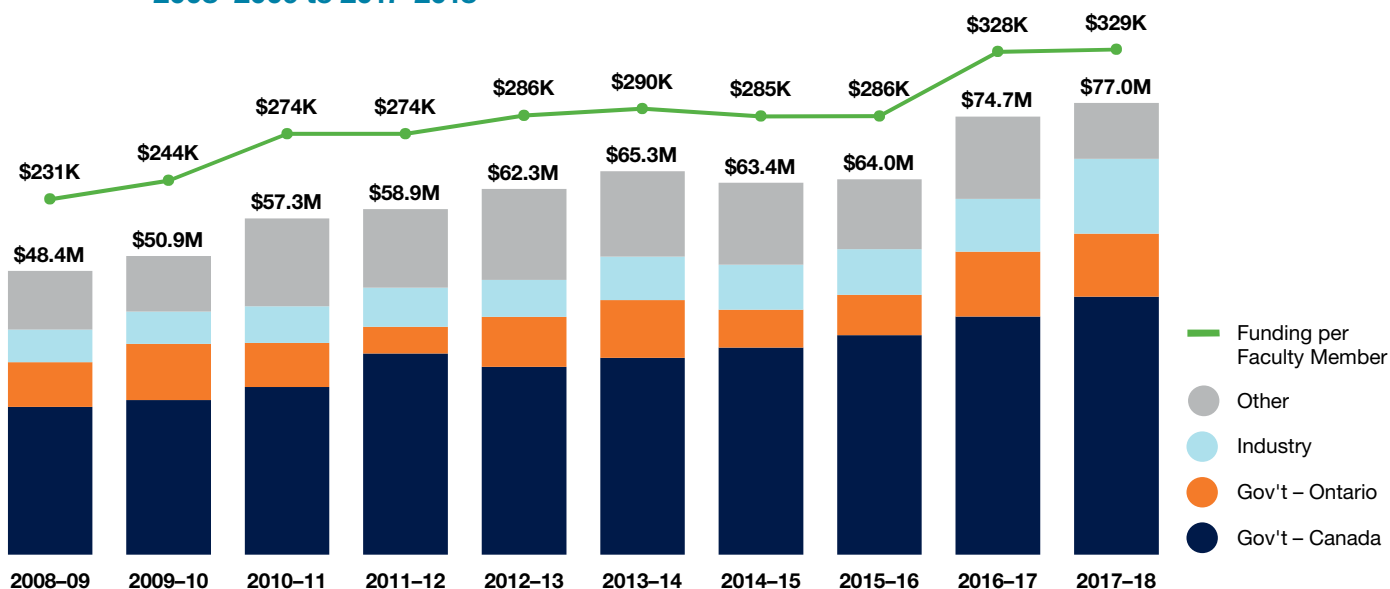
In 2018–2019 we received \$4.4 million in NSERC Discovery Grants for 45 researchers across U of T Engineering, and \$11.5 million in Strategic Partnership Grants. These funds will be reflected in the 2020 Annual Report.

All three of our applications for funding under the NSERC CREATE program were granted in 2019. This 100% success rate resulted in the largest number of NSERC CREATE grants ever received in a single round by a single institution, and brings the total number of active NSERC CREATE programs across U of T Engineering to eight. The three newest recipients are:

- **Emma Master (ChemE)** – NSERC CREATE for BioZone: An open science collaborative centre for industrial biotechnology in the context of the circular economy
- **Yu Sun (MIE)** – NSERC CREATE in Healthcare Robotics: Training Program
- **Jennifer Drake (CivMin)** – NSERC CREATE for Design of Living Infrastructure for Ecosystem Services (DesignLIFES)

Note 3.1: The figures in this chapter report research funding the Faculty received in 2017–2018. Because it takes some time after the completion of a fiscal year for research funding data to become final, this is the most recent year for which data are available.

Figure 3.1b Research Operating Funding by Year, Source and Funding per Faculty Member, 2008–2009 to 2017–2018



| | Funding per Faculty Member | Gov't – Canada | Gov't – Ontario | Industry | Other | Total |
|---------|----------------------------|----------------|-----------------|--------------|--------------|--------------|
| 2008–09 | \$231,450 | \$25,184,612 | \$7,618,345 | \$5,574,261 | \$9,995,735 | \$48,372,953 |
| 2009–10 | \$243,595 | \$26,342,234 | \$9,562,400 | \$5,540,382 | \$9,466,322 | \$50,911,338 |
| 2010–11 | \$274,046 | \$28,567,718 | \$7,520,797 | \$6,212,252 | \$14,974,772 | \$57,275,540 |
| 2011–12 | \$274,002 | \$34,287,390 | \$4,535,363 | \$6,702,708 | \$13,384,957 | \$58,910,418 |
| 2012–13 | \$286,008 | \$32,025,900 | \$8,511,021 | \$6,284,318 | \$15,528,448 | \$62,349,687 |
| 2013–14 | \$290,365 | \$33,545,785 | \$9,814,984 | \$7,449,403 | \$14,521,924 | \$65,332,097 |
| 2014–15 | \$285,428 | \$35,266,448 | \$6,486,482 | \$7,658,866 | \$13,953,120 | \$63,364,916 |
| 2015–16 | \$285,585 | \$37,411,421 | \$6,883,331 | \$7,770,092 | \$11,906,204 | \$63,971,048 |
| 2016–17 | \$327,540 | \$40,588,828 | \$11,038,645 | \$9,028,158 | \$14,023,425 | \$74,679,056 |
| 2017–18 | \$328,912 | \$43,969,492 | \$10,738,023 | \$12,743,136 | \$9,514,682 | \$76,965,334 |

Figure 3.1c Tri-Agency and NCE Support: CIHR, NSERC and NCE Funding, 2008–2009 to 2017–2018

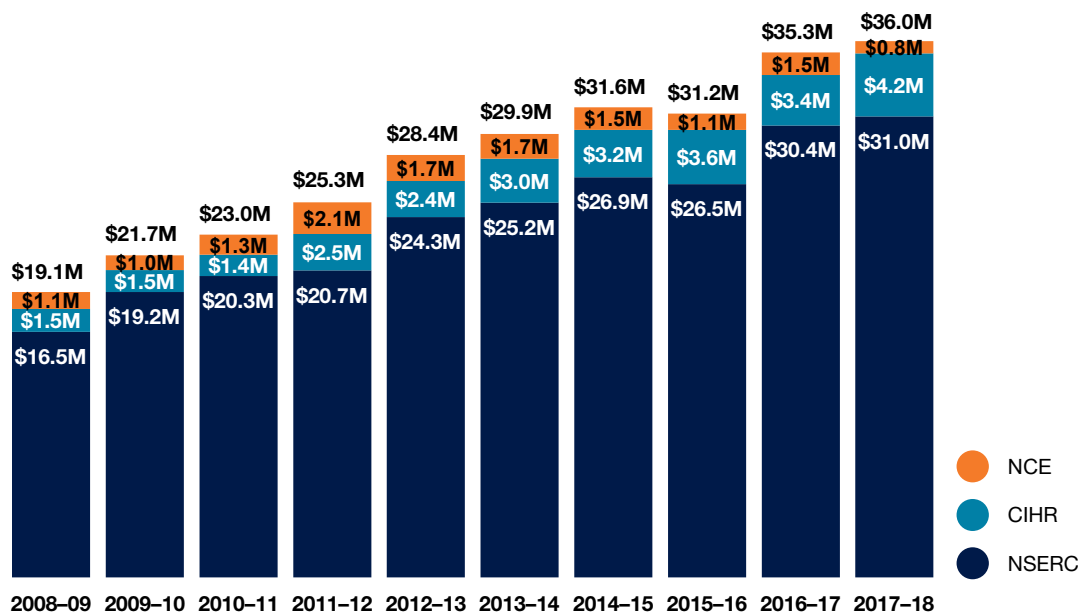
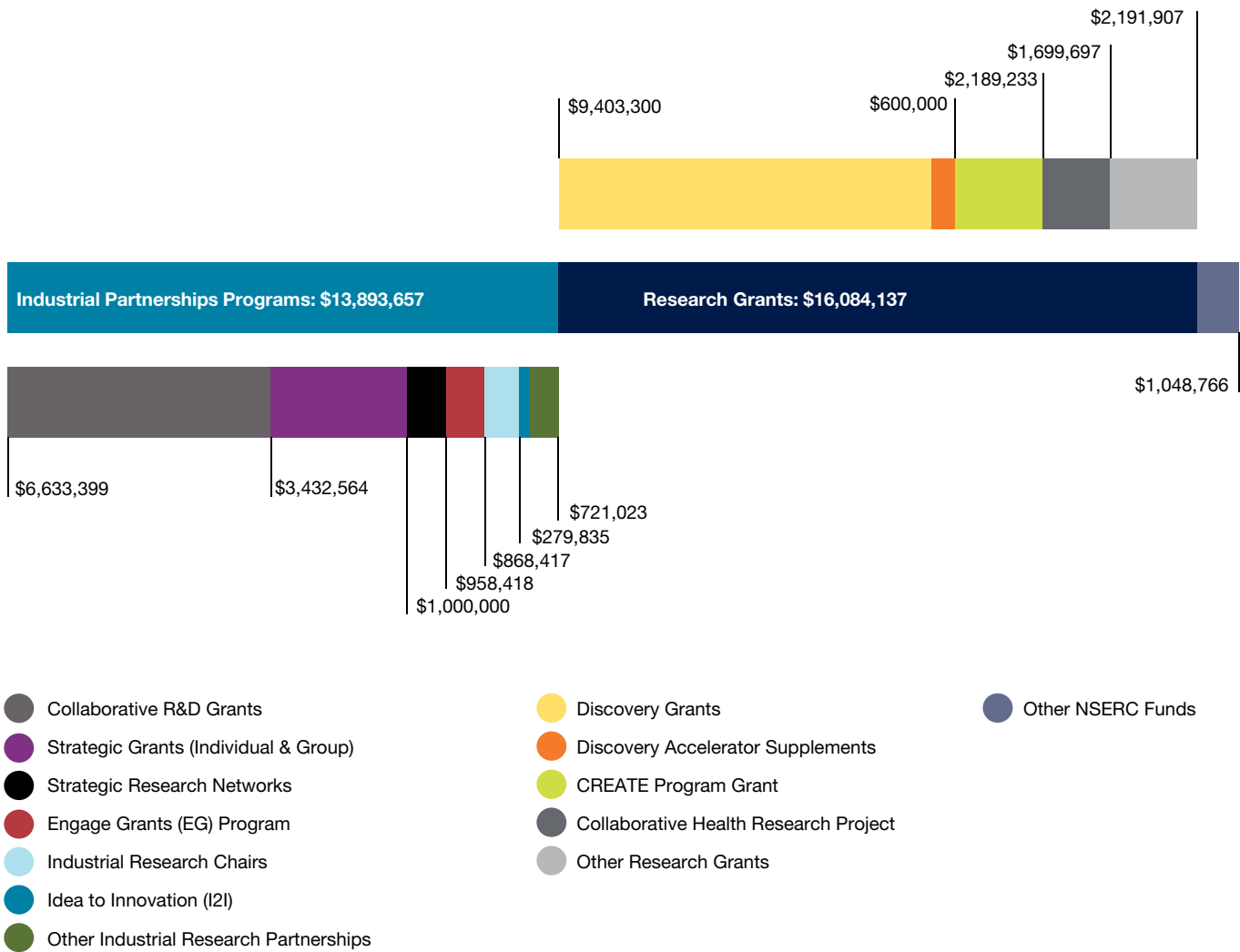


Figure 3.2a NSERC Funding, 2017–2018



We have 32 Canada Research Chairs at U of T Engineering, including the following who were added in 2018–2019:

- **Angela Schoellig (UTIAS)** – Canada Research Chair in Machine Learning for Robotics and Control
- **Natalie Enright Jerger (ECE)** – Canada Research Chair in Computer Architecture
- **Jonathan Kelly (UTIAS)** – Canada Research Chair in Collaborative Robotics
- Another faculty member, **Michael Garton (IBBME)**, holds the Canada Research Chair in Synthetic Biology through his cross-appointment to the Faculty of Medicine

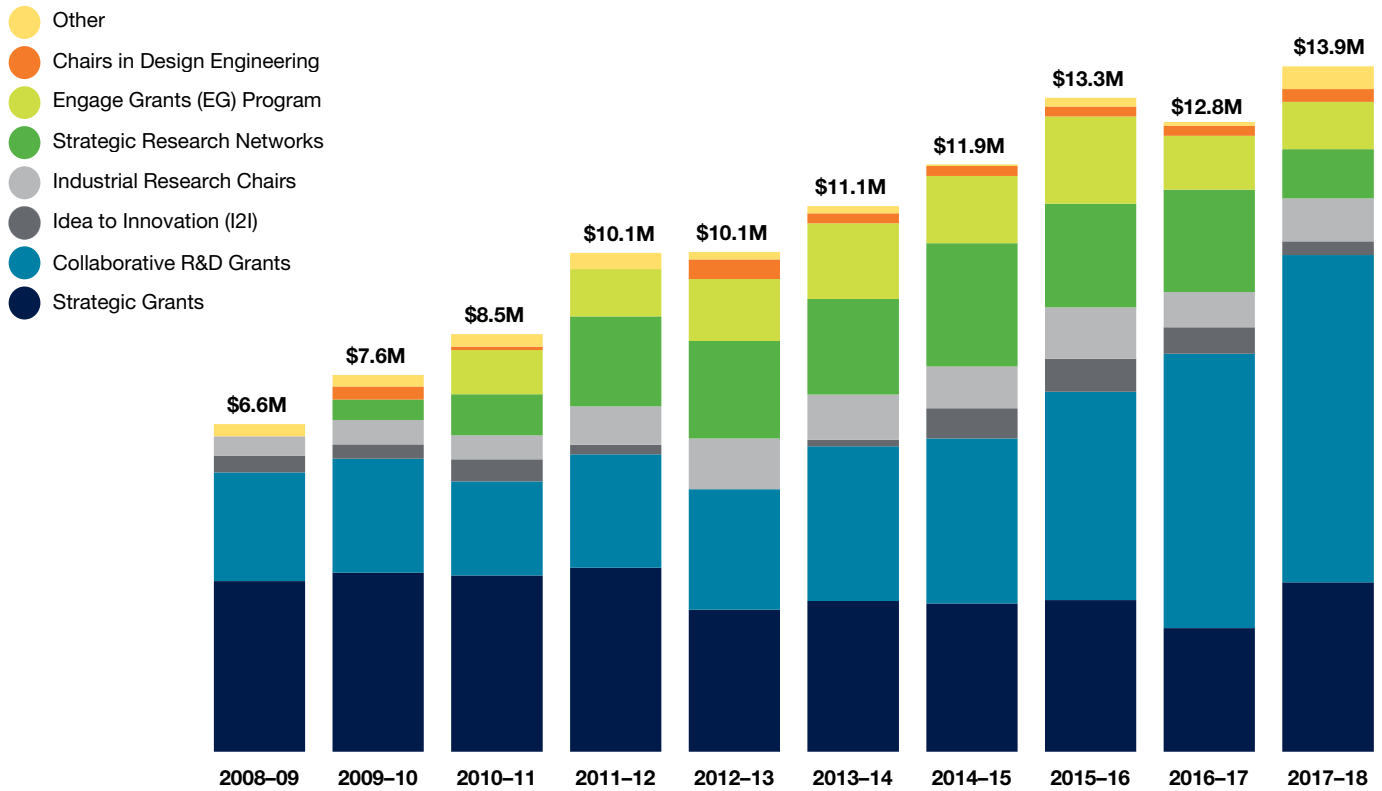
Six more CRCs were renewed in 2018–2019:

- **Aimy Bazylak (MIE)** – Canada Research Chair in Thermofluidics for Clean Energy
- **Timothy Chan (MIE)** – Canada Research Chair in Novel Optimization and Analytics in Health
- **Brendan Frey (ECE)** – Canada Research Chair in Biological Computation
- **Goldie Nejat (MIE)** – Canada Research Chair in Robots for Society
- **Piero Triverio (ECE)** – Canada Research Chair in Computational Electromagnetics
- **Wei Yu (ECE)** – Canada Research Chair in Information Theory and Wireless Communications

For a complete listing of chairholders and professorships, please see Appendix C.

Note 3.2a: Data as of May 2019 and based on grant year (April to March).

Figure 3.2b NSERC Industrial Partnership Funding by Program, 2008–2009 to 2017–2018

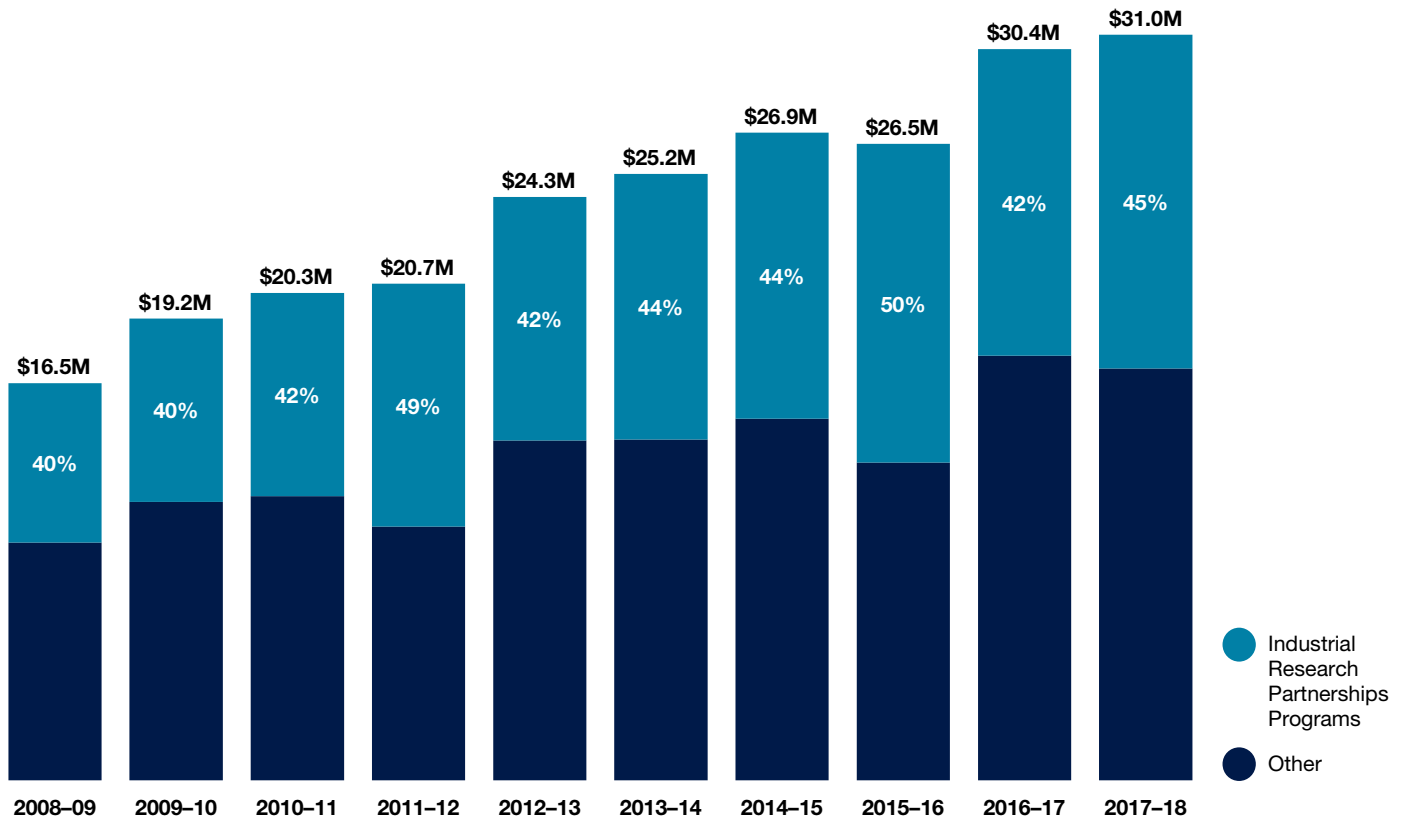


| | 2008–09 | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 |
|-------------------------------------|--------------------|--------------------|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Other | \$247,392 | \$230,000 | \$251,770 | \$328,780 | \$146,905 | \$148,381 | \$32,031 | \$178,803 | \$72,536 | \$461,023 |
| Chairs in Design Engineering | | \$267,173 | \$69,076 | | \$400,000 | \$200,000 | \$200,000 | \$200,000 | \$200,000 | \$260,000 |
| Engage Grants (EG) Program | | | \$897,115 | \$960,531 | \$1,254,468 | \$1,533,923 | \$1,362,871 | \$1,767,890 | \$1,095,326 | \$958,418 |
| Strategic Research Networks | | \$417,293 | \$832,697 | \$1,826,000 | \$1,978,886 | \$1,935,440 | \$2,500,000 | \$2,100,000 | \$2,075,000 | \$1,000,000 |
| Industrial Research Chairs | \$390,667 | \$493,197 | \$485,711 | \$773,964 | \$1,025,031 | \$918,349 | \$847,278 | \$1,040,762 | \$713,023 | \$868,417 |
| Idea to Innovation (I2I) | \$339,200 | \$287,417 | \$448,612 | \$195,000 | | \$133,750 | \$608,417 | \$669,364 | \$535,951 | \$279,835 |
| Collaborative R&D Grants | \$2,203,103 | \$2,313,127 | \$1,909,431 | \$2,301,643 | \$2,445,210 | \$3,137,628 | \$3,347,888 | \$4,226,332 | \$5,564,099 | \$6,633,399 |
| Strategic Grants | \$3,457,330 | \$3,625,316 | \$3,567,278 | \$3,725,048 | \$2,875,127 | \$3,050,468 | \$3,001,609 | \$3,070,315 | \$2,503,150 | \$3,432,564 |
| Total | \$6,637,692 | \$7,633,523 | \$8,461,689 | \$10,110,965 | \$10,125,627 | \$11,057,939 | \$11,900,094 | \$13,253,466 | \$12,759,084 | \$13,893,657 |

Several professors launched new collaborations funded by NSERC Strategic Partnership Grants in 2018–2019, including:

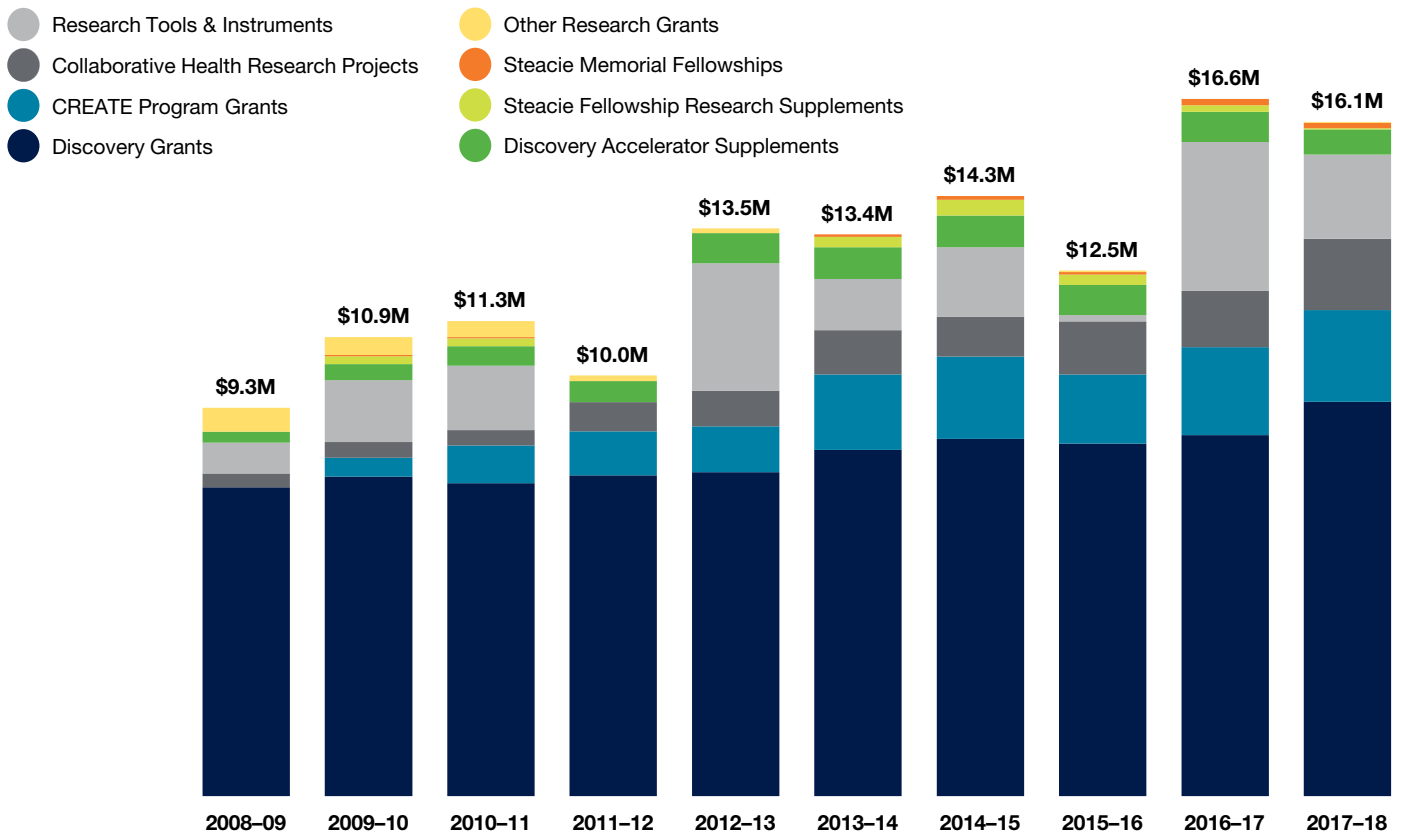
- **Erin Bobicki (MSE, ChEM)** — Novel strategies for CO₂ utilization and storage in mineral processing
- **Peter Herman (ECE)** — 3D Additive/subtractive laser manufacturing of photonic circuit and sensor micro-systems
- **Sean Hum (ECE)** — Innovative Satellite Antennas for Emerging M2M/IoT applications
- **Andreas Moshovos (ECE)** — The Computing Hardware for Emerging Intelligent Sensing Applications (COHESA)
- **Wai Tung Ng (ECE)** and **James K. Mills (MIE)** — MOST - Manufacturing and applications of GaN power semiconductor devices/modules
- **Angela Schoellig (UTIAS)** and **Steven Waslander (UTIAS)** — The NSERC Canadian Robotics Network (NCRN)
- **Yu Sun (MIE)** — Development of new techniques for high-speed and high-accuracy industrial part metrology

Figure 3.2c Industrial Partnerships as a Percentage of Total NSERC Funding, 2008–2009 to 2017–2018



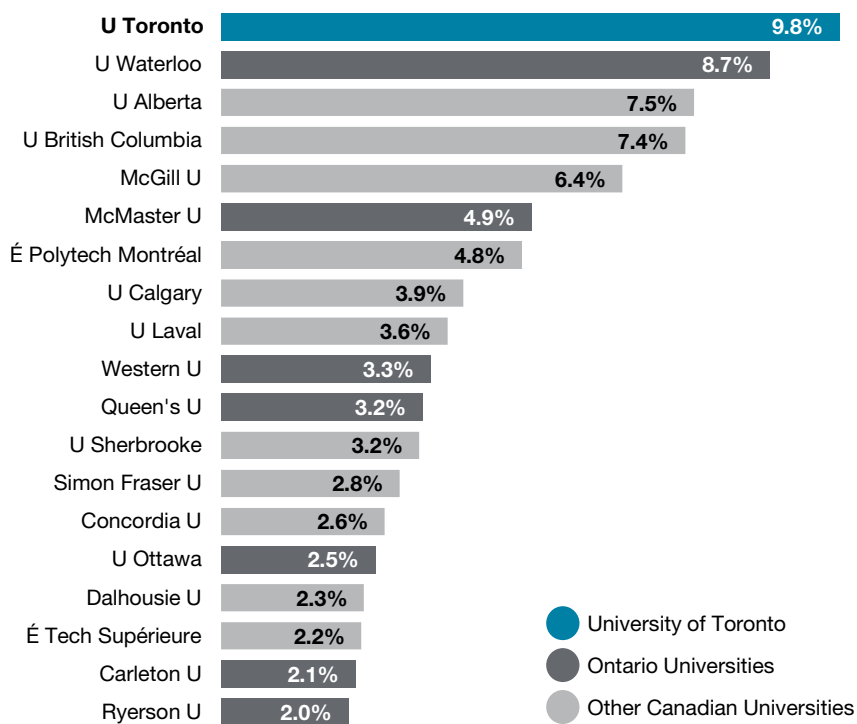
We continue to earn a larger five-year cumulative share of NSERC funding than any other engineering school in Canada. This proportion is significant as it is the metric used to determine our complement of Canada Research Chairs. In 2017–2018, we surpassed our own record for the highest-ever proportion of all NSERC funding in Engineering at 10.1%.

Figure 3.2d NSERC Research Grant Funding by Program, 2008–2009 to 2017–2018



| | | | | | | | | | | |
|--|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Other Research Grants | \$567,950 | \$422,319 | \$382,583 | \$132,000 | \$111,000 | | | \$40,000 | | \$25,000 |
| Steacie Memorial Fellowships | | \$30,000 | \$30,000 | | | \$60,000 | \$90,000 | \$60,000 | \$155,000 | \$125,000 |
| Steacie Fellowship Research Supplements | | \$187,500 | \$187,500 | | | \$250,000 | \$375,000 | \$250,000 | \$155,000 | \$30,000 |
| Discovery Accelerator Supplements | \$264,000 | \$383,999 | \$464,000 | \$504,000 | \$720,000 | \$760,000 | \$760,000 | \$716,285 | \$719,970 | \$600,000 |
| Research Tools & Instruments | \$734,572 | \$1,477,017 | \$1,533,781 | | \$3,043,029 | \$1,218,076 | \$1,654,682 | \$146,900 | \$3,553,549 | \$2,011,907 |
| Collaborative Health Research Projects | \$326,169 | \$378,774 | \$366,899 | \$696,536 | \$846,731 | \$1,060,212 | \$950,376 | \$1,270,103 | \$1,338,873 | \$1,699,697 |
| CREATE Program Grants | | \$450,000 | \$900,000 | \$1,050,000 | \$1,096,000 | \$1,797,084 | \$1,969,779 | \$1,650,000 | \$2,100,000 | \$2,189,233 |
| Discovery Grants | \$7,366,144 | \$7,617,106 | \$7,464,405 | \$7,650,892 | \$7,726,942 | \$8,256,362 | \$8,516,417 | \$8,406,314 | \$8,611,937 | \$9,403,300 |
| Total | \$9,258,835 | \$10,946,715 | \$11,329,168 | \$10,033,428 | \$13,543,702 | \$13,401,734 | \$14,316,254 | \$12,539,603 | \$16,634,328 | \$16,084,137 |

**Figure 3.3a Canadian Peer Universities vs. University of Toronto
Share of NSERC Funding for Engineering Cumulative
Five-Year Share, 2013–2014 to 2017–2018**

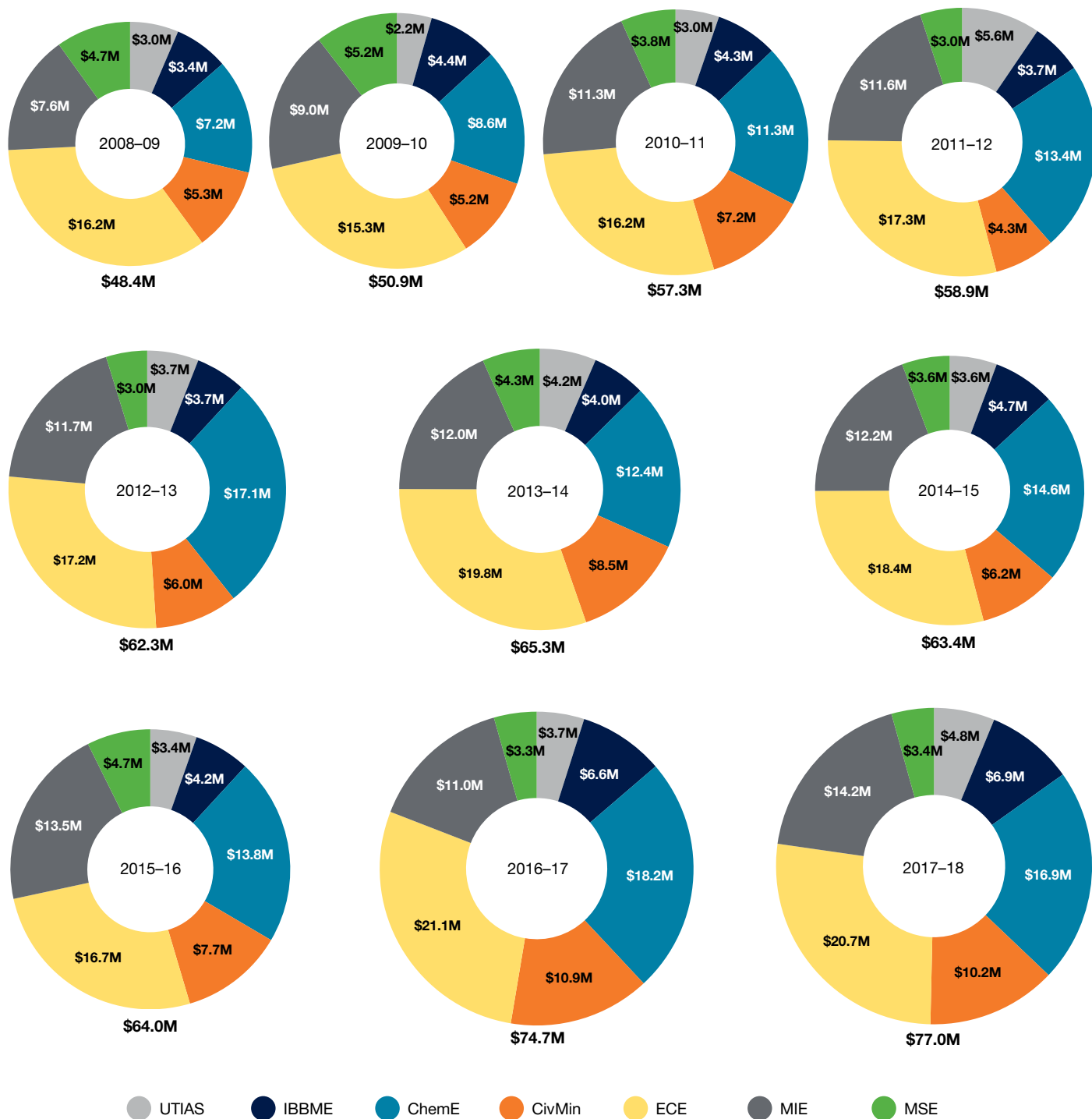


**Figure 3.3b U of T Annual Share
of NSERC Funding in
Engineering, 2008–2009
to 2017–2018**

| | |
|---------|-------|
| 2008–09 | 8.5% |
| 2009–10 | 9.4% |
| 2010–11 | 9.0% |
| 2011–12 | 9.5% |
| 2012–13 | 9.0% |
| 2013–14 | 9.6% |
| 2014–15 | 9.5% |
| 2015–16 | 10.0% |
| 2016–17 | 9.9% |
| 2017–18 | 10.1% |

Note 3.3a and 3.3b: Data are from the NSERC advanced search website and are shown by NSERC's fiscal year (April to March).

Figure 3.4 Distribution of Research Operating Funding by Academic Area, 2008–2009 to 2017–2018



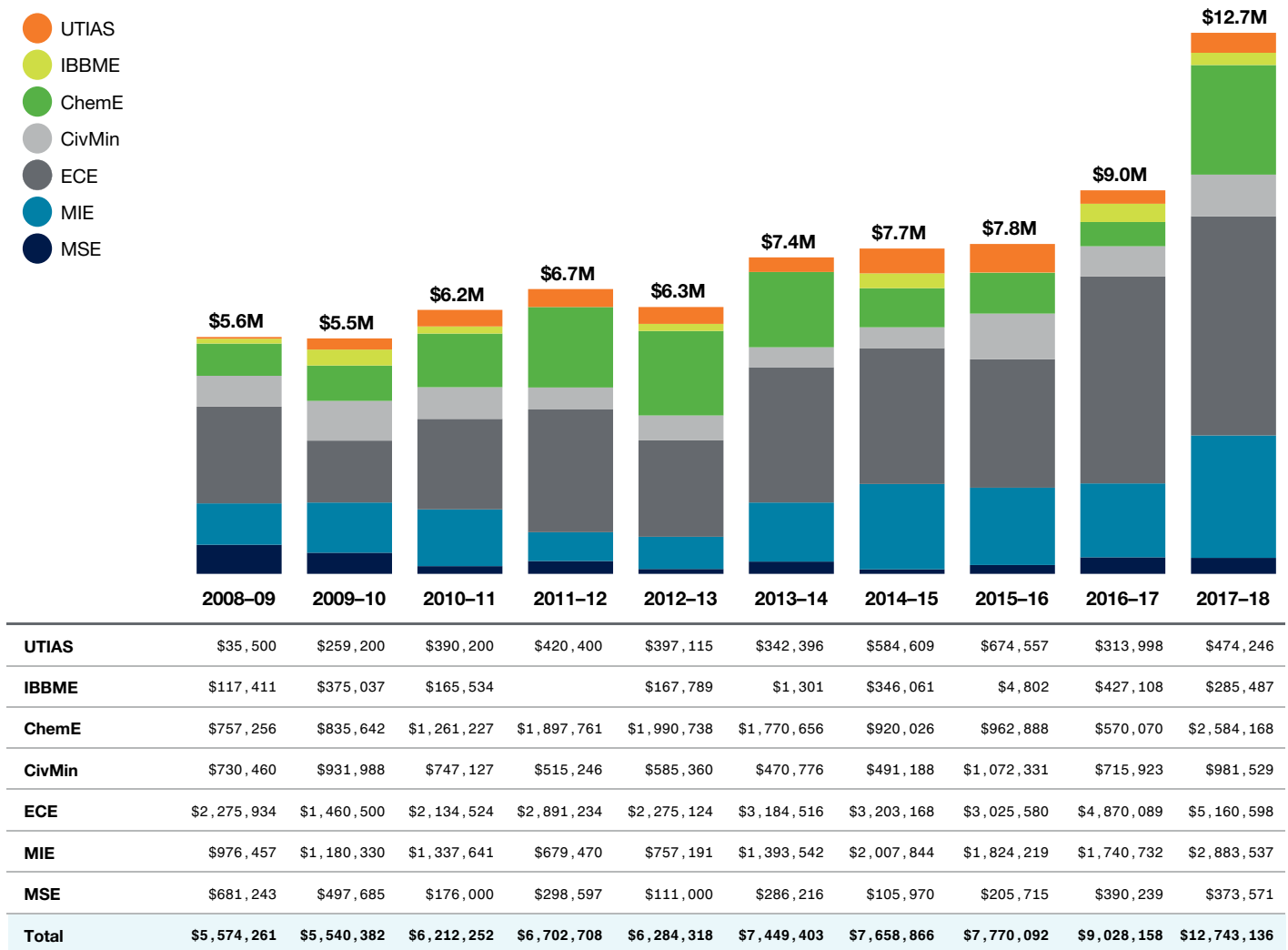
Note 3.4: Totals include a small amount of additional funding not shown in the breakdown by academic areas. The research funding attributed to IBBME for 2017–18 represents 83% of the total funding received by faculty members in the Institute. Because of IBBME’s cross-disciplinary structure, some professors have their research funding processed through the Faculty of Medicine. The figure above shows only the funding that comes through U of T Engineering and is presented by grant year (April to March).

Industry Partnerships

We have significantly increased the proportion of our funding that comes from direct partnerships with industry. The most current available figure is \$12.7 million, a 41.1% increase over the previous year and a 102.8% increase over the past five years. When additional sources of corporate funding are included, such as corporate philanthropy, foundation sponsored research, and foundation philanthropy, the total reaches \$18.0 million. This reflects the increasing emphasis and resources that the Faculty has dedicated to fostering and strengthening industry partnerships, including through the Corporate & Foundation Partnerships Office.

One thriving partnership is the **Fujitsu Co-Creation Research Laboratory**. Situated on the eighth floor of the Myhal Centre, the research facility grew out of collaborations between Fujitsu Laboratories Ltd. and Professor Ali Sheikholeslami (ECE) which have flourished over more than two decades. As part of the centre, Fujitsu has also signed research partnership agreements with Professors Alberto Leon-Garcia (ECE), Shahrokh Valaee (ECE), Taufik Valiante (Department of Surgery, ECE) and Yuri Lawryshyn (ChemE).

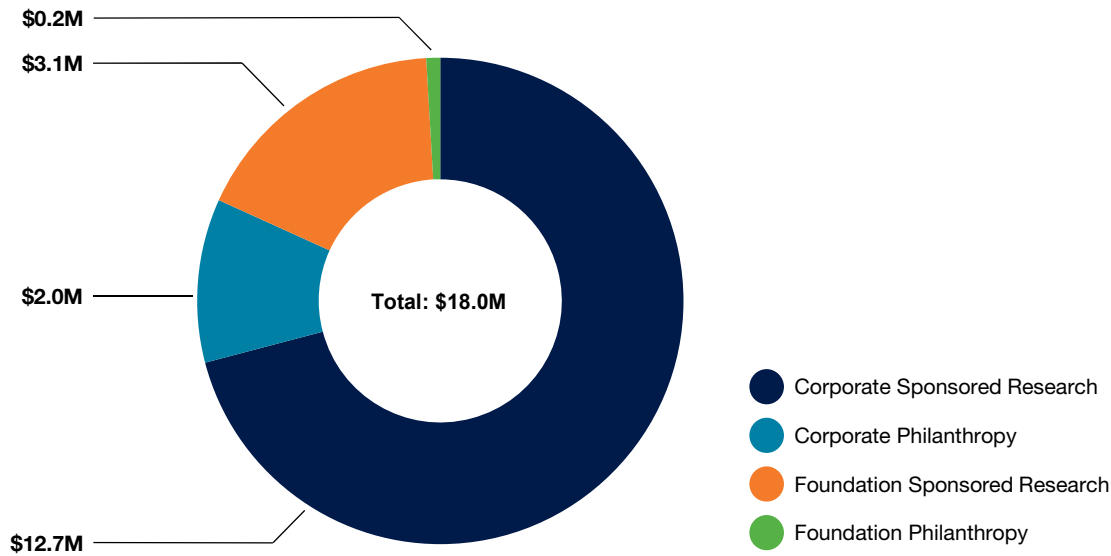
Figure 3.5a Industry Research Funding by Academic Area, 2008–2009 to 2017–2018



We also created the **Centre for Research and Applications in Fluidic Technologies (CRAFT)** in collaboration with the National Research Council. The first institute of its kind, CRAFT will bring together researchers from government and academia to advance microfluidic technologies and catalyze the commercialization of devices. Applications include point-of-care devices for rapid diagnosis of diseases, growing organ tissues on devices outside the body to test

drugs or do research related to personalized medicine, and printing biological tissues that can be used to repair organs of the human body. CRAFT includes 200 researchers, 45 labs and 25 technology companies, and will be jointly funded by both partners with a \$22 million investment over five years. The lead researchers from U of T Engineering are Axel Guenther (MIE), Milica Radisic (IBBME, ChemE) and Aaron Wheeler (Chemistry, IBBME).

Figure 3.5b Industry Research Funding Sources, 2018



Last year, our Faculty collaborated with more than 400 external research partners. In addition to these, many more companies hire our undergraduates through the Professional Experience Year Co-op Program, work with students on multidisciplinary capstone projects or provide philanthropic support.

Figure 3.5c Industrial Partners, 2018–2019

- 3E Nano Inc.
- ABB Group
- Advanced Measurement and Analysis Group Inc.
- Advanced Micro Devices Inc.
- Advanis
- Aerodyne
- Afsan Engineering Co.
- AGFA
- Agnico-Eagle Mines Ltd.
- Agrium Inc.
- Airbus SAS
- Alcan Aluminum International
- Alcohol Countermeasure Systems
- Altera Corp.
- AMAG Ltd.
- AMEC Foster Wheeler
- Americas Styrenics LLC
- Analog Devices Inc.
- Andec Manufacturing Ltd.
- Andritz Group
- Anemol Technologies Inc.
- Angstrom Engineering Inc.
- Antex Western
- Apotex Inc.
- Applanix
- Apple
- Aquafor Beech
- ArcelorMittal Dofasco
- Armacell
- Artium Technologies
- Atomic Energy of Canada Ltd.
- AUG Signals Ltd.
- Autodesk
- AV Nackawic Group
- Avalon Rare Metals
- Avertus Epilepsy Technologies Inc.
- Babcock & Wilcox Ltd.
- BaoWu Steel Group Corp.
- Barrick Gold Corp.
- Bell Helicopter Textron Inc.
- Bickell Foundation (J. P. Bickell)
- BiomeRenewables
- Bio-Rad Laboratories Canada Ltd.
- Blackberry
- BMW
- Boeing
- Boise Cascade
- Bombardier Aerospace
- Bombardier Inc.
- Braskem

- Bresotec Inc.
- Brican Automated Systems Inc.
- Brigham & Women's Hospital
- CAE
- Calera
- CalEnergy Generation
- Calgon Carbon Corp.
- Canadian Institute of Steel Construction
- Canadian Nuclear Safety Commission
- Canadian Precast/Prestressed Concrete Institute
- Canadian Urban Transit Research & Innovation Consortium
- Candu Energy Inc.
- Candu Owners Group
- Candura Instruments
- CanSyn Chem Corp.
- Carbon Cure Technologies
- Cardinal Health
- Carter Holt Harvey Ltd.
- Cascades
- Cast Connex Corp.
- CD Nova
- Celestica
- CellScale Biomaterials Testing
- Celulose Nipo-Brasileira
- Cement Association of Canada
- Center for Automotive Materials and Manufacturing
- Centre Line Ltd.
- Chemetry
- Christie Digital Systems Canada Inc.
- Chrysler Canada Inc.
- Ciena Canada Inc.
- CIMA Canada Inc.
- Clearpath Robotics
- Clyde-Bergemann Inc.
- CMC Electronics
- Colibri Technologies
- COM DEV International Ltd.
- Commissariat à l'énergie atomique
- ConCast Pipe
- Concretex Ltd.
- Connaught Foundation
- Cook Medical
- Coraltec Inc.
- CPCI
- Createx Technology (Suzhou) Co., Ltd.
- Crosswing Inc.
- Curiousitate
- Cyberworks Robotics
- Daishowa-Marubeni International (DMI) Ltd.
- Dana Canada Corp.
- Daniels Group
- Dasaerospace Inc.
- Datatrends Research Corp.
- DCL International
- Defence Science & Technology Lab (UK)
- Dell
- Detour Gold Corp.
- Deveron
- Dionex
- Dongwon Technology Co. Ltd.
- Domtar Inc.
- Dr. Robot Inc.
- Drone Delivery Canada
- Droplet Measurement Technologies
- DSO National Laboratories
- DuPont Canada Inc.
- Eavor Technologies Inc.
- eCamion Incorporated
- Eclipse Scientific Inc.
- Ecobee Inc.
- Ecosynthetix
- Eco-Tec Inc.
- Eldorado Brasil
- Electrovaya Inc.
- Eli Lilly Research Laboratories
- EllisDon
- Enbridge Gas Distribution Inc.
- Energent Inc.
- Engineering Services Inc.
- ENMAX Power Corp.
- Ensyn Technologies Inc.
- ERCO Worldwide
- Ericsson Canada Inc.
- ESG Solutions
- exactEarth Inc.
- Exigence Technologies
- Expert Process Solutions (XPS)
- Explora Foundation
- Exxon Mobil Corp.
- Facca Inc.
- Fibria Celulose
- Fidelity Canada
- Finisar Corp.
- Flight Safety International
- Food BioTek Corp.
- Ford Motor Company (USA)
- Ford Motor Company of Canada
- FP Innovations
- Fuji Electric Co. Ltd.
- Fujitsu Laboratories Ltd.
- Fujitsu Labs of America Inc.
- Futurebound Corp.
- Futurewei Technologies Inc.
- G. Cinelli – Esperia Corp.
- GE Energy
- GE Global Research
- GE Zenon
- Gedex Inc.
- Gener8 Inc.
- General Dynamics Canada
- General Electric Canada
- General Electric Inc.
- General Motors of Canada Ltd.
- Genpak
- Geosyntec Consultants
- Gerdau Long Steel North America
- GHGSat Inc.
- GlaxoSmithKline Inc.
- Glencore Canada Corp.
- Goodrich Landing Gear
- Grafoid Inc.
- Greencore Composites
- Groupe Mequaltech Inc.
- GTAA Toronto Pearson
- GVA Lighting
- Hanwha Solar Canada
- Hard Rock Innovations Inc.
- Hatch Ltd.
- Havelaar Canada
- Hawker Siddeley Canada
- HDR Corp.
- Hedgefog Research Inc.
- Hitachi High-Technologies
- Holcim Inc.
- Honeywell
- Huawei Technologies Co. Ltd.
- Hunch Manifest Inc.
- Huron Digital Pathology
- Hydro One Networks
- Hydro Quebec
- Hydrogenics
- Hyundai Motor Company
- IBI Group
- IBM Canada Ltd.
- IBM T. J. Watson Research Center
- IMAX Corp.
- Imperial Oil Ltd.
- Independent Electricity System Operator (IESO)
- Indian Oil Company
- Industrial Thermo Polymers Ltd.
- Ingenia Polymers Corp.
- Inphi Corp.
- Institute for Energy Technology (Norway)
- Integran Technologies Inc.
- Intel Corp.
- Interface Biologics Inc.
- International Business Machines (IBM)
- International Paper Company
- Isonicon
- Ionics Mass Spectrometry Group Inc.
- IRISNDT Corp.
- Irving Pulp & Paper Ltd.
- JDS Uniphase Inc.
- JITRI Micro and Nano Automation
- JNE Chemicals
- Johnson Matthey
- Kapik Integration
- Kasai Kogyo Co. Ltd.
- Kevin Quan Studios
- Keysight Technologies Canada Inc.
- Kiln Flame Systems Ltd.
- Kimberly-Clark Corp.
- Kinetica Dynamics
- Kinross Gold Corp.
- Klabin
- KQS Inc.
- Krauss Maffei Corp.
- Kumho Petrochemical R & D Center
- Laboratoire d'essai Mequaltech
- LaFarge Canada
- Lallemand Inc.
- Lattice Semiconductor Ltd.
- Leader's Circle
- LG Chem
- LightMachinery Inc.
- Lisgar Construction Company
- Litens Automotove Group

- Lubrizol
- Lumentra Inc.
- MacDonald, Dettwiler and Associates (MDA) Ltd.
- Magellan Aerospace
- Magna Closures
- Magna Exteriors and Interiors
- Magna International Inc.
- Magna Powertrain
- Manitoba Hydro
- Mantech Inc.
- Marmak Information Technologies
- Materials & Manufacturing Ontario
- Maxim Integrated Products Inc.
- McEwen Mining Inc.
- MeadWestvaco (MWV) Corp.
- Mercedes-Benz Canada Inc.
- Messier-Bugatti-Dowty
- Messier-Dowty Inc.
- Metso Pulp, Paper and Power
- Microbonds Inc.
- Micropilot
- Millipore
- Mine Environment Neutral Drainage
- Mitsubishi Rayon Co. Ltd.
- Moldflow Corp.
- Monaghan Biosciences Ltd.
- Nanowave
- NanoXplore Inc.
- National Aeronautical Establishment (USA)
- NatureWorks LLC
- NCK Engineering
- Nestle Canada
- New World Laboratories
- Newterra
- Nike Inc.
- Northern Yashi Engineering Construction, Ltd.
- NUCAP Global
- Nuclear Waste Management Organization
- NXP Semiconductors Netherlands BV
- OCMR
- Olympus Canada
- Olympus NDT Canada
- Ontario Clean Water Agency
- Ontario Power Generation Inc.
- Ontario Renal Network
- Opal-RT Technologies Inc.
- ORNGE Medical Transport
- Ossur Canada Inc.
- OtoSim
- OZ Optics Ltd
- Pall Corp.
- Perkin Elmer Canada
- Petronas Canada
- Philips Electronics North America Corp.
- Plasco Energy Group
- Platinum Unlimited Inc.
- Polumiros Inc.
- Polycron Industries
- Porewater Solutions
- Potent Group Inc.
- Pratt & Whitney Canada Inc.
- PrecisionHawk
- Process Research Ortech Inc.
- Procter & Gamble
- Prothena Biosciences Inc.
- Purolator
- QD Solar Inc.
- Qualcomm Canada Inc.
- Qualcomm Technologies Inc.
- Quanser Inc.
- Quantum Dental Technologies (QDT) Inc.
- Questor Technologies Inc.
- Quorum Technologies Inc.
- RBC – Royal Bank of Canada
- Regeneron Pharmaceuticals
- RESCON
- Resertrac Inc.
- Resonance Ltd.
- Resource Systems Group Inc.
- Rio Tinto Alcan Inc.
- Robert Bosch Corp.
- Rockwell International
- Rocscience Inc.
- Rolls Royce Canada Ltd.
- Rubikloud Technologies Inc.
- RWDI
- Safety Power Inc.
- Safran Electronics Canada
- Samsung Advanced Institute of Technology
- Samsung Display
- Samsung Electronics
- Sanofi Pasteur
- Saudi Basic Industries Corp. (SABIC)
- Sceye Inc.
- Schlumberger Canada Ltd.
- Sealed Air Corp.
- Semiconductor Research Corp.
- Sensor Technology Ltd.
- S-FRAME Software Inc.
- ShawCor
- Shinil Chemical Industry Co. Ltd.
- Side Effects Software
- Sidewalk Toronto Employees Ltd.
- Siemens ADGT
- Sinclair Interplanetary
- Sinclair Technologies Inc.
- Solantro Semiconductor Corp.
- Solar Ship Inc.
- Solvay Specialty Polymers
- Sony Corp.
- SPP Canada Aircraft Inc.
- St Mary's Cement Group
- Stackpole International
- Stantec Inc.
- Steel Structures Education Foundation
- StemCell Technologies Inc.
- StoraEnso
- Sulzer Metco
- Suncor Energy Inc.
- Sunnybrook Health Sciences Centre
- Sunwell Technologies
- Suzano Papel e Celulose
- Synbra
- Syncrude Canada Ltd.
- Teck Resources Ltd.
- Teledyne ISCO
- TELUS
- Telus Mobility
- Tembec Industries Inc.
- Tenova GoodFellow Inc.
- Tessonics Inc.
- Thales Canada Inc.
- The Iron Ore Company of Canada (IOC)
- The Miller Group
- Theralase Inc.
- ThermoFisher Scientific
- Tolko Industries Ltd.
- Toronto Hydro
- Total American Services Inc.
- Tower Automotive
- Tower Solutions
- Toyota Collaborative Safety Research Center (CSRC)
- Toyota Technical Center USA Inc.
- TransCanada
- Trapeze Software ULC
- TSI
- Ultrasonix
- Uncharted Software Inc.
- Unisearch Associates
- US Steel Canada
- VAC Aero International Inc. Vale Canada Ltd.
- Valmet Ltd.
- Vicicog
- VisImage Systems Inc.
- Visual8 Corp.
- Volkswagen Canada Inc.
- VTT Technical Research Centre of Finland
- Waterloo Instruments Inc.
- Westport Innovations
- Whitemud Resources
- WSP Canada Inc.
- Wugang Canada Resources Invest. Ltd.
- Wurth Elektronik eiSos GmbH & Co. KG
- Wuzhong Instrument Company
- Xilinx Inc.
- Xiphos Technologies Inc.
- XOR-Labs Toronto
- Zotefoams PLC

Note 3.5c: The list above includes companies from U of T's Research Information System, along with collaborators that fund research through a number of industrial research consortia, including those associated with many of our Industrial Research Chairs. It does not include companies that hire our students through the Professional Experience Year Co-op program, work with them on Multidisciplinary Capstone Projects, or provide philanthropic support.

Catalyzing Multidisciplinary Collaboration

U of T Engineering is home to 29 multidisciplinary research centres and institutes, nearly half of which have been created in the last decade. By bringing together leading researchers from across our Faculty and beyond, we are catalyzing unexpected collaborations that drive innovation and spark new ventures in areas from sustainable energy and water to robotics and artificial intelligence.

In 2018–2019 we evolved the structure of the **University of Toronto Robotics Institute** to strengthen our brand in this rapidly evolving field and ensure that our leading-edge research cluster is well recognized both in Canada and internationally. The Robotics Institute includes more than 50 principal investigators from across the Faculty and beyond, bringing together expertise in various areas of robotics technology such as sensing, control and human-machine interfaces. The institute is now focused around three pillars:

- **Autonomous vehicles and field robotics** – This area includes both land-based and airborne vehicles which can greatly enhance monitoring of remote sites, including mines or power stations. In the future, such field robots may also be able to deliver goods to remote communities such as those in northern Canada.
- **Health care robotics** – Robotics Institute researchers and their collaborators are designing robots to enhance the diagnosis and treatment of diseases. These include robots that can automate surgical procedures to enhance accuracy and safety, assistive robotics that can aid physiotherapy, and nanoscale robots that can probe structures within human organs or even individual cells.
- **Advanced manufacturing** – The manufacturing industry was one of the first to implement robotics on a wide scale. Our researchers and their collaborators are leveraging new technologies, such as smart sensing and wearable electronics, to enhance human-robot interaction and further improve efficiency across the industry.

Our newest multidisciplinary research institute is the **Centre for Analytics and Artificial Intelligence Engineering (CARTE)**, which fosters collaborations between researchers who study analytics and AI directly and those in domains where AI could be a useful tool. The goal is to catalyze translation of analytics and AI techniques and algorithms to practical challenges in areas including human health, sustainability and advanced manufacturing.

Our EMHSeed and XSeed initiatives are strengthening multidisciplinary collaborations across U of T. By providing seed funding for research projects that include professors both at U of T Engineering and in other Faculties, they encourage the development of new partnerships while enhancing creativity and innovation.

EMHSeed was created in 2016 as a partnership between U of T Engineering, the Faculty of Medicine and the Toronto Academic Health Sciences Network. It is well-aligned with other multidisciplinary initiatives such as Medicine by Design and the Translational Biology Engineering Program. Over the last four years, 29 projects have received funding through EMHSeed.

XSeed builds on the success of EMHSeed and expands the list of collaborators to include researchers in the Faculty of Arts & Science, University of Toronto Mississauga (UTM) and University of Toronto Scarborough (UTSC). Eight projects were funded through the program in 2018: four with co-investigators from the Faculty of Arts & Science, two from UTM and two from UTSC. For the 2019 cycle, the Faculty of Kinesiology & Physical Education has joined the partnership, and we expanded the total number of funded projects to 11. Examples include:

- A project to investigate the fate of nanoplastics in the environment (collaboration between Professors Bob Andrews (CivMin) and Chelsea Rochman (Ecology and Evolutionary Biology))
- A new strategy for asthma drug discovery through organ-on-a-chip enabled protein engineering (collaboration between Professors Edmond Young (MIE) and Jumi Shin (Chemistry, UTM))
- An evaluation of the environmental impact of alternative fuel vehicles under a diverse and changing climate (collaboration between Professors Daniel Posen (CivMin) and Paul Kushner (Physics))

Invention & Commercialization

Figure 3.6a **Engineering Invention Disclosure by Academic Area, 2014–2015 to 2018–2019**

| | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 | 5-Yr Total |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| UTIAS | | 1.0 | 0.3 | 2.0 | | 3.3 |
| IBBME | 6.5 | 7.8 | 5.9 | 4.4 | 8.8 | 33.4 |
| ChemE | 9.0 | 7.0 | 13.2 | 6.1 | 10.3 | 45.5 |
| CivE | 5.0 | 5.0 | 1.7 | 4.0 | 2.0 | 17.7 |
| ECE | 41.6 | 23.5 | 34.8 | 46.0 | 39.5 | 185.3 |
| EngSci | | 0.1 | 0.3 | 0.4 | 0.5 | 1.4 |
| MIE | 18.8 | 17.0 | 19.8 | 15.6 | 15.9 | 87.1 |
| MSE | 1.5 | 0.3 | 2.3 | 3.3 | 6.6 | 14.0 |
| Annual Total | 82.4 | 61.7 | 78.3 | 81.8 | 83.7 | 387.8 |
| University Annual Total | 174.0 | 162.7 | 209.0 | 165.0 | 183.1 | 893.8 |
| Engineering Percentage | 47% | 38% | 37% | 50% | 46% | 43% |

U of T Engineering continues to lead our institution in invention disclosures, as recorded by the Innovations and Partnerships Office. Our researchers accounted for 46% of these disclosures in 2018–2019 and 43% over the past five years. We also led the way in patent applications with 33 in 2018–2019, representing 50.8% of the University’s total.

Figure 3.6b **U of T Invention Disclosures by Faculty, 2018–2019**

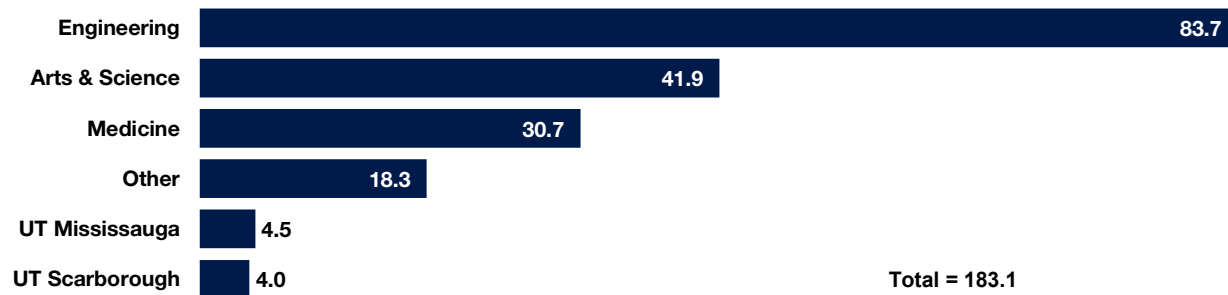
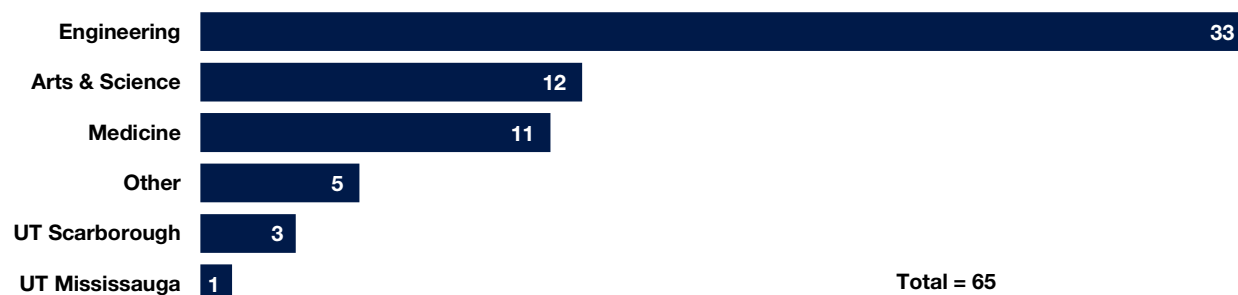


Figure 3.6c **U of T Patent Applications by Faculty, 2018–2019**



Several U of T Engineering startups and spinoffs achieved significant milestones this year:

- **AmacaThera**, built on gel-based technology developed in the lab of Professor Molly Shoichet (ChemE, IBBME) raised \$3.25 million to develop a drug delivery system that could eliminate the need to give patients powerful painkillers following surgery – a key source of the current opioid crisis.
- **Peraso Technologies**, a Canadian semiconductor startup based on technology developed in the lab of Professor Sorin Voinigescu (ECE), reached a new funding milestone of US\$110 million. The support will enable the company to further develop its chips for the 60 gigahertz (GHz) wireless band, enabling more data to be pushed through wireless hotspots for applications like streamed 4K television or virtual reality.
- **TARA Biosystems**, co-founded by Professor Milica Radisic (IBBME, ChemE), worked with Radisic's lab to develop the Biowire II, a platform that enables testing of potential drug molecules on realistic lab-grown heart tissues. The technique can prevent harmful drugs from reaching the commercial market and bring personalized medicine closer to reality.

For more details about entrepreneurship and commercialization, see the Student Entrepreneurship section of Chapter 4 – Cross-Faculty Education and Experiential learning.

4

Cross-disciplinary collaboration and experiential learning are integral to our innovative approach to engineering education. Through rich curricular and co-curricular opportunities, we enable our students to apply their strong technical abilities in context, as well as to develop competencies in leadership, project management, communication and entrepreneurship.

Students in all of our programs can customize their degrees and pursue their interests through 21 minors and certificates, including our newest offerings in Artificial Intelligence Engineering, Music Performance and Music Technology. They may also choose to gain industry exposure through our Professional Experience Year Co-op (PEY Co-op) Program, which this year celebrated its 40th year and its largest-ever cohort of 853 students, one in 10 of whom worked outside of Canada.

Our two campus-linked accelerators, Start@UTIAS and The Entrepreneurship Hatchery, are foundational to U of T's rich entrepreneurial ecosystem. Over the last five years, we have launched more than 80 startups, which have collectively raised approximately \$40 million in seed funding. Our Troost Institute for Leadership Education in Engineering (Troost ILead) brings together faculty and instructors with expertise across education, social science, business and engineering to empower and facilitate self-discovery among all our students.

In 2018, we created the Institute for Studies in Transdisciplinary Engineering Education and Practice (ISTEP) to unite faculty, programming and initiatives on a number of curricular themes, including technical communication, leadership, global fluency, business and multidisciplinary design. ISTEP strengthens our position as an innovator and global leader in engineering education.

Undergraduate Engineering Minors and Certificates, Complementary Courses and Inter-Divisional Collaboration

In 2018–2019, we further expanded our suite of minors and certificates that enable students to customize their degrees and specialize in fields from sustainable energy to engineering business. Students in all disciplines can choose from 10 minors and 11 certificates, in which they collaborate with their peers from across the Faculty to strengthen their professional competencies and widen the breadth of their experience.

Students must complete six half-courses to earn a minor, and three half-courses for a certificate. We offer the following minors and certificates:

Minors

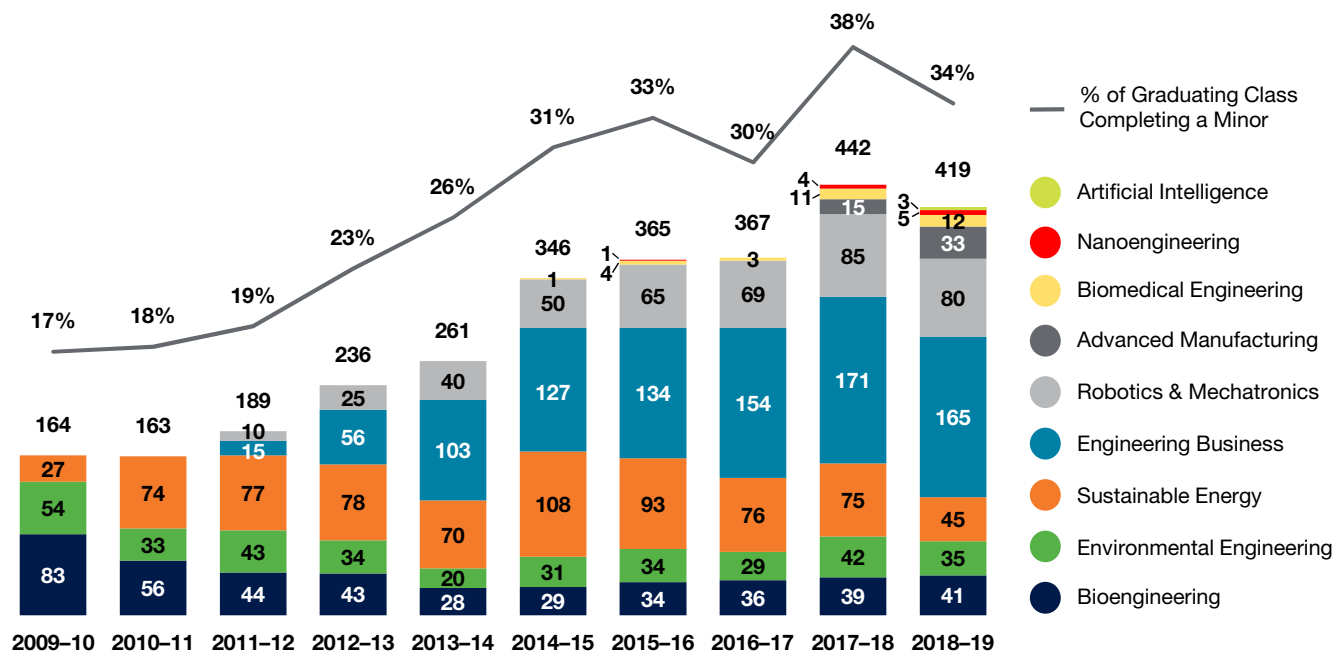
- Advanced Manufacturing
- Artificial Intelligence Engineering (new in 2019)
- Bioengineering
- Biomedical Engineering
- Engineering Business
- Environmental Engineering
- Music Performance (new in 2018, collaboration with the Faculty of Music)
- Nanoengineering
- Robotics & Mechatronics
- Sustainable Energy

Certificates

- Artificial Intelligence Engineering (new in 2019)
- Communication
- Engineering Business
- Engineering Leadership
- Entrepreneurship
- Forensic Engineering
- Global Engineering
- Mineral Resources
- Music Technology (new in 2018, collaboration with the Faculty of Music)
- Nuclear Engineering
- Renewable Resources

Students may complete more than one minor, and may also complete minors through the Faculty of Arts & Science in areas such as economics, math, sociology, philosophy and history, among others.

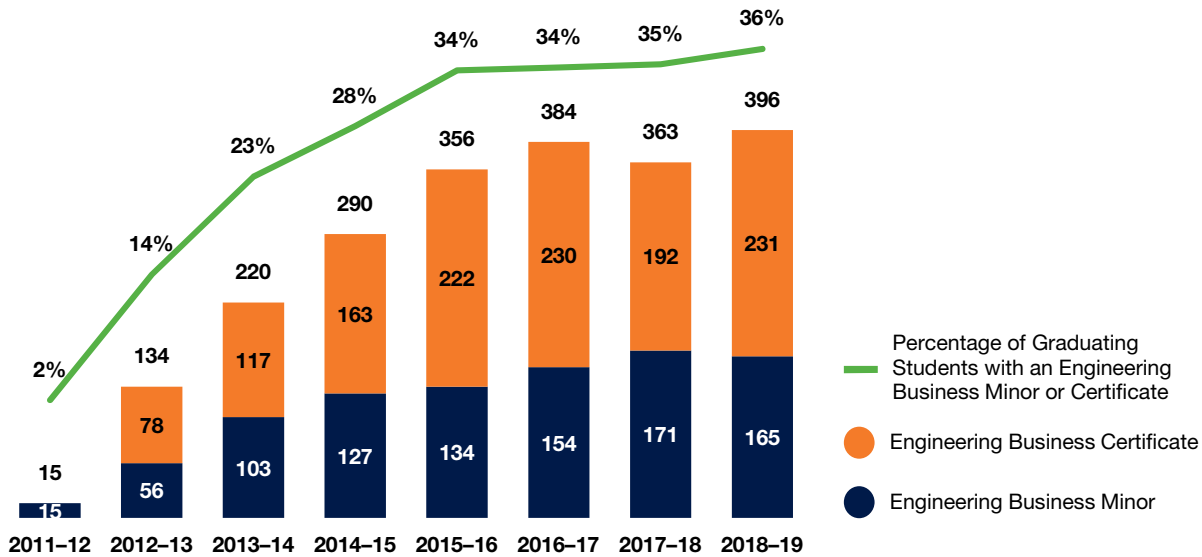
Figure 4.1a Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2009–2010 to 2018–2019



Data and highlights in this chapter are presented for the period from July 2018 to June 2019.

Note 4.1a: A total of 419 minors were completed by 373 students in 2018–2019, with many students completing more than one minor.

Figure 4.1b Students Graduating with an Engineering Business Minor or Certificate, 2011–2012 to 2018–2019



This year, 419 minors were completed by 373 students in the graduating class. More than a third (34%) of this cohort completed at least one minor, and more than half (53%) completed at least one Engineering minor, certificate or Arts & Science minor. Of these, 36% completed either the minor or certificate in Engineering Business, the highest number of graduates for any minor or certificate.

In September 2018, we welcomed the first students into our new cross-disciplinary minor in Music Performance and our certificate in Music Technology. These programs are administered collaboratively by U of T Engineering and the Faculty of Music. The minor includes courses in music theory and a newly created music performance course. Led by Faculty of Music

professors and doctoral candidates in performance, the course features weekly individual and group instruction and can be completed either as a soloist or as part of a small ensemble. The certificate focuses on the intersection between the technical and artistic aspects of sound, and prepares graduates to make an impact in areas such as digital music distribution, music production or hardware/software development.

Our newest offerings are the minor and certificate in Artificial Intelligence Engineering, which launched in January 2019. Both of these programs include a new course in AI fundamentals, and additional courses specializing in data mining, neural networks and deep learning.

Undergraduate Design and Research

We incorporate practical engineering design projects into all of our undergraduate programs, across all years of study. By working in multidisciplinary teams to design, build and test prototypes, often in collaboration with external clients, students have the opportunity to develop engineering competencies such as leadership, effective communication, professionalism and entrepreneurship.

First-Year Courses

We offer practical engineering design courses for students in the first year of all our programs. *Engineering Strategies & Practice I and II* courses are for students in TrackOne and Core 8 programs, while *Praxis I and II* are for Engineering Science students.

Praxis students partner with community groups across the Greater Toronto Area to address challenges and enhance daily life. Designs presented at the Praxis showcase in April 2019 included:

- A system to improve safety at the Toronto Tool Library's Makerspace
- New methods to improve locational awareness and navigational abilities of firefighters in active incidents at Toronto Fire Station No. 322
- An improved motorboat transportation system at the Richmond Canoe Club

Upper-Year Courses

Final-year capstone design courses are integrated into every undergraduate program we offer. In addition to their discipline-specific capstone courses, students can also choose to enroll in our *Multidisciplinary Capstone Design Project (MCP)* course through the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI). In the six years since its creation, more than 550 students from across the Faculty have completed over 120 projects for a wide range of industry clients.

In 2018–2019, 22 student teams comprising 95 students worked with companies and organizations such as the Mill Street Brewery, Defence Research and Development Canada and World Vision Canada. Projects presented at the annual MCP Showcase in April 2019 included:

- Improved earthen flooring design to enhance hygiene in rural Guatemala
- Using machine learning to predict energy consumption in buildings
- Redesigning the lower body of space suits to improve blood flow in microgravity

Undergraduate Research Opportunities

Across all years, our undergraduates engage in research that advances the frontiers of engineering, both within the Faculty and around the world.

The Engineering Science Research Opportunities Program (ESROP) enables Engineering Science students to spend the summer conducting research, both with professors at U of T (ESROP – U of T) and with researchers at partner institutions around the world (ESROP – Global). In the summer of 2019, nearly 50 students, 50% more than in the previous year, went abroad with ESROP – Global to institutions such as Osaka University (Osaka, Japan), Technion (Haifa, Israel), Massachusetts Institute of Technology (Cambridge, U.S.) and the Technical University of Darmstadt (Darmstadt, Germany).

Students in the Core 8 disciplines also have opportunities to conduct research at U of T or abroad through programs administered by the Centre for International Experience. In 2019, a total of 319 students participated in summer research opportunities across all programs. This includes 10 students who were awarded First-Year Summer Research Fellowships, which provide \$7,000 in support to students seeking to gain research experience immediately after their first year of study.

Each year, undergraduates across all programs presented their summer research findings at the Undergraduate Engineering Research Day (UnERD). The event features more than 100 posters and podium presentations on topics ranging from advanced materials to sustainable energy.

Figure 4.2a Undergraduate Participation in Summer Research Opportunities, 2010 to 2019

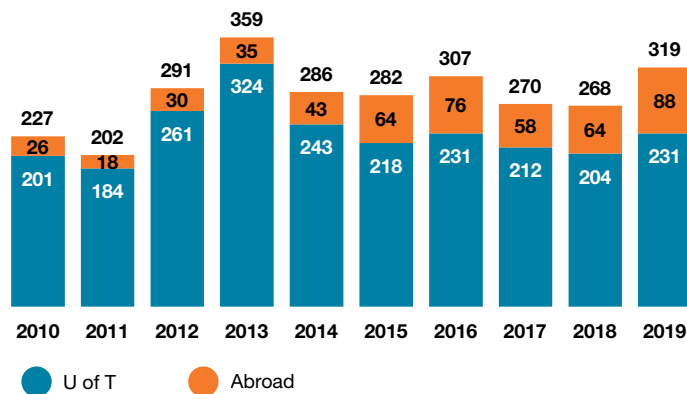


Figure 4.2b Undergraduate Participation in Summer Research Opportunities, by Academic Area, 2019

| Research Participation: | U of T | Abroad | Total |
|-------------------------|------------|-----------|------------|
| ChemE | 20 | 8 | 28 |
| CivE & MinE | 21 | 2 | 23 |
| ECE | 47 | 11 | 58 |
| EngSci | 79 | 51 | 130 |
| MIE | 42 | 14 | 56 |
| MSE | 20 | 2 | 22 |
| TrackOne | 2 | | 2 |
| Total | 231 | 88 | 319 |

Professional Experience

We offer a wide range of work-integrated learning opportunities that enable students to apply their technical and professional competencies in context, both in Canada and around the world.

The Engineering Career Centre (ECC) provides professional development programming for students through a range of engagement activities designed to facilitate the employment process and a positive transition to the workplace. In 2018–2019 we celebrated the 40th anniversary of ECC’s flagship Professional Experience Year Co-op (PEY Co-op) Program. Through PEY Co-op, undergraduates have the opportunity to gain up to 20 months of paid industry experience before graduation. PEY Co-op is the largest program of its kind in Canada. Students have access to more than 360 partner organizations, including large multinationals, startups, government agencies and hospitals.

In February 2019, we launched the inaugural PEY Co-op Awards and Recognition Reception. Awards were presented for Student of the Year, Employer of the Year, Mentors of the Year and Employers of Distinction. In addition, we recognized employers who are going above and beyond in the area of Equity, Diversity and Inclusion. This event acknowledged the strong and longstanding professional relationships between U of T Engineering and industry leaders in sectors from aerospace to software development.

A record 853 engineering students participated in the optional PEY Co-op Program in 2018–2019, representing 71% of eligible students. PEY Co-op students continue to be in extremely high demand: the number of employers hiring U of T Engineering students in 2018–2019 was 368, a 133% increase over the past 10 years. One in 10 PEY Co-op positions was located outside of Canada. The average

annualized salary was \$49,308, and the top annualized salary was \$105,375.

The ECC is poised to advance its mandate for the 2019-2020 academic year with these initiatives:

- **First-year entry** — ECC now offers students the opportunity to register for PEY Co-op directly during the admissions process.
- **Integration of ECC programs** — Previously, ECC operated the Engineering Student Internship Program (ESIP), which facilitated four-month internships, primarily during the summer term. This program is being combined with PEY Co-op, so that students who sign up in first year now have the option of completing both a four-month internship after their second year, and a PEY Co-op term of up to 16 months after their third year.
- **Professional competencies** — We have appointed a Director, Student Development and Career Programming to advance new programs that enable students to develop competencies in professional communication, teamwork, leadership and the impact of engineering on society. These programs will build on the success of existing initiatives such as the PEY Edge Conference and the Engineering Career Fair.
- **Graduate internship program** — We will expand the benefits of PEY Co-op to our graduate students by launching a professional internship program aimed at MEng candidates. The initial program will partner with companies to create work terms of up to four months.
- **Industry site visits** — We are developing protocols to meet with all PEY Co-op students on site during their work terms to steward industry relationships, assess the quality of the student experience and gather feedback about ways the program could be further improved.

Figure 4.3a Engineering Undergraduate Students Participating in PEY Co-op with Percentage Participation, 2009–2010 to 2018–2019

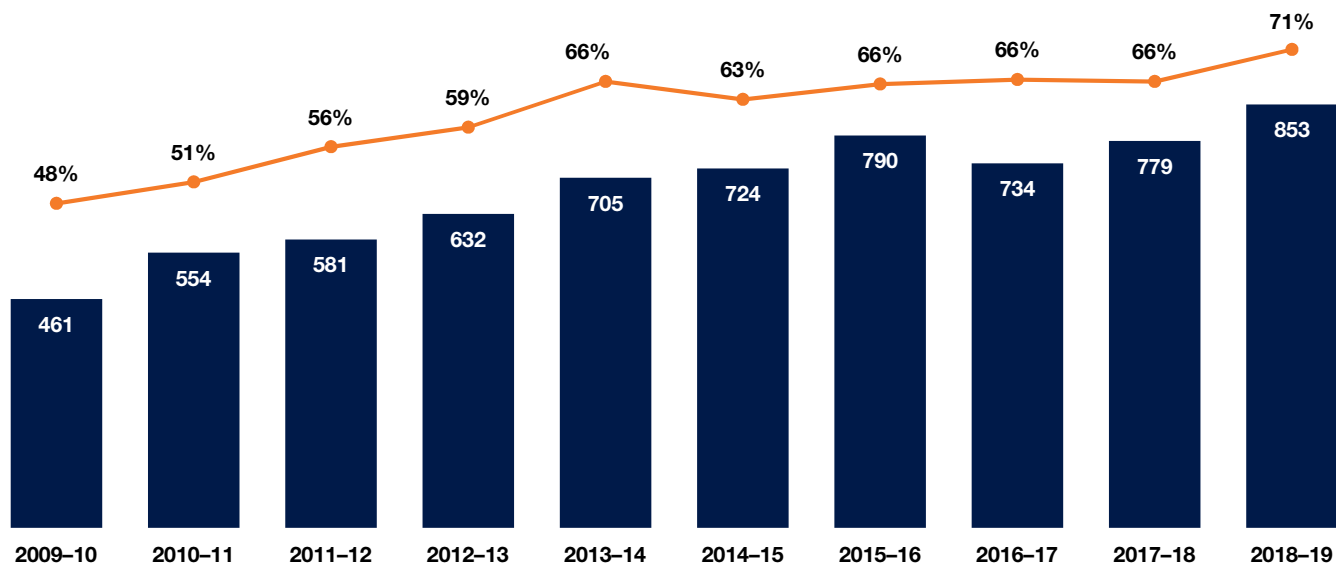


Figure 4.3b Canadian and International PEY Co-op Positions, 2009–2010 to 2018–2019

| | Canadian Positions | U.S. Positions | Other International Positions | Total Positions |
|---------|--------------------|----------------|-------------------------------|-----------------|
| 2009–10 | 426 | 24 | 11 | 461 |
| 2010–11 | 530 | 11 | 13 | 554 |
| 2011–12 | 547 | 26 | 8 | 581 |
| 2012–13 | 592 | 24 | 16 | 632 |
| 2013–14 | 644 | 36 | 25 | 705 |
| 2014–15 | 663 | 42 | 19 | 724 |
| 2015–16 | 711 | 50 | 29 | 790 |
| 2016–17 | 669 | 49 | 16 | 734 |
| 2017–18 | 713 | 48 | 18 | 779 |
| 2018–19 | 768 | 64 | 21 | 853 |

Figure 4.3c PEY Co-op Employers, 2009–2010 to 2018–2019

| | PEY Co-op Employers who Hired Engineering Students |
|---------|--|
| 2009–10 | 158 |
| 2010–11 | 185 |
| 2011–12 | 221 |
| 2012–13 | 241 |
| 2013–14 | 304 |
| 2014–15 | 317 |
| 2015–16 | 310 |
| 2016–17 | 337 |
| 2017–18 | 318 |
| 2018–19 | 368 |

Note 4.3a: Percentage participation is calculated by dividing the number of completed PEY Co-op positions by the number of eligible students (i.e. the third-year cohort from the previous year).

Student Entrepreneurship

Through both curricular and co-curricular programs, we offer strong support for undergraduate and graduate students who are interested in entrepreneurship. We provide access to mentorship, fabrication facilities, seed funding and office space to enable our community members to translate their innovations from concepts into viable, market-ready products. We integrate our efforts with other programs available across U of T to form a rich ecosystem of entrepreneurship support.

Curricular Programs

Students in our Core 8 streams can complement their technical studies with an Engineering Business minor or certificate, or a certificate in Entrepreneurship, Innovation & Small Business. For Masters of Engineering students, the Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) emphasis prepares them to lead in business and entrepreneurial enterprises.

The Entrepreneurship Hatchery

Established in 2012, The Entrepreneurship Hatchery provides a comprehensive suite of programs and services to nurture a culture of entrepreneurship across the Faculty. Over the last five years, the Hatchery has launched more than 80 startups, including many based on U of T Engineering research. To date, these companies have collectively raised more than \$40 million in seed funding.

Events such as the weekly Idea Markets, Hatchery Speaker Series, Co-Founders Day and Accelerator Weekend enable students with a drive to create their own companies to meet and interact with each other, and with experienced mentors from a variety of fields. These experiences spark collaborations and help form teams that enter Hatchery programs.

Hatchery NEST

This rigorous summer program guides student teams as they turn their business ideas into companies, including designing and creating prototypes or minimum viable products. Over four months, students receive mentorship and advice from seasoned professionals in intellectual property, marketing, finance and other areas of business development. They also have access to fellowships, work space and prototyping facilities featuring 3D printers, laser cutters, tools and materials.

In 2018, Hatchery NEST received 118 applications and accepted 38 teams, 13 of which competed at the annual Hatchery Demo Day in September 2018, where they pitched

their startups to investors and the U of T community. The winners included:

- **Grid** — Grid uses wide-angle cameras programmed with image recognition technology to detect available parking spaces and broadcast their location in real time, so drivers can navigate to the available spot or reserve a parking space before setting out. The system also provides parking lots with real-time analytics, allowing them to introduce dynamic pricing models.
- **Voco** — Voco is a platform that allows audio content creators and advertisers to easily upload their content to all smart speakers. Just as Spotify works for music, Voco would enable users to search for audio news, commentary, comedy or drama, all via voice command.
- **Knowtworthy** — Knowtworthy's software provides real-time automated transcription of meeting minutes, instant action items that can be linked to team members' calendars, and provides personalized reports to each member on how to improve their communication skills by providing metrics on a team member's engagement or openness to ideas.
- **Zeroth Responders** — Using the Zeroth app, volunteers trained in CPR or first aid would be alerted if someone nearby is in distress. The goal is to reduce response times for medical emergencies and keep patients stable until paramedics arrive.

Hatchery LaunchLab

Established in fall 2016, the Hatchery LaunchLab provides support for research-driven startup companies led by graduate students and faculty. Teams benefit from enriched support including legal counsel, accounting and marketing services, an advisory board composed of experts in technical and business development, mentors with experience in the industries in which the startups hope to compete and funding for an extended incubation period of one to two years. LaunchLab equips teams to sustain themselves while they complete the development necessary to deliver proof-of-concept for their technology and attract investment from venture capitalists.

Teams currently part of Hatchery LaunchLab include:

- **Pliant Power Devices** — Pliant creates electrically conductive plastics for next-generation batteries.
- **Phycus Biotechnologies** — Phycus produces bio-based ingredients for personal care products.
- **Amber Molecular** — Amber develops organic light-emitting diodes for electronic displays and interior lighting.
- **Iconthin Biotech Corp.** — Iconthin leverages microfluidics to grow microalgae that produce nutritional supplements, such as astaxanthin.

Institute for Studies in Transdisciplinary Engineering Education and Practice (ISTEP)

Created in 2018, the Institute for Studies in Transdisciplinary Engineering Education and Practice (ISTEP) is reshaping the way our Faculty educates engineers, preparing the next generation to contribute to society, build a prosperous economy, and enjoy lifelong career growth in an increasingly complex and global environment.

Under the direction of Professor Greg Evans (ChemE), ISTEP consolidates and expands our graduate and undergraduate programming in communication, leadership, business, entrepreneurship and engineering education. It also brings together faculty members engaged in the scholarship of teaching and learning to improve pedagogy, enhance learning and growth, and foster the transdisciplinary competencies necessary for future success.

ISTEP comprises the following six areas:

- The Engineering Communication Program, which for more than 20 years has been a leader in teaching and research in professional communication;
- The Troost Institute for Leadership Education in Engineering, which conducts research and builds programming to help students discover and enhance their leadership potential;
- The Centre for Global Engineering, a cross-disciplinary hub for research projects that address some of the world's most pressing challenges;
- The undergraduate-level Engineering Business minor, the most in-demand of the Faculty's 10 multidisciplinary engineering minors;
- The undergraduate certificate in Entrepreneurship Innovation and Small Business; and
- The graduate-level Collaborative Specialization in Engineering Education (EngEd)

ISTEP now has 11 faculty and more than 30 adjunct and sessional instructors.

The major contributions of ISTEP to teaching and learning in 2018–2019 include:

- **Specialized courses** — ISTEP led the delivery of more than 30 courses that focus on engineering competencies such as communication (10 courses), leadership (14 courses), business & entrepreneurship (five courses) and engineering education (three courses).
- **Embedded learning** — ISTEP faculty collaborated with professors across U of T Engineering to integrate the instruction of transdisciplinary competencies into 20 design and other technical courses. This instruction of communication and team skills enhanced the learning experience for students across each of the Faculty's

undergraduate programs.

- **Ethics and equity** — Workshops on ethics and equity were developed from 15 case studies based on interviews with engineers across diverse career trajectories and piloted in eight engineering courses.
- **EngEd** — Two MASc students graduated last year from the Collaborative Specialization in Engineering Education (EngEd) program. Currently, 13 PhD students are enrolled in the program, including seven from Engineering and six from the Ontario Institute of Studies in Education (OISE). The Graduate Program in Higher Education at OISE joined the specialization last year.
- **OPTIONS** — The Opportunities for PhDs: Transitions, Industry Options, Networking and Skills (OPTIONS), an initiative led jointly by the Vice-Dean, Graduate Studies and Troost ILead, prepares PhD students and postdoctoral fellows for careers outside academia. More than 30 students completed all requirements of the OPTIONS program in the fall of 2018, with a total of 229 participating in complementary events associated with the program. (*For more information on OPTIONS, see Chapter 2: Enriching the Graduate Student Experience*)

ISTEP increased its research and scholarship on engineering education and the development of professional skills and competencies, such as:

- **Engineering education and professional development** — ISTEP faculty are active in the leadership of a number of professional associations, including the Canadian Engineering Education Association (CEEA) and the American Society for Engineering Education (ASEE). The Faculty hosted the IEEE Professional Communication Conference in July 2018, which drew participants from all over North America and Europe.
- **Skills development and assessment** — ISTEP helped to develop major research proposals on skills development and assessment to the federal Future Skills Centre initiative and provincial Higher Education Quality Council of Ontario.
- **Work-integrated learning and leadership** — In collaboration with the Engineering Career Centre, the PEY Co-op Project began exploring ways to enhance work-integrated learning. The Engineering Leadership Project examined how engineers learn to lead at all stages of their careers.
- **Data analysis** — At the national level, Statistics Canada data were analyzed to explore the transition from university to the workforce and new questions were added to Engineers Canada's Final Year Student Exit Survey to provide a national snapshot of the leadership competencies of engineering graduates.

Engineering Communication Program (ECP)

The Engineering Communication Program provides support to all students and is a leading centre for teaching, research and professional communication in engineering. Its programming is integrated into courses across the curriculum from first to fourth year. Writing and communication workshops and one-to-one tutoring are also available to students through ECP.

In 2018–2019, more than 1,000 students received communication support through ECP's tutoring service and demand for this support continues to increase. ECP also coordinates the undergraduate certificate in Communication, launched in 2015–2016, which leverages eight humanities and social sciences electives offered by ECP faculty since 2008, with a ninth set to be launched in 2019–2020.

Our Faculty has been very successful in attracting increased numbers of international students. ECP has supported this transition by growing the support it provides, including professional language support for multilingual students. In 2015–2016, ECP piloted the Diagnostic English Language Needs Assessment (DELNA) for all incoming first-year students, enabling identification of those who may experience challenges participating in their lectures, tutorials or team projects. Partnering with Queen's University, faculty developed a suite of assignment-specific workshops, increased the capacity of the Tutoring Centre to work with multilingual students, tracked student progress in second and third year, and produced an 8-module *Interventions for Engineering Communication Development* resource to be published online under a Creative Commons license.

Troost Institute for Leadership Education in Engineering (Troost ILead)

The Troost Institute for Leadership Education in Engineering prepares students to maximize their impact as engineers, innovators and leaders by providing transformative curricular and co-curricular learning opportunities. Troost ILead also conducts academic and industry-focused research and outreach to engineering leadership educators and engineering-intensive enterprises.

Troost ILead offered six undergraduate and eight graduate courses in 2018–2019. MEng students can count these courses toward the Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) certificate, while undergraduate students can earn credits toward the minor in Engineering Business or the certificate in Engineering Leadership. Demand for these courses was strong, with overall enrolment reaching 672, a 14% increase from the previous year.

Engineering students also gained opportunities to hone their leadership competencies and self-development through Troost ILead's innovative co-curricular programs. In 2018–2019, Troost ILead offered 24 co-curricular Leadership Labs that reached more than 1,000 students. Moreover, these labs provided work experience for four students who were trained as co-facilitators. A further nine students participated in the 16-week Troost ILead Summer Fellowship. Students developed strategies for organizational development, peer learning and individual coaching, to help them increase the impact of their student organizations. Thirty students participated in the Faculty-wide Summer Leadership Program. This eight-week series of workshops provides students with opportunities to better understand their strengths and values, and gain new perspectives on engineering and its impact on society.

Troost ILead's research efforts in 2018–2019 involved three different project types: insight research, pedagogical and programmatic innovation research, and secondary analyses of large-scale data sets with associated knowledge mobilization. Updates from the Engineering Leadership Project and the PEY Co-Op Project were presented as part of two Community of Practice Workshops that brought together industry partners, faculty and students to further explore the findings. Troost ILead also hosted four well-attended seminars with speakers from Pennsylvania State University, Purdue University, Western University and Colorado School of Mines.

Student Clubs and Teams

U of T Engineering is home to more than 100 student clubs and teams. Some of these groups, such as the University of Toronto Aerospace Team, the aUToronto team, and the Blue Sky Solar Racing team, compete in and win intercollegiate contests across North America and around the world. Others, such as Skule™ Nite, the Spark Design Team and the Skule™ Orchestra, emphasize cultural or artistic pursuits, further enriching the student experience.

All undergraduates can document their co-curricular activities in the U of T Co-curricular Record, an official report that offers recognition for competencies gained through athletic teams, student government, cultural clubs, design teams and other campus organizations.

The Centralized Process for Student Initiative Funding (CPSIF) allows student groups to apply to various funding sources within the Faculty via a single application. In 2018–2019, 92 undergraduate and graduate engineering student groups and initiatives shared a total of \$368,669.36 through CPSIF.

A complete list of student clubs and teams is available in Appendix D.

5

Our U of T Engineering community continues to earn local, national and international recognition for outstanding achievements in research, teaching, professional leadership and community service.

In 2018, we received more than 15% of major national and international awards won by Canadian engineering professors, while making up 6% of the engineering faculty in Canada. This year, these included fellowships in the Royal Society and the Canadian Academy of Engineering, as well as the Engineers Canada Awards.

Our international recognition grew this year with the induction of our faculty members into academies around the world. Paul Young (CivMin) was inducted into the U.K.'s Royal Academy of Engineering and Molly Shoichet (ChemE, IBBME) was inducted into the Royal Society (U.K.), the world's oldest scientific academy and one of the most prestigious.

Several professors were recognized for a lifetime of notable achievements, including Levente Diosady (ChemE) who was inducted into the Order of Canada. Tom Chau (IBBME) received the Governor General's Innovation Award, which celebrates innovations that are exceptional, transformative and positive in their impact on quality of life in Canada.

U of T Engineering professors in the early stages of their careers also earned a number of prominent awards. Shoshanna Saxe (CivMin) received the Ontario Professional Engineers Young Engineer Medal and Jennifer Drake (CivMin) garnered the Young Engineer Achievement Award from Engineers Canada. Alison McGuigan (ChemE) was inducted into the Royal Society of Canada's College of New Scholars, Artists and Scientists.

Our faculty also garnered honours for innovation in teaching, such as the President's Teaching Award earned by Will Cluett (ChemE), and the Northrop Frye Award received by Michael Carter (MIE). We also received recognition for equity, diversity and inclusion, such as the International Day for the Elimination of Racial Discrimination Recognition Award presented to Mikhail Burke. In addition to external accolades, we continue to recognize the excellence of our staff and faculty through a number of internal awards for research, teaching, leadership and dedication to improving the student experience.

Measuring Excellence

In 2018, U of T Engineering faculty earned 12 major awards and honours in recognition of our excellence in research, teaching and contributions to the engineering profession.

Figure 5.1 Summary of Major International, National and Provincial Awards and Honours, 2009 to 2018

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| International | | | | | | | | | | |
| AAAS Fellowships (Engineering Section) | 4 | 6 | 5 | 3 | | | 1 | 4 | 1 | |
| MIT Top 35 Under 35 | | | | 1 | | | | | 1 | |
| National Academy of Inventors | | | | 1 | | | | | | 1 |
| Royal Academy of Engineering | | | | 1 | | | | | | 1 |
| U.S. National Academies* | | 1 | 1 | | | 1 | | 1 | | |
| National | | | | | | | | | | |
| Brockhouse Prize | | | | | | | | 1 | | |
| Canadian Academy of Engineering Fellowship | 9 | 8 | 1 | 7 | 6 | 3 | 5 | 5 | 5 | 3 |
| Engineering Institute of Canada Fellowship | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 1 |
| Engineering Institute of Canada Awards | | 1 | 2 | 1 | 2 | | 1 | 1 | 2 | |
| Engineers Canada Awards | 1 | 3 | | 1 | 1 | 1 | 1 | | 1 | 1 |
| Governor General's Innovation Award | | | | | | | | | 1 | 1 |
| Killam Research Fellowship* | | 2 | | | | | | | | |
| Killam Prize* | | | | | | 1 | | 1 | 1 | |
| Manning Innovation Award | | | | | | 1 | | | | |
| Order of Canada | | | | | | | | | 2 | 1 |
| Royal Society of Canada Fellowship* | 1 | 2 | 4 | 3 | | 2 | 2 | 1 | 2 | |
| Royal Society of Canada College of New Scholars, Artists and Scientists | | | | | | 1 | 1 | 1 | 1 | 1 |
| Steacie Fellowship* | 1 | | | 2 | 1 | 1 | 1 | 1 | | |
| Steacie Prize* | | | | 1 | | | | | 1 | |
| Synergy Award for Innovation | 1 | | | 1 | | | | | | |
| Provincial | | | | | | | | | | |
| Ontario Professional Engineers Awards | 4 | 4 | 5 | 3 | 2 | 2 | 1 | 2 | 3 | 1 |
| OCUFA Teaching Award | | 1 | | | | | 1 | 1 | | |
| Order of Ontario | | 1 | 1 | | | | | | | 1 |
| Total | 25 | 32 | 22 | 26 | 15 | 16 | 16 | 22 | 22 | 12 |

Data in this chapter are presented for the 2018 calendar year (January to December). Selected faculty, alumni and staff awards were received between summer 2018 and summer 2019.

Note 5.1: (*) denotes U of T performance indicator. Data shown are by calendar year (January to December) and include faculty award recipients only. Please see Appendix G to read descriptions of the listed awards and honours.

Of the prestigious national and international awards that are presented annually to Canadian engineering professors, U of T Engineering professors earned 10, or 15.2% of the total, while representing just 6.0% of engineering faculty members nationally.

Figure 5.2a Number of Major National and International Awards Received by U of T Engineering Compared to Other Canadian Engineering Faculties, 2018

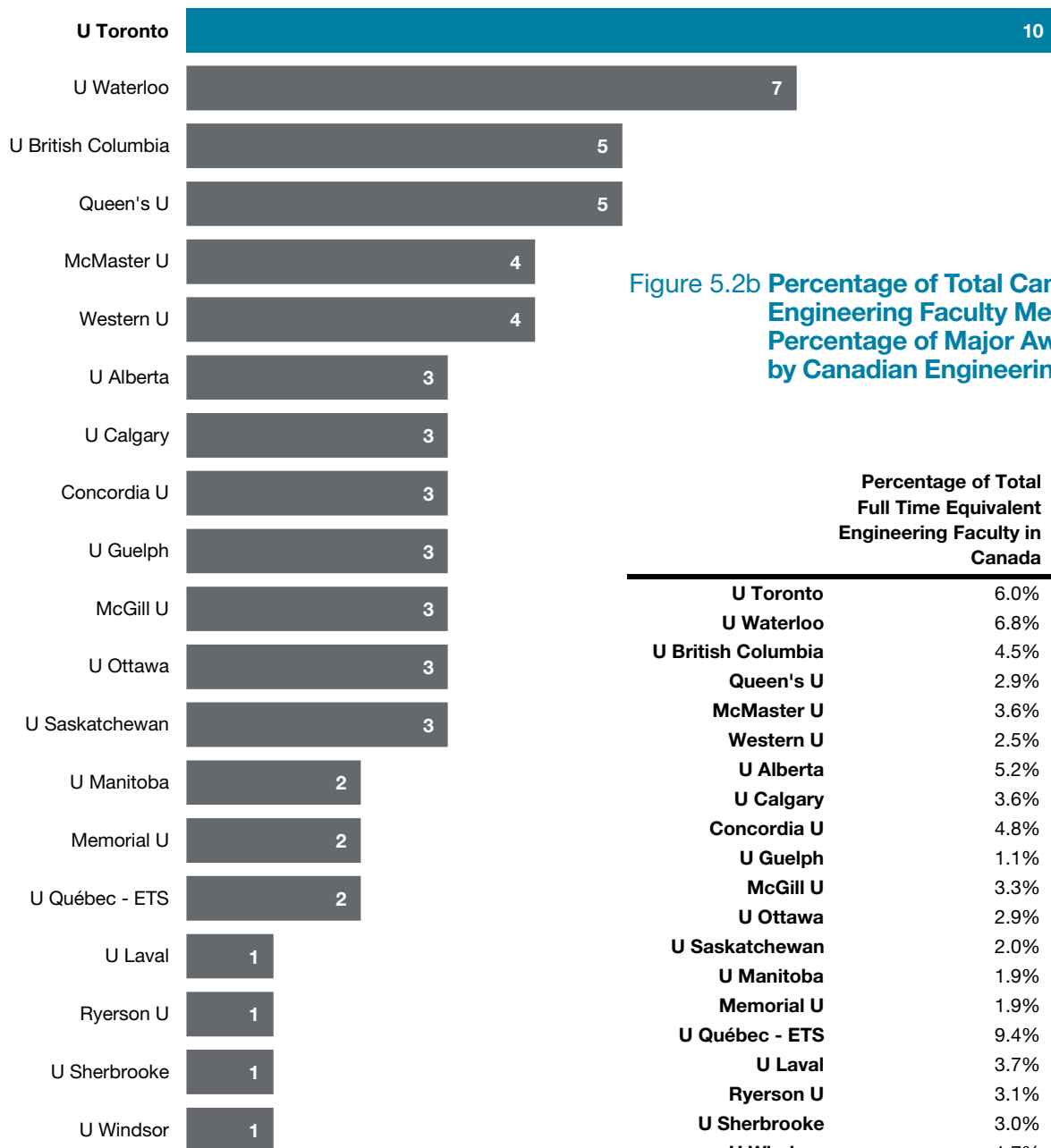
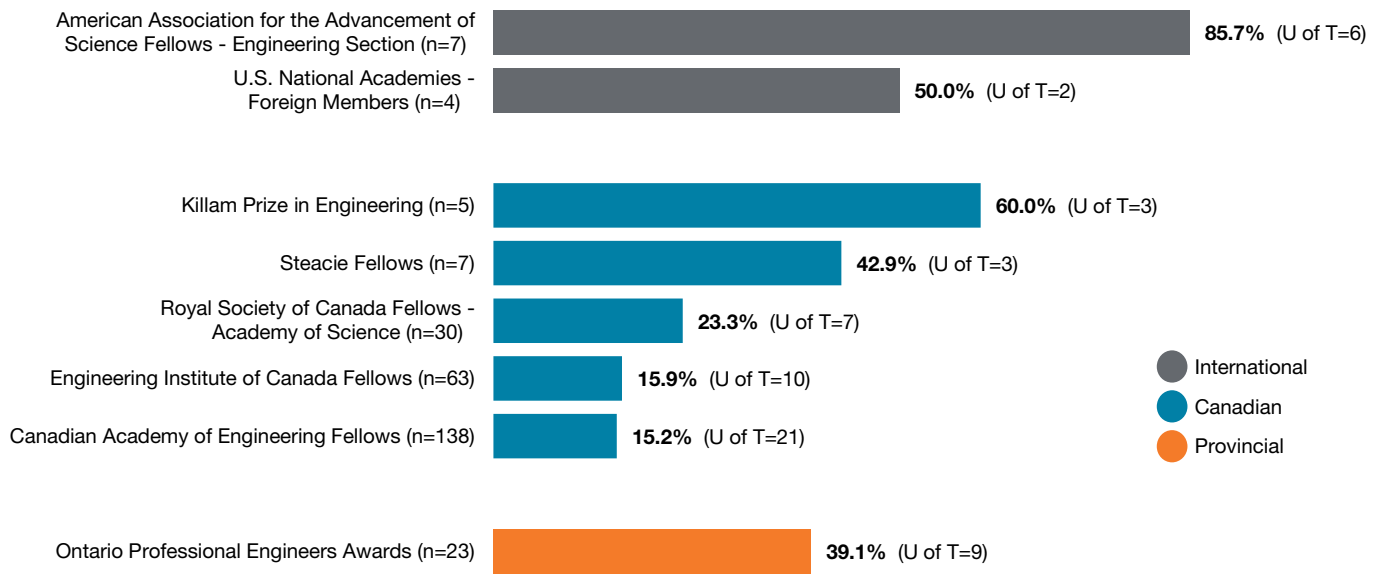


Figure 5.2b Percentage of Total Canadian Engineering Faculty Members and Percentage of Major Awards Received by Canadian Engineering Faculties, 2018

| | Percentage of Total Full Time Equivalent Engineering Faculty in Canada | Percentage of Total Major Awards Received by Engineering Faculties |
|---------------------------|--|--|
| U Toronto | 6.0% | 15.2% |
| U Waterloo | 6.8% | 10.6% |
| U British Columbia | 4.5% | 7.6% |
| Queen's U | 2.9% | 7.6% |
| McMaster U | 3.6% | 6.1% |
| Western U | 2.5% | 6.1% |
| U Alberta | 5.2% | 4.5% |
| U Calgary | 3.6% | 4.5% |
| Concordia U | 4.8% | 4.5% |
| U Guelph | 1.1% | 4.5% |
| McGill U | 3.3% | 4.5% |
| U Ottawa | 2.9% | 4.5% |
| U Saskatchewan | 2.0% | 4.5% |
| U Manitoba | 1.9% | 3.0% |
| Memorial U | 1.9% | 3.0% |
| U Québec - ETS | 9.4% | 3.0% |
| U Laval | 3.7% | 1.5% |
| Ryerson U | 3.1% | 1.5% |
| U Sherbrooke | 3.0% | 1.5% |
| U Windsor | 1.7% | 1.5% |

Note 5.2a, b: Data shown are by calendar year (January to December) and include faculty award recipients only. The following major awards are included: International — American Association for the Advancement of Science Fellowship (Engineering Section), MIT Top 35 under 35, the National Academy of Inventors, the Royal Academy of Engineering and the U.S. National Academies; National — Brockhouse Prize, Canadian Academy of Engineering Fellowship, Engineering Institute of Canada Awards, Engineering Institute of Canada Fellowship, Engineers Canada Awards, Governor General's Innovation Awards, Killam Prize (Engineering), Killam Research Fellowship, Manning Innovation Award, Order of Canada, Royal Society of Canada Fellowship (Engineering/Physical Sciences), Royal Society of Canada College of New Scholars, Artists and Scientists, Steacie Fellowship, Steacie Prize and Synergy Awards for Innovation.

Figure 5.3 Number of Awards Received by U of T Engineering Faculty Compared to Other Canadian Engineering Faculties, 2014 to 2018



Selected Awards Received by Faculty

The following is a selected list of awards U of T Engineering faculty received between summer 2018 and summer 2019:

INTERNATIONAL

American Concrete Institute: *Honorary Member*

Doug Hooton (CivMin)

American Physical Society: *Fellow*

Nazir Kherani (ECE, MSE)

Hoi-Kwong Lo (ECE)

American Society of Metals: *Thermal*

Spray Society Hall of Fame

Javad Mostaghimi (MIE)

Association for Computing

Machinery: Distinguished Member

Natalie Enright Jerger (ECE)

Institute of Electrical and Electronics Engineers:

Electron Device Society Service Award

Wai Tung Ng (ECE)

Institute of Electrical and Electronics Engineers: *Fellow*

Stewart Aitchison (ECE)

Paul Chow (ECE)

Mark Fox (MIE)

Hans-Arno Jacobsen (ECE)

International Association for Travel Behavior

Research: Lifetime Achievement Award

Eric Miller (CivMin)

International Union of Pure and Applied

Chemistry: Distinguished Women in

Chemistry or Applied Chemistry Award

Molly Shoichet (ChemE, IBBME)

National Academy of Inventors: *Fellow*

Yu Sun (MIE)

Optical Society of America: *Fellow*

Amr Helmy (ECE)

Hoi-Kwong Lo (ECE)

Note 5.3: Data shown are by calendar year (January to December) and include faculty award recipients only.

Royal Academy of Engineering: *Fellow*

Paul Young (CivMin)

Royal Society (U.K): *Fellow*

Molly Shoichet (ChemE, IBBME)

Society for Biomaterials: *Clemson Award for Contributions to the Literature*

Paul Santerre (IBBME)

NATIONAL

Canadian Academy of Engineering: *Fellow*

Frank Kschischang (ECE)

Zheng-Hong Lu (MSE)

Harry Ruda (MSE)

Canadian Academy of Health Sciences: *Fellow*

Michael Carter (MIE)

Canadian Society for Civil Engineering: *Fellow*

Robert Andrews (CivMin)

Canadian Society for Mechanical

Engineering: *I.W. Smith Award*

Eric Diller (MIE)

Canadian Society for Mechanical

Engineering: *Robert W. Angus Medal*

Markus Bussmann (MIE)

Delta Management Clean50: *Emerging Leader*

Shoshanna Saxe (CivMin)

Engineers Canada: *Young Engineer Achievement Award*

Jennifer Drake (CivMin)

Engineering Institute of Canada: *Fellow*

Robert Andrews (CivMin)

Andrew Jardine (MIE)

Jeff Packer (CivMin)

Engineering Institute of Canada:

Julian C. Smith Medal

Heather MacLean (CivMin)

Order of Canada: *Officer*

Levente Diosady (ChemE)

IEEE Canada: *M. B. Broughton Central Canada Award*

Wai Tung Ng (ECE)

Office of the Governor General: *Governor General's Innovation Award*

Tom Chau (IBBME)

Royal Society of Canada College of New Scholars, Artists and Scientists: *Member*

Alison McGuigan (ChemE)

Senior Women Academic Administrators of Canada: *Angela Hildyard Recognition Award – Influential Leader*

Susan McCahan (MIE)

Provincial / Municipal

Ontario Professional Engineers

Awards: *Entrepreneurship Medal*

Milos Popovic (IBBME)

Ontario Professional Engineers Awards:

Research and Development Medal

Milica Radisic (IBBME, ChemE)

Ontario Professional Engineers

Awards: *Young Engineer Medal*

Shoshanna Saxe (CivMin)

U of T

Northrop Frye Award

Michael Carter (MIE)

President's Teaching Award

Will Cluett (ChemE)

University Professor

Elizabeth Edwards (ChemE)

Selected Awards Received by Staff, April 2018 to April 2019

INTERNATIONAL

Council for Advancement and Support of Education (CASE) – District II Honourable Mention

Plunge A Prof Staff & Faculty Campaign

Engineering Advancement & Alumni Relations,
Engineering Strategic Communications

Canadian Council for the Advancement of Education (CCAIE) – Prix d'Excellence: Best Photo

Skule Bnad Pride

Engineering Strategic Communications

NATIONAL

Canadian Council for the Advancement of Education (CCAIE) – Prix d'Excellence: Best New Idea

Plunge A Prof Staff & Faculty Campaign

Engineering Advancement & Alumni Relations,
Engineering Strategic Communications

U of T

International Day for the Elimination of Racial Discrimination Recognition Award

Mikhail Burke (Dean's Office)

U of T Engineering Staff and Faculty Awards, 2015–2016 to 2018–2019

Each year, U of T Engineering recognizes the excellence of our staff and faculty through a number of awards for research, teaching, leadership and dedication to improving the student experience.

Agnes Kaneko Citizenship Award

Presented to a staff member who has served with distinction and made contributions to the Faculty's mission above and beyond their job description over a long period of time.

2018–19: Jennifer Rodrigues (ECE)

2017–18: Mary Butera (ChemE)

2016–17: Joan DaCosta (UTIAS)

2015–16: Matthew Chow (ECE)

Early Career Teaching Award

Presented in recognition of exceptional teaching by a faculty member who has taught at U of T for less than six years.

2018–19: Arthur Chan (ChemE)

2017–18: Vaughn Betz (ECE)

2016–17: Matthew Mackay (MIE)

Faculty Teaching Award

Recognizes a faculty member who demonstrates outstanding classroom instruction and develops innovative teaching methods.

2018–19: Jason Anderson (ECE)

2017–18: Manfredi Maggiore (ECE)

2016–17: Craig Simmons (MIE, IBBME)

Harpreet Dhariwal Emerging Leader Award

Presented to a staff member who leads by example in their dedication to the Faculty's mission. Recipients are held in high regard by colleagues and demonstrate potential to assume more senior leadership roles within the Faculty.

2018–19: Caroline Ziegler (Office of the Dean)

2017–18: Shawn Mitchell (ECE)

2016–17: Andrey Shukalyuk (IBBME)

2015–16: Bruno Korst (ECE)

Innovation Award

Presented to staff who, individually or as a team, address a problem creatively by developing a new technology or making significant improvements to an existing system or method.

2017–18: Sarah Steed (Office of Advancement)
2016–17: Pauline Martini (ChemE)
2015–16: Roberta Baker, Raymond Cheah, Shilpa Gantotti and Catherine Riddell (Engineering Strategic Communications)

Quality of Student Experience Award (Behind-the-scenes staff)

Presented to a staff member who has made significant improvements to the quality of student experience.

2018–19: Teresa Didiano (Troost ILead)
2017–18: Scott Sleeth (EngSci)

Barbara McCann Quality of Student Experience Award for Frontline Staff

Presented to a staff member who has made significant improvements to the quality of student experience.

2018–19: Jho Silverio Nazal (MIE)
2017–18: Jennifer Fabro (Office of the Registrar)
2016–17: Cori Hanson (Office of the Registrar)
Endang (Susie) Susilawati (ChemE)
2015–16: Carla Baptista (MIE)

Safwat Zaky Research Leader Award

Presented to a faculty member or team who has shown leadership in innovative, interdisciplinary and/or collaborative research initiatives that have enhanced the Faculty's research profile within the broader community.

2018–19: Stewart Aitchison (ECE)
2017–18: George Eleftheriades (ECE)
2016–17: Greg Evans (ChemE)
2015–16: Alberto Leon-Garcia (ECE)

Catherine Gagne Sustained Excellence in Leadership Award

Presented to a staff member who has demonstrated leadership in supporting the Faculty's education and/or research endeavours over a sustained period (typically 10 years or more).

2018–19: Krisztina Harmath (ECE)
2017–18: Kelly Chan (ECE)
2015–16: Leslie Grife (First Year Office)

Sustained Excellence in Teaching Award

Recognizes a faculty member who has demonstrated excellence in teaching over the course of at least 15 years.

2018–19: Frank Kschischang (ECE)
2017–18: Graeme Norval (ChemE)
2016–17: Will Cluett (ChemE)

Engineering Alumni Network Awards, 2015–2016 to 2018–2019

The Engineering Alumni Network's annual awards honour graduates for outstanding contributions to U of T Engineering and to the profession.

L.E. (Ted) Jones Award of Distinction

Inspired by the contributions of Professor Emeritus L.E. (Ted) Jones, this award honours an alumnus/alumna for his or her support and dedication to U of T Engineering and its arts community.

2018–19: Robert Bazzocchi (EngSci 1T9);
Emma Sexton (IndE 1T9)
2017–18: Reena Cabanilla (ChemE 1T8)
2016–17: Allan Kuan (EngSci 1T4 + PEY, CivE MAsc 1T7);
Alex Perelgut (EngSci 1T6 + PEY)
2015–16: Xiao Fionna Gan (EngSci 1T6)

7T6 Early Career Award

Presented to an alumnus/alumna 10 years after graduation who is distinguished in the profession and community.

2018–19: Holly Johnson (MechE 1T0)
2017–18: Huda Idrees (IndE 1T3); Cameron Robertson
(EngSci 0T8, UTIAS MAsc 0T9)
2016–17: Andrew Gillies (MechE 0T7); Christopher Wilmer
(EngSci 0T7)
2015–16: Gimmy Chu (ElecE 0T6)

2T5 Mid-Career Achievement Award

Presented to an alumnus/alumna 25 years after graduation who has earned respect within the profession and broader community, attained significant achievement and exhibits promise of further contributions.

2018–19: Maryam Shanechi (EngSci 0T4)
2017–18: Alvin Mok (EngSci 0T3)
2016–17: Tom Chau (EngSci 9T2)
2015–16: Raffaello D'Andrea (EngSci 9T1)

Malcolm F. McGrath Alumni Achievement Award

Named in honour of Malcolm McGrath on his retirement as assistant dean, alumni liaison, this award recognizes contributions of personal service to the Faculty, University or to the greater community.

2018–19: James Courtney (EngSci 6T6, Physics MSc 1967, PhD 1971, MBA 1985)
2017–18: Elias Kyriacou (ChemE 7T6)
2016–17: Don Andrew (CivE 5T4)
2015–16: Ross Pitman (GeoE 7T4)

Engineering Alumni Hall of Distinction Award

The Hall of Distinction is an assembly of extraordinary alumni, selected by their peers for their lifelong accomplishments. These are graduates who have ultimately defined what is most exemplary in the engineering profession.

2018–19:
Deborah Goodings (CivE 7T5)
John A. MacDonald (ElecE 7T9)
Shawn Qu (MSE PhD 9T5)
Bob Simmonds (EngSci 7T5)

2017–18:
Alfred Aho (EngPhys 6T3)
Janis Chodas (EngSci 7T8, UTIAS MASc 8T0)
Bob Howard (IndE 7T2)
Brian Kernighan (EngPhys 6T4)
Catherine Lacavera (ECE 9T7)

2016–17:
Rocco Martino (Physics 5T1, Astrophysics MASc 5T2, UTIAS PhD 5T6)
Kathy Milsom (CivE 8T3)
Jonathan Rose (EngSci 8T0, ECE MASc 8T2, PhD 8T6)
The Honourable Tom Siddon (UTIAS MASc 6T6, PhD 6T9)

2015–16:
Paul Henderson (EngBus 5T7)
Ali Khademhosseini (ChemE 9T9, IBBME MASc 0T1)
Ronald Sidon (IndE 6T6)
John Weber (MechE 7T9)

Engineering Alumni Medal

As the Engineering Alumni Association's highest honour, this award is presented to an alumnus/alumna who has demonstrated superior accomplishment and serves as an outstanding role model for students.

2018–19: Levente Diosady (ChemE 6T6, MASc 6T8, PhD 7T2)
2017–18: Larry Seeley (ChemE 6T6, MASc 6T8, PhD 7T2)
2015–16: David Colcleugh (ChemE 5T9, MASc 6T0, PhD 6T2)

Honorary Member

This year, the EAN recognizes a special friend of the Faculty for her outstanding and sustained efforts, enhancing the international reputation of the Faculty and providing excellent learning opportunities for our graduate students. The following colleague will be named an honorary member of the Engineering Alumni Network:

2018–19: Laura Fujino

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Through a comprehensive suite of metrics, we evaluate our performance in engineering research and education, including the quality of applicants to our programs and the awards and honours earned by our faculty members. International rankings are complementary measures of excellence, capturing factors such as our research influence, reputation, learning environment and knowledge transfer.

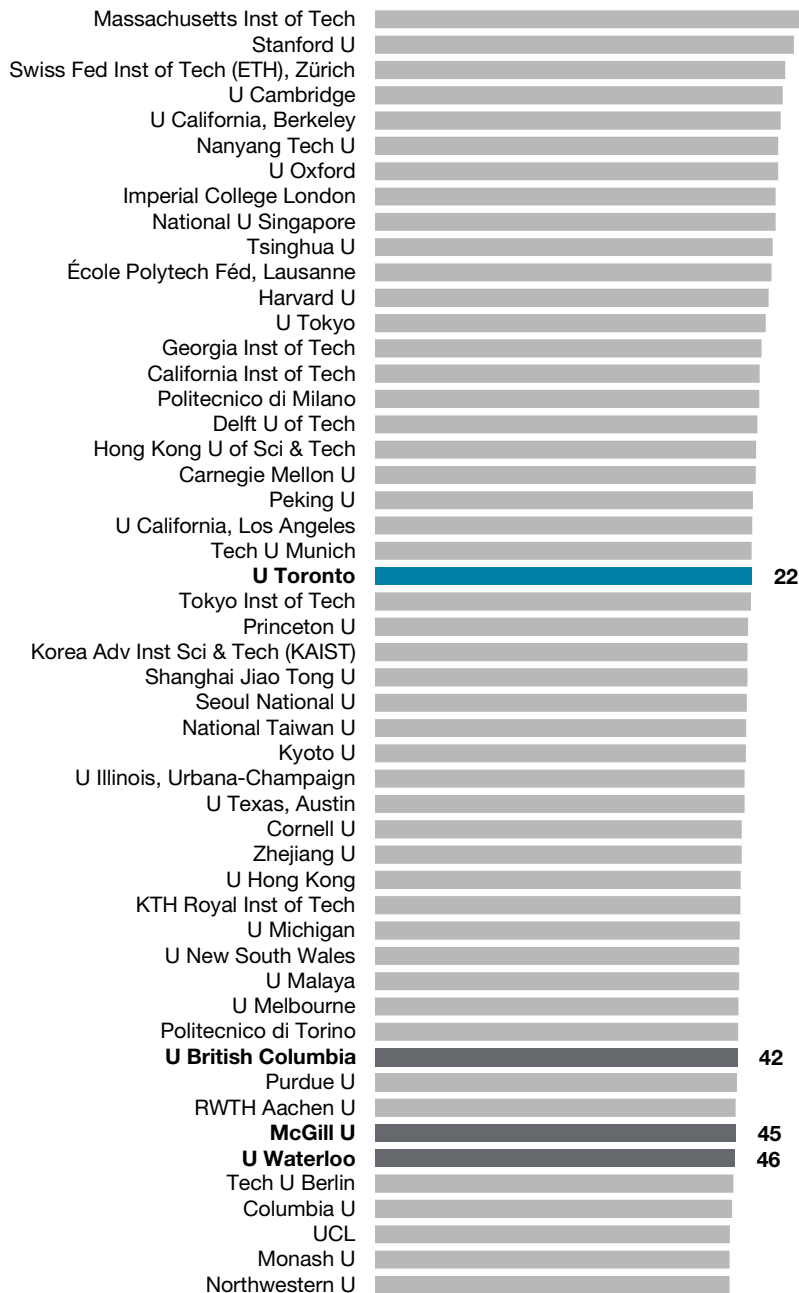
Over the past decade, we have continued to strengthen our position as the highest-ranked engineering school in Canada. This rank is consistent across four organizations that produce world university rankings specific to engineering: the Quacquarelli Symonds World University Rankings (QS), the Times Higher Education World University Rankings (THE), Academic Ranking of World Universities (ARWU) published by ShanghaiRanking Consultancy and the National Taiwan University Performance Ranking of Engineering Papers (NTU; formerly HEEACT). Our Faculty also ranks in the top 10 of North American public universities. We are also the highest-ranked Canadian university across many subject-level rankings, from Chemical Engineering to Electrical Engineering.

While each organization's assessments and methodologies are unique, our high standing across all major rankings is one of the factors that enables us to attract top students, faculty, staff and industry partners. We will continue to focus on maintaining and enhancing our global reputation in the years to come.

Comprehensive University Rankings

QS World University Rankings for Engineering and Technology

Figure 6.1a QS Top 50 World Universities, 2019



U of T Engineering ranked 22nd in the most recent QS World University Rankings for Engineering and Information Technology. This was a significant rise from last year's ranking of 43rd and remains well ahead of our Canadian peer universities. Our standing among North American public universities remained in fourth place.

We rank as the top Canadian engineering and information technology school in three of the seven engineering and information technology subjects (Chemical Engineering, Computer Science & Information Systems, Electrical & Electronic Engineering) and second in three of the others (Civil & Structural Engineering, Materials Sciences, Mechanical, Aeronautical & Manufacturing Engineering) demonstrating our strength across a range of disciplines.

Figure 6.1b QS Top North American Public Universities, 2019

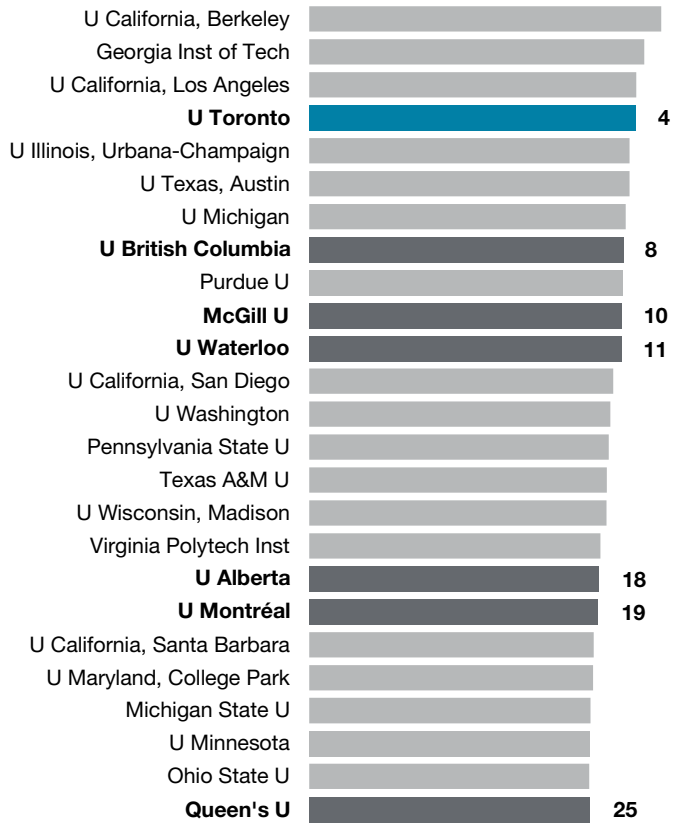


Figure 6.1c Canadian U15 Universities in QS Top 200, 2019

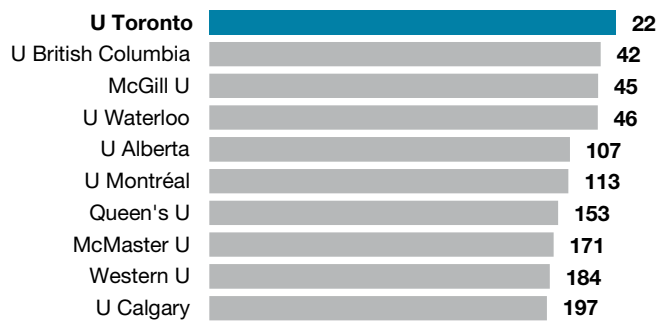
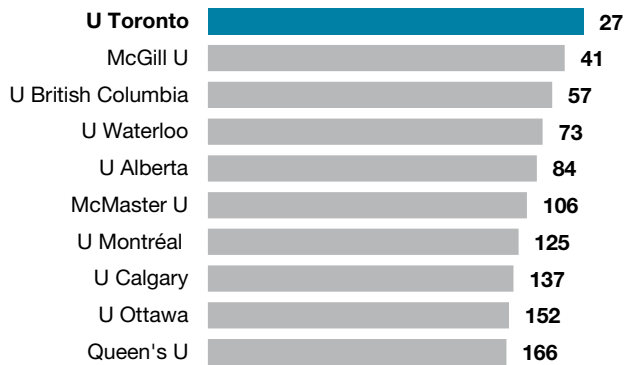
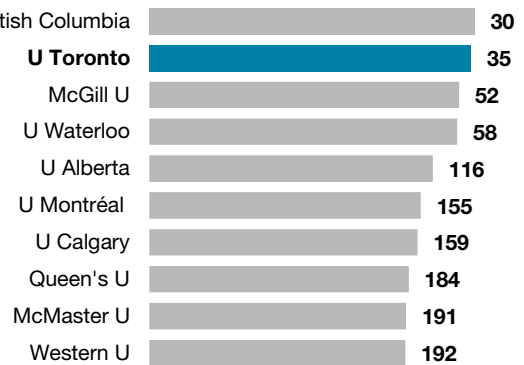


Figure 6.1d Canadian Universities in QS Top 200 by Subject, 2019

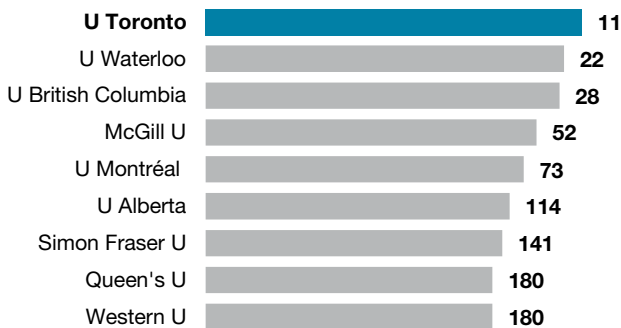
Chemical Engineering



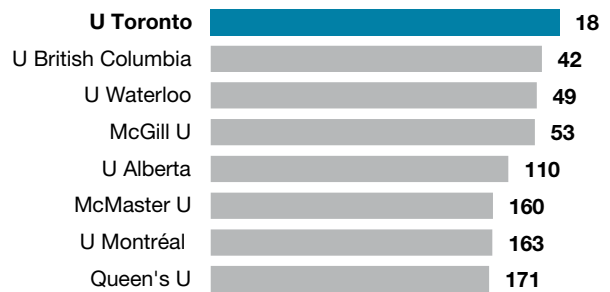
Civil & Structural Engineering



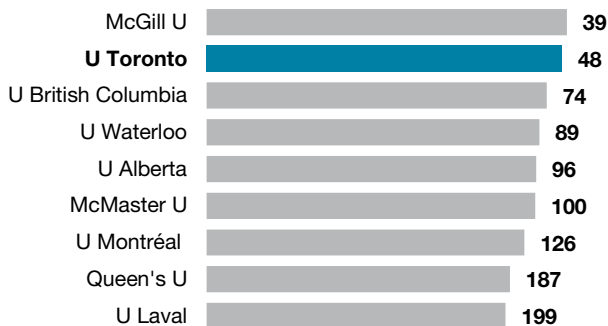
Computer Science & Information Systems



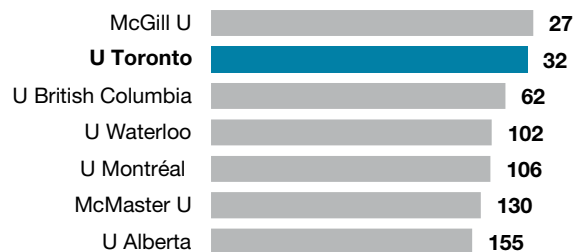
Electrical & Electronic Engineering



Materials Sciences



Mechanical, Aeronautical & Manufacturing Engineering

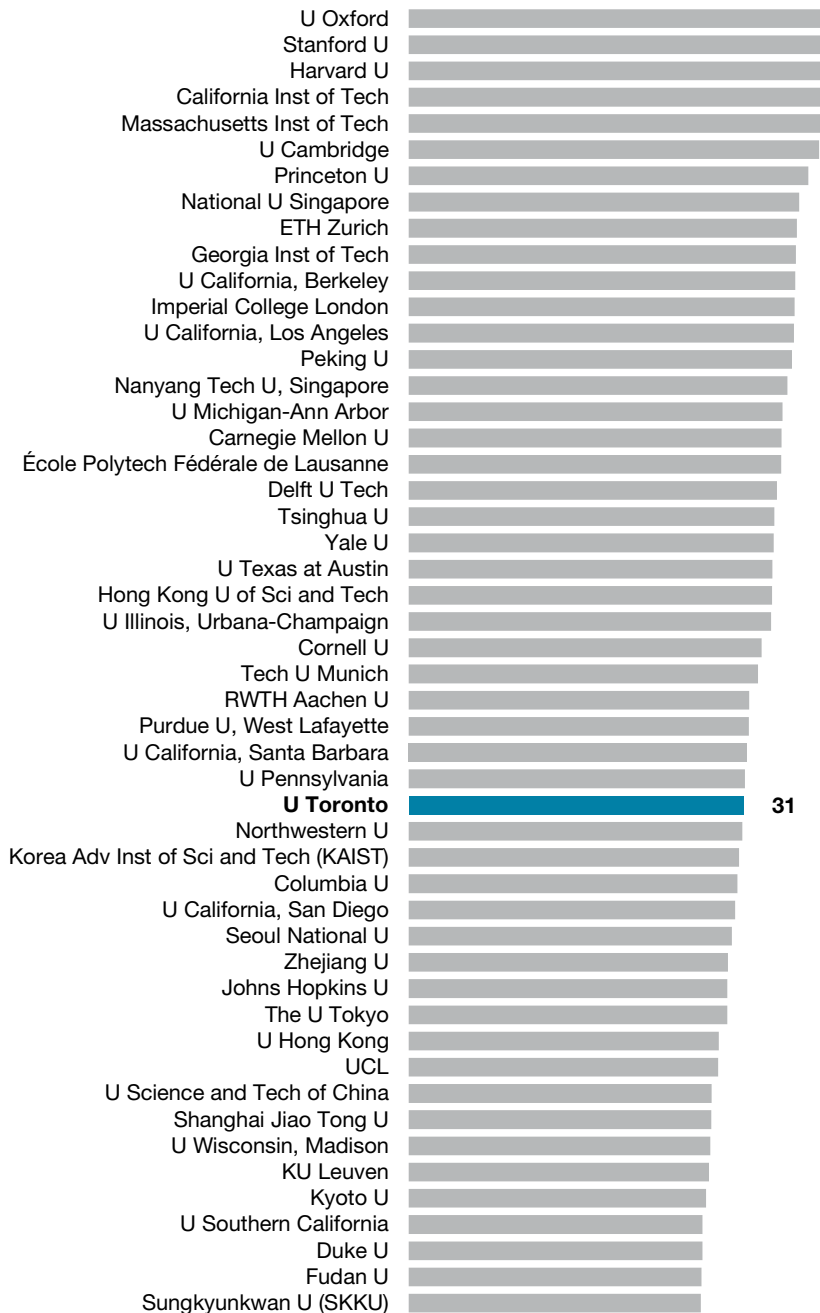


Mineral & Mining Engineering



Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Technology

Figure 6.2a THE Top 50 World Universities, 2019



In the 13 years that Times Higher Education (THE) has published rankings in Engineering and Information Technology, our Faculty has consistently been ranked the top Canadian school and among the top 10 North American public universities, this year placing ninth. THE is characterized by the breadth of its evaluation, which uses 13 performance indicators in five weighted categories:

- Teaching: the learning environment (30%)
- Research: volume, income and reputation (30%)
- Citations: research influence (30%)
- International outlook: staff, students and research (7.5%)
- Industry income and innovation (2.5%)

Figure 6.2b THE Top North American Public Universities, 2019

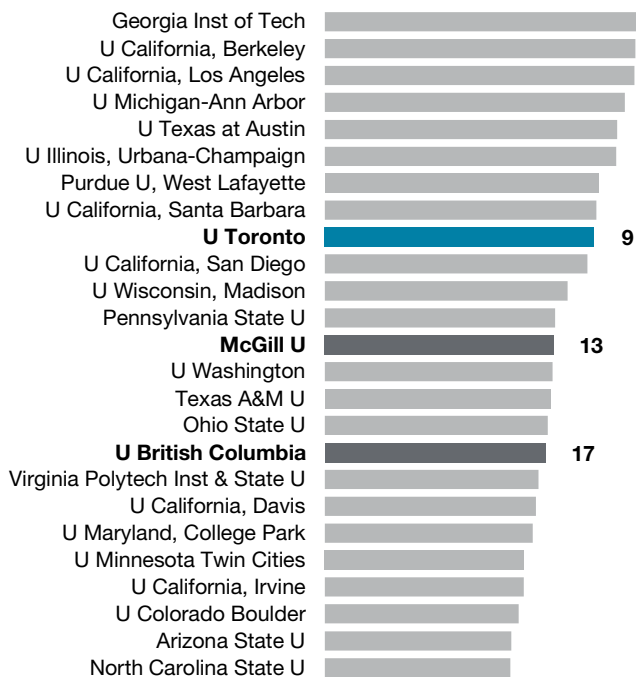


Figure 6.2c Canadian U15 Universities in THE Top 200, 2019



Academic Ranking of World Universities (ARWU) for Engineering Subjects

U of T Engineering is Canada's top school across four of the engineering subject-level rankings provided by ARWU: Aerospace Engineering, Biomedical Engineering, Computer Science & Engineering and Materials Science & Engineering. We rank second or third in Canada in four more: Mechanical Engineering, Civil & Structural Engineering, Electrical & Electronic Engineering and Mineral Engineering.

ARWU is produced by ShanghaiRanking Consultancy, and has provided university-level rankings since 2003. The company also provided field-level rankings (e.g., Engineering, Science, Medicine) from 2007 to 2016. In 2016, ARWU first introduced subject-level rankings for engineering disciplines (e.g., Mechanical Engineering, Aerospace Engineering). These subject-level rankings have now replaced the field-level rankings that have formed the basis of our previous reporting. Of the 22 engineering-related fields, which we have chosen to report the nine most relevant to our programs.

The ARWU's methodology has changed in recent years, and is currently based on five scoring measures:

- PUB – The number of papers authored by an institution in an academic subject during 2011-2015, as indexed in Clarivate's InCites report.
- CNCI – Category Normalized Citation Impact: The ratio of citation of papers published by an institution in an academic subject during the period of 2011–2015 to the average citation of papers in the same category, of the same year and same type.
- IC – The extent of international co-authorship.
- TOP – The number of papers published in top journals.
- AWARD – The number of faculty members winning a significant award.

Below is the complete list of ARWU Subject Rankings in Engineering, with those relevant to our programs in bold:

Aerospace Engineering
Automation & Control
Biomedical Engineering
Biotechnology
Chemical Engineering
Civil Engineering
Computer Science & Engineering
Electrical & Electronic Engineering
Energy Science & Engineering
Environmental Science & Engineering
Food Science & Technology
Instruments Science & Technology
Marine/Ocean Engineering
Materials Science & Engineering
Mechanical Engineering
Metallurgical Engineering
Mining & Mineral Engineering
Nanoscience & Nanotechnology
Telecommunication Engineering
Transportation Science & Technology
Remote Sensing
Water Resources

Figure 6.3 Canadian Universities in ARWU Top 200 World Universities by Subject, 2018

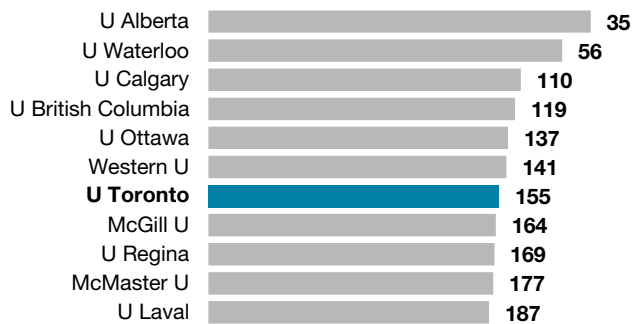
Aerospace Engineering



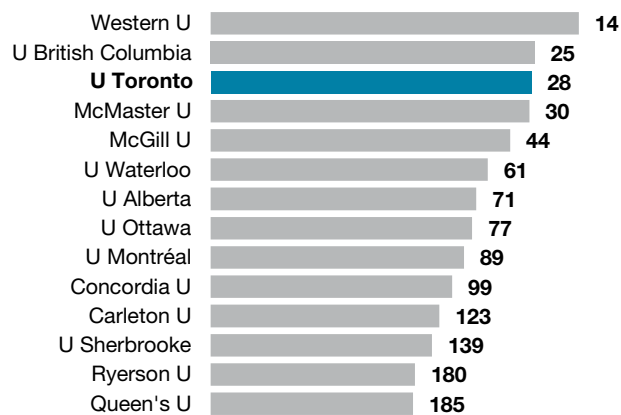
Biomedical Engineering



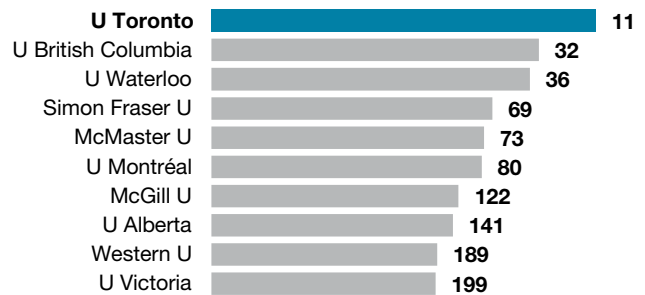
Chemical Engineering



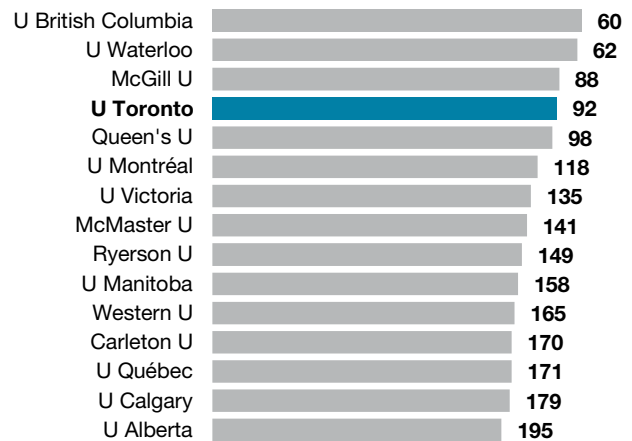
Civil & Structural Engineering



Computer Science & Engineering



Electrical Engineering



Materials Science & Engineering



Mechanical Engineering



Mineral Engineering



National Taiwan University (NTU) Performance Ranking of Engineering Papers

U of T Engineering ranked first in Canada, eighth among top-tier North American public universities, and 55th in the National Taiwan University (NTU) Performance Ranking of Engineering Papers.

Unlike the other rankings in this section, the NTU rankings are based entirely on bibliometrics. It compares the top 200 universities in the world by subject, using eight weighted criteria grouped into three broad categories:

Research Productivity

- Total number of articles published in the past 11 years (2007–17) [10%]
- Total number of articles published in the most recent year reported (2017) [15%]

Research Impact

- Total number of citations in the past 11 years (2007–17) [15%]
- Total number of citations in the past two years (2016–17) [10%]
- Average annual number of citations over the past 11 years (2007–17) [10%]

Research Excellence

- H-index (measures productivity and impact of published work) of the past two years (2016–17) [10%]
- Number of highly cited papers in the past 11 years (2007–17) [15%]
- Number of papers published in high-impact journals in the current year (2016) [15%]

Figure 6.4a NTU Top 60 World Universities, 2018

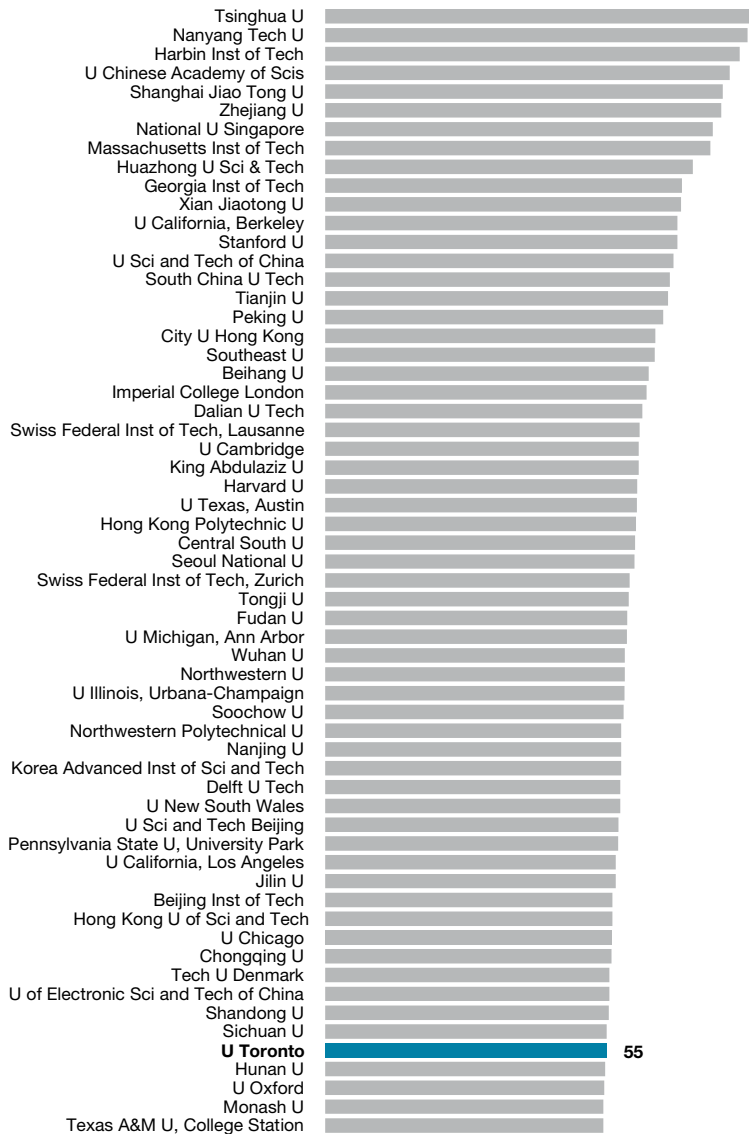
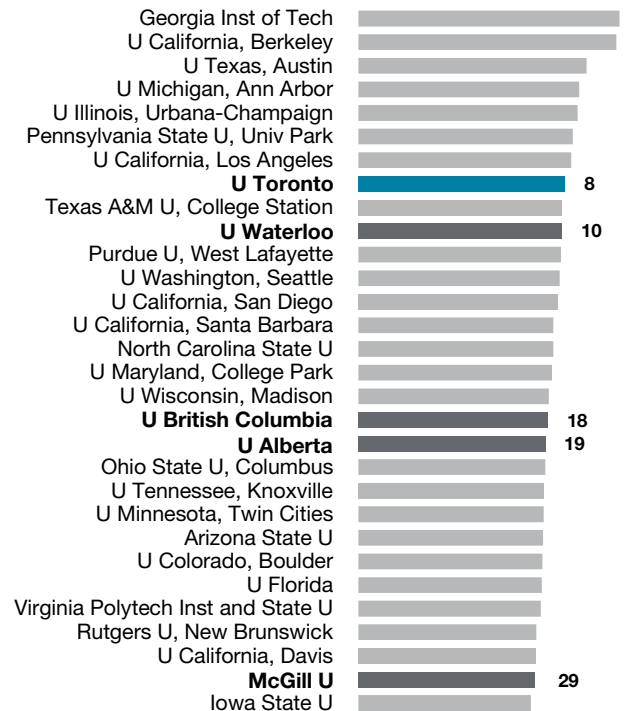


Figure 6.4b NTU Top North American Public Universities, 2018



In NTU's rankings of engineering and information technology subject areas, U of T Engineering placed first among Canadian institutions in two out of six subject rankings and second in two more, as shown in Figure 6.4d. We are among the top 50 globally in Computer Science and Electrical Engineering.

Figure 6.4c Canadian U15 Universities in NTU Top 200, 2018



Figure 6.4d Canadian Universities in NTU Top 200 By Subject, 2018

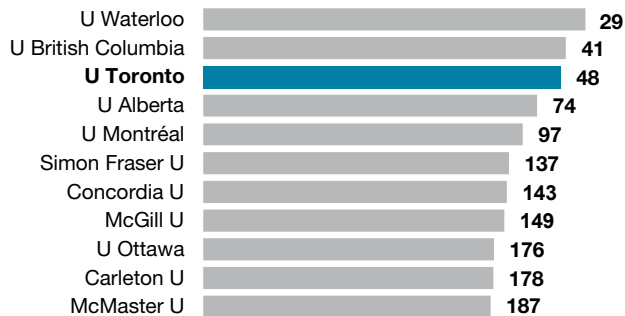
Chemical Engineering



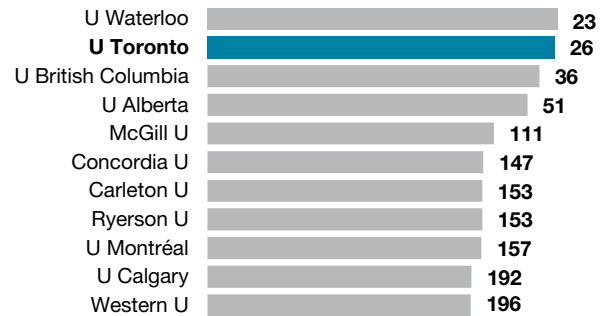
Civil Engineering



Computer Science



Electrical Engineering



Materials Science



Mechanical Engineering



Rankings Based on Publications and Citations

The Association of American Universities (AAU) index measures research output, productivity and intensity based on publication counts. Once again, U of T Engineering ranked 10th in North America and second in Canada, based on a total publication count of 3,169 papers between 2013 and 2017. The metric utilized by this ranking, shown in Figure 6.5a, is influenced by the size of the faculty complement, and tends to favour large faculties.

Figure 6.5a Number of Engineering Publications Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2013 to 2017

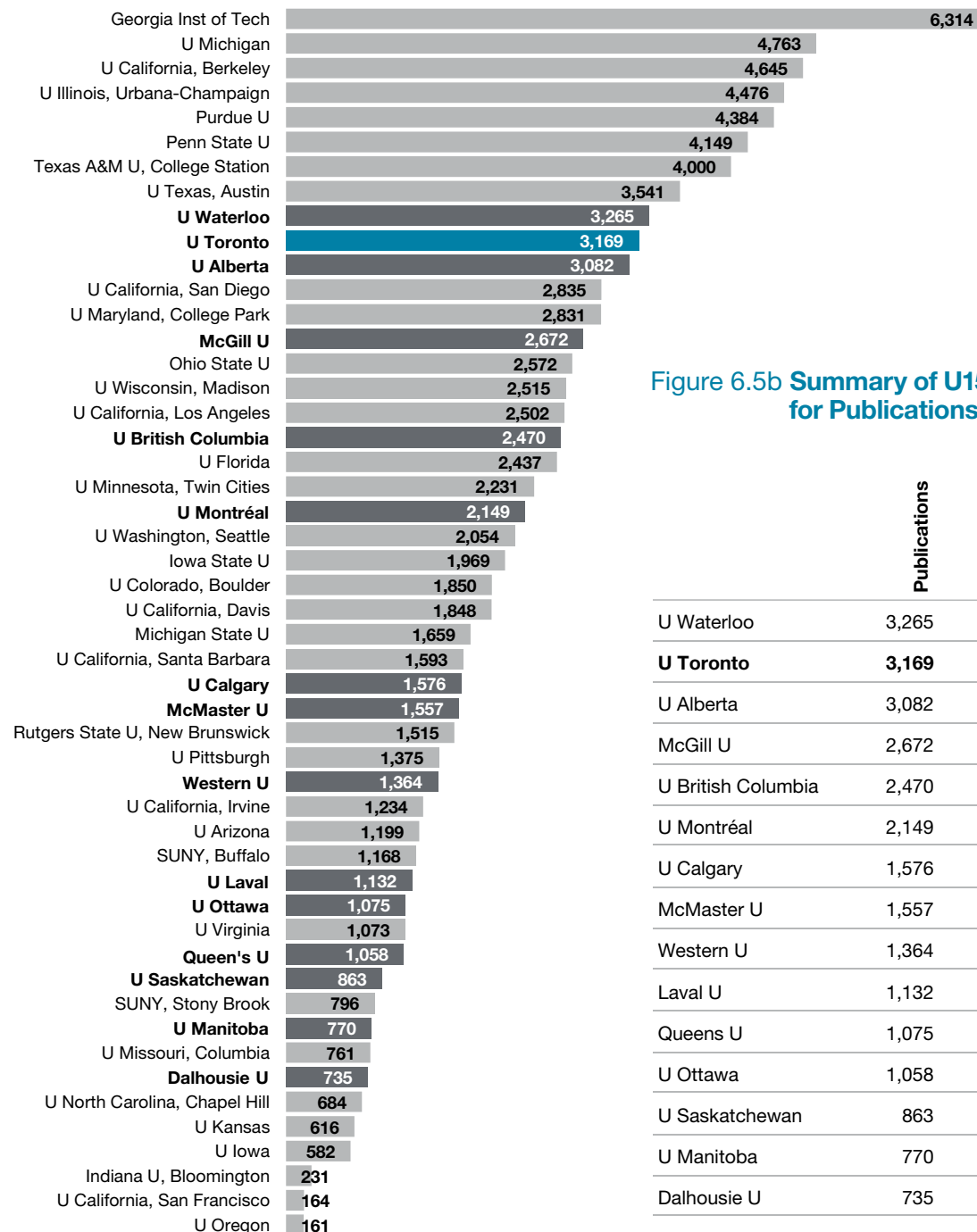


Figure 6.5b Summary of U15 Bibliometrics for Publications, 2013 to 2017

| | Publications | Faculty Count | Publications per Faculty | Rank on Pub per Faculty |
|--------------------|--------------|---------------|--------------------------|-------------------------|
| U Waterloo | 3,265 | 296 | 11.0 | 6 |
| U Toronto | 3,169 | 261 | 12.2 | 5 |
| U Alberta | 3,082 | 227 | 13.6 | 2 |
| McGill U | 2,672 | 143 | 18.8 | 1 |
| U British Columbia | 2,470 | 195 | 12.7 | 3 |
| U Montréal | 2,149 | 254 | 8.5 | 12 |
| U Calgary | 1,576 | 159 | 9.9 | 8 |
| McMaster U | 1,557 | 156 | 10.0 | 7 |
| Western U | 1,364 | 108 | 12.6 | 4 |
| Laval U | 1,132 | 162 | 7.0 | 15 |
| Queens U | 1,075 | 127 | 8.5 | 13 |
| U Ottawa | 1,058 | 125 | 8.5 | 11 |
| U Saskatchewan | 863 | 87 | 9.9 | 9 |
| U Manitoba | 770 | 85 | 9.1 | 10 |
| Dalhousie U | 735 | 104 | 7.1 | 14 |

Note 6.5 and 6.6: Faculty counts are based on data from the Engineers Canada Resources Report (2017) Publication and citation data from Thomson Reuters InCites™, updated April 30, 2019.

The AAU index citation counts are based on the total number of papers cited over a five-year period, as well as the frequency of citations per faculty member and article. U of T Engineering placed first in Canada and ninth among North American public institutions in the total number of citations.

We ranked second in Canada for citations per faculty after McGill University, and retained the lead among Canadian universities in the number of citations per publication, which is the metric representing the relevance of our publications as cited by other researchers.

Figure 6.6a Number of Engineering Citations Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2013 to 2017

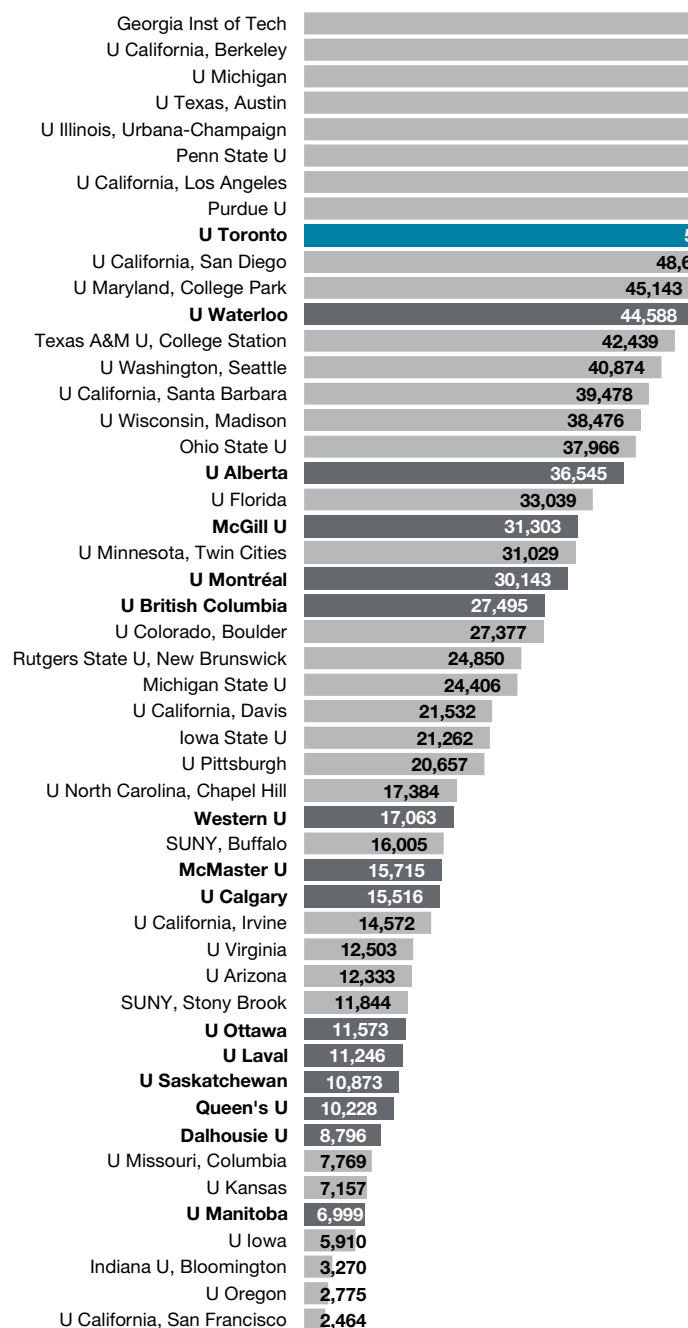


Figure 6.6b Summary of U15 Bibliometrics for Citations, 2013 to 2017

| | Citations | Faculty Count | Citations per Faculty | Rank on Citations per Faculty | Citations per Publication | Rank on Citations per Publication |
|--------------------|---------------|---------------|-----------------------|-------------------------------|---------------------------|-----------------------------------|
| U Toronto | 51,854 | 261 | 199.1 | 2 | 16.4 | 1 |
| U Waterloo | 44,588 | 296 | 150.7 | 5 | 13.7 | 3 |
| U Alberta | 36,545 | 227 | 160.9 | 3 | 11.9 | 7 |
| McGill U | 31,303 | 143 | 219.7 | 1 | 11.7 | 8 |
| U Montréal | 30,143 | 254 | 118.7 | 8 | 14.0 | 2 |
| U British Columbia | 27,495 | 195 | 141.2 | 6 | 11.1 | 9 |
| Western U | 17,063 | 108 | 158.0 | 4 | 12.5 | 5 |
| McMaster U | 15,715 | 156 | 100.9 | 9 | 10.1 | 11 |
| U Calgary | 15,516 | 159 | 97.6 | 10 | 9.8 | 13 |
| U Ottawa | 11,573 | 125 | 92.6 | 11 | 10.9 | 10 |
| Laval U | 11,246 | 162 | 69.4 | 15 | 9.9 | 12 |
| U Saskatchewan | 10,873 | 87 | 124.8 | 7 | 12.6 | 4 |
| Queens U | 10,228 | 127 | 80.5 | 14 | 9.5 | 14 |
| Dalhousie U | 8,796 | 104 | 84.5 | 12 | 12.0 | 6 |
| U Manitoba | 6,999 | 85 | 82.4 | 13 | 9.1 | 15 |

Summary of Ranking Results

In the most recent results available, we strengthened our position as the top Canadian engineering school across all rankings. We placed in the top 10 among North American public universities, our closest peers. Although no ranking can decisively illustrate a school's performance, our high rankings enhance our ability to attract top students, faculty and collaborators from around the world.

Figure 6.7 Summary of University of Toronto Engineering Performance in World Rankings

| Ranking Organization | Release Date | Canada | North American Public | World |
|--|----------------------|--------|-----------------------|-------|
| QS World University Rankings for Engineering and Information Technology | February 2019 | 1 | 4 | 22 |
| QS World University Rankings by Subject | February 2019 | | | |
| • Chemical Engineering | | 1 | 7 | 27 |
| • Civil & Structural Engineering | | 2 | 7 | 35 |
| • Electrical & Electronic Engineering | | 1 | 4 | 18 |
| • Materials Science | | 2 | 10 | 48 |
| • Mechanical, Aeronautical & Manufacturing Engineering | | 2 | 7 | 32 |
| • Mineral & Mining Engineering | | 5 | 8 | 22 |
| • Computer Science & Information Systems | | 1 | 2 | 11 |
| Times Higher Education (THE) – Elsevier World University Ranking for Engineering & Technology | November 2018 | 1 | 9 | 31 |
| Academic Ranking of World Universities (ARWU) for Engineering Subjects | July 2018 | | | |
| • Aerospace Engineering | | 1 | 6 | 15 |
| • Biomedical Engineering | | 1 | 7 | 27 |
| • Chemical Engineering | | 7 | 27 | 155 |
| • Civil Engineering | | 3 | 13 | 28 |
| • Computer Science and Engineering | | 1 | 3 | 11 |
| • Electrical & Electronic Engineering | | 4 | 25 | 92 |
| • Mechanical Engineering | | 2 | 18 | 71 |
| • Materials Science & Engineering | | 1 | 14 | 69 |
| • Mining & Mineral Engineering | | 3 | 6 | 25 |
| National Taiwan University (NTU) Performance Ranking of Scientific Papers for World Universities by Subject | August 2018 | 1 | 8 | 55 |
| NTU Performance Ranking by Subject | August 2018 | | | |
| • Chemical Engineering | | 4 | 20 | 140 |
| • Civil Engineering | | 2 | 12 | 58 |
| • Electrical Engineering | | 2 | 6 | 26 |
| • Materials Science | | 1 | 11 | 73 |
| • Mechanical Engineering | | 1 | 11 | 73 |
| • Computer Science | | 3 | 8 | 48 |



7

Our global network of more than 50,000 alumni is a strength of our vibrant community. Graduates from U of T Engineering dedicate their time and talents to nurturing the next generation of global engineering leaders through investments in infrastructure, enriched educational programming and mentorship.

Both current students and recent graduates benefit enormously from the mentorship and advice they receive from our alumni, whether through guest lectures, curricular and co-curricular design projects, or one-on-one meetings. Alumni support also enables us to enhance our world-class research programs, improve our infrastructure and develop new educational programs that enrich the learning environment.

The Myhal Centre for Engineering Innovation & Entrepreneurship is an example of what can be accomplished when our alumni and friends come together in support of excellence. A cornerstone of our Boundless fundraising campaign, the Myhal Centre is home to more than 40 named spaces, including technology-enhanced active learning spaces, design studios, meeting rooms, fabrication facilities, event spaces and multidisciplinary centres and institutes.

In 2018–2019, we surpassed our goals as part of the University of Toronto’s Boundless Campaign, attracting more than \$246 million in support, well beyond our ambitious \$200 million target. We directly engaged with more than 2,000 alumni through over 40 events, including our popular BizSkule speaker series, held in Toronto, Calgary and Silicon Valley. Our online community, U of T Engineering CONNECT, has exceeded 9,000 active users representing 67 countries around the world.

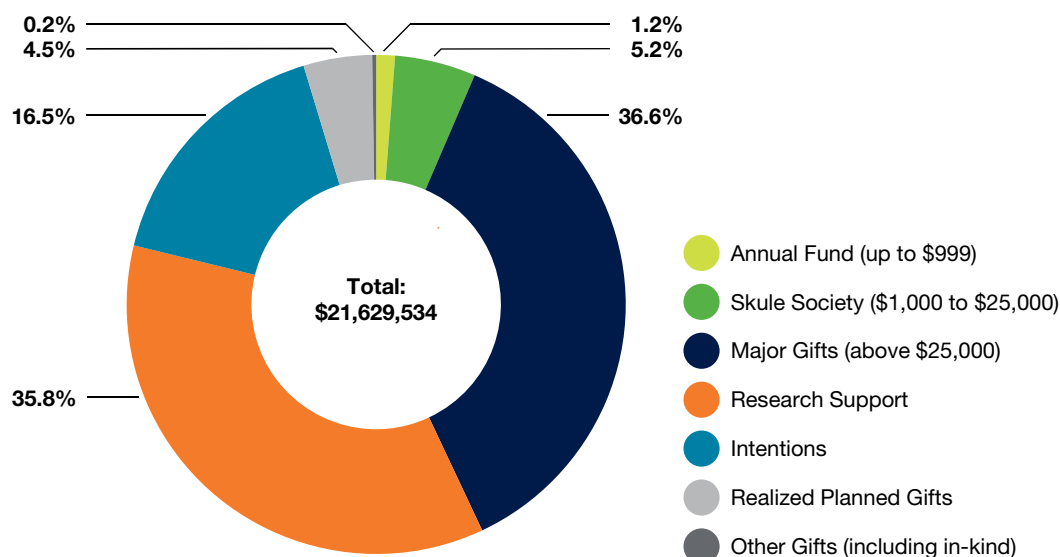
With each graduating class, our alumni network grows larger and more diverse. We will continue to reinforce relationships between all members of our community – students, faculty, staff, alumni and industry partners – to further strengthen our position as Canada’s #1-ranked engineering school and among the best in the world.

Philanthropic Support

Support from alumni, corporate donors, students, faculty and staff enables us to enhance our programs and infrastructure — from the creation of the Myhal Centre, to expansion of the activities of Troost ILead, to enhanced financial support for students through scholarships and other awards.

On December 31, 2018, we celebrated the completion of the University of Toronto’s Boundless Campaign, the most ambitious fundraising campaign in Canadian history. U of T Engineering achieved a total of more than \$246 million, exceeding our ambitious \$200 million target by nearly 25%. Our philanthropic support for 2018–2019 reached \$21.6 million, and is broken down by source and designation in figures 7.1a, 7.1b and 7.2.

Figure 7.1a Philanthropic Support, 2018–2019



Data in this chapter are presented by fiscal year, May 1, 2018 to April 30, 2019. Gifts and other highlights are from July 2018 to June 2019.

Note 7.1a: In keeping with University-wide advancement policies, “intentions” refers to new planned gifts that have been agreed to but not yet realized. “Realized planned gifts” includes all realized donations by bequest, excluding those previously reported as intentions.

Figure 7.1b Philanthropic Support, 2009–2010 to 2018–2019

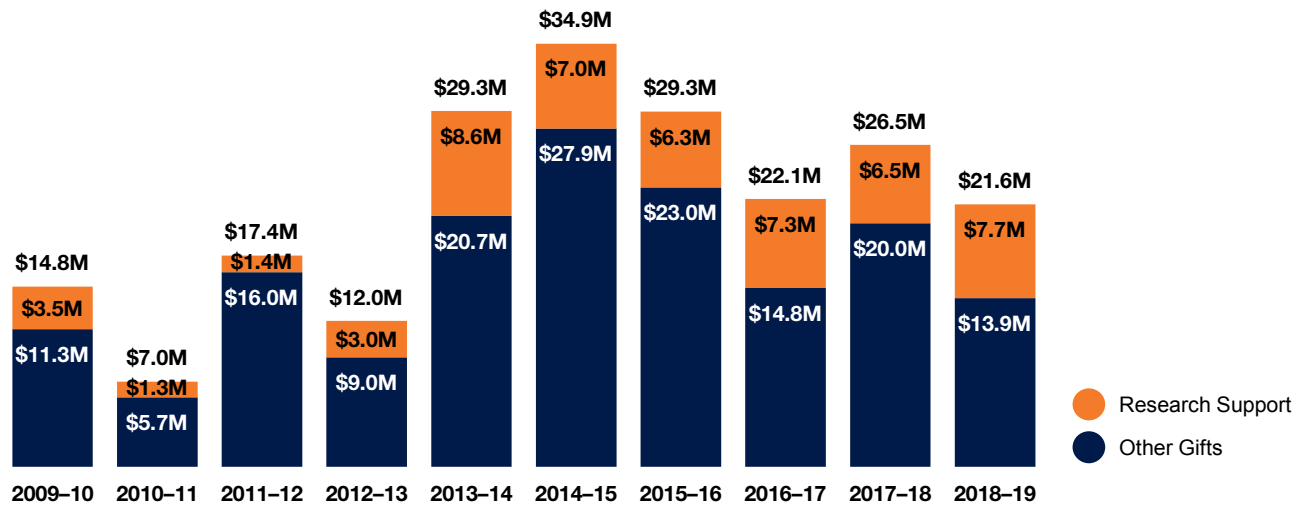
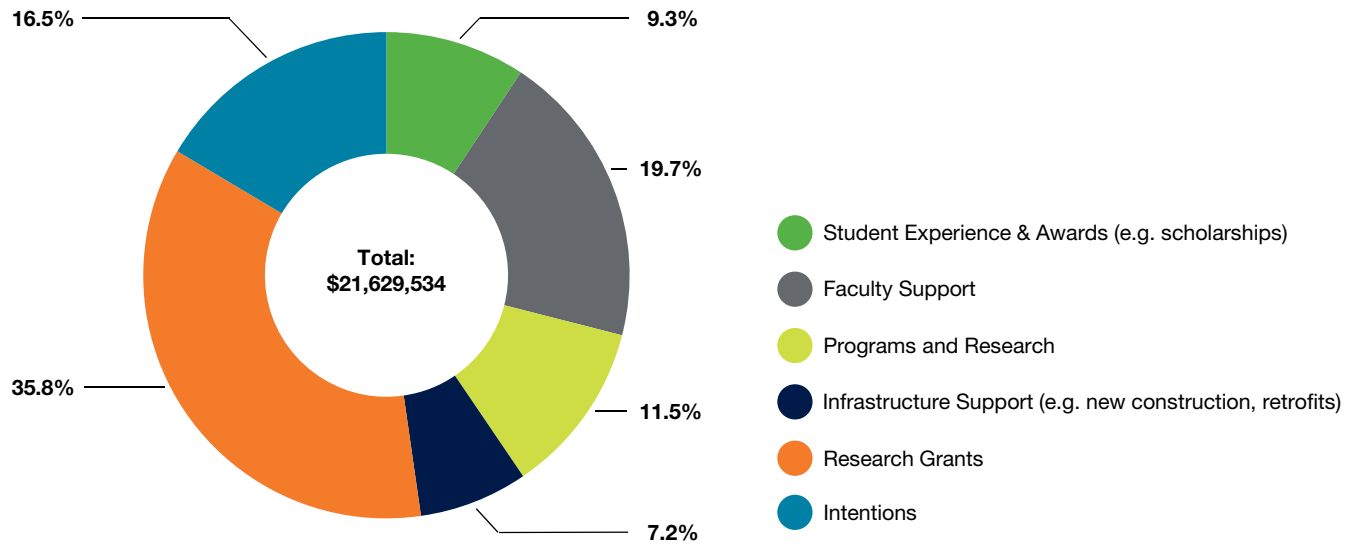


Figure 7.2 Gift Designation, 2018–2019



Special Campaigns and Projects

Decanal Chair in Innovation

The Decanal Chair in Innovation honours more than a decade of visionary leadership by Dean Cristina Amon. This Chair will be held by all future Deans of the Faculty, providing strategic funds to support innovation in education and research that will have broad impact within U of T Engineering. Paul Cadario (CivE 7T3), Distinguished Senior Fellow in Global Innovation, led the efforts of the fundraising committee, which has so far raised more than \$1.6 million from students, faculty, staff and alumni around the world to endow this new chair. This remarkable support is triple-matched by the Faculty and the University for a total of \$6.4 million.

Dean Cristina Amon — A Celebration of Leadership

We hosted several events in Toronto, the U.S. and around the world to celebrate the tremendous contributions and legacy of Dean Cristina Amon. As the longest serving Dean in our Faculty's history, these events provided an opportunity to reflect on the impact of Dean Amon's transformational leadership and all the Faculty has accomplished during the past decade. They included a series of dinners and receptions held in Hong Kong, Singapore and San Francisco as well as in Toronto, in conjunction with our annual Alumni Reunion. The event series culminated with *A Celebration of Leadership*, an evening reception held in the Myhal Centre on June 26, 2019.

The Centennial Campaign for CAMP (CivMin)

The Centennial Campaign for CAMP funds repairs, renovations and an expansion of the site of Civil and Mineral Practicals (CAMP) on Gull Lake. It includes the construction of a new bunkhouse and common space for undergraduate students. To date, \$1.1 million of the \$1.5 million target has been raised, representing more than 70% of the goal total.

This success is due to the dedication and commitment of a wide range of benefactors, including lead donors Robert MacGillivray (CivE 8T5) and Scott MacGillivray (CivE 8T2), as well as The Heavy Construction Association of Toronto. On September 7, 2019, alumni and current students will gather at Gull Lake to unveil the planned upgrades and celebrate the rich history of the facility, which will mark its 100th anniversary in 2020.

Unit Operations Lab (ChemE, MIE, CivMin, EngSci, MSE)

This campaign is revitalizing one of the Faculty's flagship laboratory facilities, located in the Wallberg building. The vision is to transform the Unit Ops Lab into one of the best chemical engineering teaching labs in the world. The revitalized facility will include modern instrumentation and automation capability, with an outward focus on the wide variety of industry sectors that employ chemical engineers. It will be the Faculty's premier "wet" lab, servicing students from ChemE as well as several other disciplines including MIE, CivMin, MSE and EngSci. Combined with dry labs available in the Myhal Centre, the Unit Ops Lab will set a new standard in immersive undergraduate engineering education. Phase 1 of the project, which involved recruiting two professors to lead second- and third-year labs, is now complete. Phase 2 will focus on physical renovations including improved ventilation, acquisition of new experimental equipment and the modernization of the distillation column.

Alumni Events and Engagement

Myhal Centre Open House

In September 2018, we invited more than 1,000 alumni, students, staff and faculty to explore the Myhal Centre. Interactive and engaging displays welcomed guests into the building's new spaces. Highlights included autonomous vehicles, medical and health-care robots in the Norris Walker 5T7 Robotics Laboratory; a Water and Energy Trivia Challenge from the Institute for Sustainable Energy (ISE) and the Institute for Water Innovation (IWI); and a taste test of iron-fortified tea from the Centre for Global Engineering (CGEN). *(For more details on MY Open House and related events, see Chapter 8 – Communications)*

Alumni Reunion

Our 2018 Alumni Reunion featured a new Class Giving Campaign, which encouraged all honoured-year alumni to make a gift to U of T Engineering. More than 300 alumni made donations, with the highest giving rate from the class of 5T3. In 2019, this annual event expanded with the addition of PEY Co-op classes to the list of years being honoured (e.g. honouring both the classes of 9T4 and 9T4 + PEY). We also invited the entire class of Ajax Alumni (class of 4T9-5T2), who represent a unique and rich part of our Faculty's history. New offerings included the Dean's Breakfast for all alumni and a Student Design Club Showcase.

EAN Awards Program

This year we held the 2018 Engineering Alumni Network Awards in the Myhal Centre for the first time. The applications process has been streamlined and the Adjudicating Committee is now composed of previous award winners, enhancing alumni engagement. Recipients included Levente Diosady (ChemE 6T6, MAsc 6T8, PhD 7T2), who earned the Engineering Alumni Medal, the network's highest honour. *For a complete list of recipients, see Chapter 5 – Awards and Honours.*

Skule™ Lunch and Learn

Eight of these signature events were held in the Faculty Club throughout 2018–2019, enabling us to leverage proximity to labs and spaces across the Faculty to engage alumni in a more meaningful way. The talks featured both alumni and current professors speaking on engaging topics such as sustainable infrastructure and blockchain technology. Tickets consistently sold out throughout the year. Total attendance for all events reached more than 330.

U of T Engineering CONNECT

We continue to strengthen our global alumni network through the use of this proprietary social media platform. CONNECT enables the Faculty to quickly update our alumni records, as well as seek feedback, publicize events and facilitate mentorship between students and alumni. In just a few years, the platform has attracted more than 9,000 members in over 67 countries. Of these, 32% hold leadership positions, and 70% have indicated that they are willing to mentor current students.

CONNECT is one component of a University-wide effort to double the number of newly engaged alumni by 2023. We engaged with 600 alumni for the first time in 2018–2019, and continue to refine our strategies with a greater emphasis on inclusion and global opportunities.

Gift Highlights

True Blue Fund

This fund will establish vital support for The Entrepreneurship Hatchery, which provides mentorship, business development support and other resources to launch student startups. Since its creation in 2012, more than 80 startups have been through the Hatchery's programs. Collectively, these companies have raised more than \$40 million in seed funding. This year, we received commitments from the first two donors to this innovative fund: John MacDonald (ElecE 7T9) and his wife Katherine, as well as Bereskin & Parr, a law firm specializing in intellectual property.

Lorne Heuckroth

Lorne Heuckroth (EngSci 5T8, UTIAS MSc 6T0, Physics PhD 6T4) has been a longstanding supporter of U of T Engineering, and is the naming donor of the Heuckroth Learning Commons on Level 5 of the Myhal Centre. His latest gift of \$1 million will create the Heuckroth Faculty Scholars in Aerospace Engineering, which will provide funding for as many as 10 early-career professors at UTIAS for a maximum of two years each. This gift catalyzes UTIAS' research mission by supporting state-of-the-art facilities, research equipment and materials.

Engineering Alumni Network Scholarship

This endowed scholarship was created by the Engineering Alumni Network in 2018–2019 and supported broadly by alumni from around the world. It will be awarded for the first time in fall 2019 to a student proceeding to second, third or fourth year in any program. Recipients will be selected based on the demonstration of a passion for engineering-related design, creativity and innovation, as exhibited by involvement in the Skule™ community through design-related extracurricular activities, co-curricular involvement or entrepreneurial pursuits. This scholarship was established by the EAN Board, who have committed \$30,000 as a matching offer for donations from alumni.

8

Effective and engaging communication with our audiences is critical to maintaining and strengthening our position as Canada's top-ranked engineering school and among the best in the world. The stories we tell enable us to attract brilliant students, faculty members and partners from around the world, and inspire our alumni and friends to support our continued evolution.

We produce and share award-winning content across print, digital and social media platforms, and lead innovative experiential marketing initiatives. Our Engineering Communications Network includes the Faculty-level Engineering Strategic Communications office and more than 30 colleagues across our departments and divisions, along with University of Toronto Communications. Through strategic relationships with external media and targeted pitching, U of T Engineering earns a larger share of national coverage than any other engineering school in Canada.

In 2018–2019, we completed a multi-year campaign to raise awareness of the many ways the Myhal Centre for Engineering Innovation & Entrepreneurship is setting a new standard in engineering education and research. Through media outreach, creative storytelling, an open house event for everyone in the U of T Engineering community and participation in city-wide events such as Doors Open Toronto and the Scotiabank CONTACT Photography Festival, we elevated the new building to its place of prominence at the heart of our campus and the centre of Ontario's Innovation Supercorridor.

We also renewed our Faculty's online presence with a focus on our six research Innovation Clusters, and celebrated the 40th anniversary of our Professional Experience Year Co-op Program, the largest program of its kind in Canada.

This year provides a unique opportunity to reflect on our Faculty's remarkable advances under the visionary leadership of Dean Cristina Amon. The launch of our contemporary history book *Ambition, Innovation & Excellence: The Skule™ Story 2000-2018*, along with supporting online material, captures the Faculty's tremendous accomplishments of the past two decades. It also signals our bright future, in which impactful research, unparalleled student experience and a strong global network of strategic partnerships will continue to drive innovation and create a more prosperous world.

Selected Communications Projects

New and Relunched Websites

In March 2019, we relaunched our U of T Engineering News website (www.news.engineering.utoronto.ca) with a new design focused around our six Innovation Clusters: robotics, sustainability, analytics & artificial intelligence, advanced manufacturing, human health and water. We produced original content for these themes — including profiles of alumni who are well-recognized leaders in each of these areas — and customized each theme page with a distinct visual identity. Improved site navigation further enables users to engage with stories that resonate, while giving prominence to priority content that highlights our key messages. The new design increases the appeal of social sharing, prioritizing visual presentations that feature rich imagery and video.

We significantly expanded the Industrial Partnerships section of our U of T Engineering site (www.engineering.utoronto.ca) with new content and an enhanced look and feel, as well as downloadable material tailored to each domain. We also added an interactive timeline highlighting “A Decade of Excellence at U of T Engineering” (www.uoft.me/10years) which celebrates selected achievements under the leadership of Dean Cristina Amon. This digital material supplements our contemporary history book *Ambition, Innovation & Excellence: The Skule™ Story 2000-2018*.

We redesigned the Current Engineering Undergraduates website (www.undergrad.engineering.utoronto.ca) and the Discover Engineering website (www.discover.engineering.utoronto.ca), the primary destinations for our current and prospective undergraduate students, respectively. These redesigns included the application of a new WordPress theme as well as reworking the information architecture to make it easier for current and prospective students to find relevant information quickly. The newly updated Equity, Diversity & Inclusion (EDI) page on Faculty website includes a form that enables students, faculty and staff to submit EDI-related feedback, questions and concerns (www.uoft.me/EngEDI).

Throughout the year, we oversaw major visual updates to the websites of several departments and divisions, including the Department of Chemical Engineering & Applied Chemistry, the Department of Civil & Mineral Engineering and the Institute of Biomaterials & Biomedical Engineering. We also created landing pages for some of our

newest multidisciplinary institutes, including the Institute for Studies in Transdisciplinary Engineering Education and Practice (ISTEP) and the Centre for Analytics and Artificial Intelligence Engineering (CARTE). We are currently developing a new website for the relaunched Robotics Institute.

Ambition, Innovation & Excellence: The Skule™ Story 2000-2018

Published in September 2018, this 192-page coffee table-style book captures the transformative change led by U of T Engineering since the turn of the millennium. It includes chapters on engineering education, research and entrepreneurship, and student experience, and reflects the physical changes across our facilities, including the creation of the Myhal Centre for Engineering Innovation & Entrepreneurship. With vibrant imagery and editorial photography throughout, the volume serves both as an engaging and elegant record of this remarkable period in our Faculty's history, and to inspire ambitious achievements in the future. Two thousand copies were printed and distributed to a wide range of U of T Engineering community members, including students, faculty, staff, alumni and supporters.

40th anniversary of the Professional Experience Year Co-op Program

This year marked the 40th anniversary of the Engineering Career Centre's flagship offering, the Professional Experience Year Co-op (PEY Co-op) Program. Our communications campaign was aimed at further enhancing awareness and reach of this program — the largest of its kind in Canada — as well as thanking the many companies, hiring managers, mentors, and students who have partnered with us. Tactics included online material highlighting the evolution of PEY Co-op over the past four decades, as well as news stories and a social media campaign featuring dynamic video profiles of PEY Co-op students and alumni sharing their experiences. The Engineering Career Centre also hosted the inaugural PEY Co-op Recognition Reception at Hart House with more than 180 attendees. Awards were distributed for Student of the Year, Employer of the Year, Mentors of the Year, Employers of Distinction and recognition of Equity, Diversity & Inclusion among employers. (*For more information on PEY Co-op, see Chapter 4 — Cross-Faculty Education and Experiential Learning.*)

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

Note: Impressions are the estimated number of people who may have interacted with a story, based on circulation (newspapers/magazines), viewers (TV), listeners (radio) and unique monthly visitors (online).

Myhal Centre for Engineering Innovation & Entrepreneurship

Building on the momentum generated by the official opening of the Myhal Centre in April 2018, we hosted several events throughout 2018–2019 to further elevate the presence of the new building and integrate it into the vibrant life of our Faculty, our University and our city:

- **MY Open House, September 13, 2018** — The MY Open House celebration was designed to engage the entire U of T Engineering community, and attracted more than 500 current students, alumni, staff and faculty. Through 15 interactive exhibits situated throughout the Myhal Centre’s nine levels, guests were invited to learn more about the building’s unique facilities and the many ways in which they are catalyzing innovation. The event also featured a design team showcase, a technology expo hosted by the Centre for Global Engineering, and the official reveal of the Engineering Society Arena, located on Level 0.
- **Scotiabank CONTACT Photography Festival** — For the first time, our Faculty participated in this city-wide festival, the largest photography event of its kind in the world. Throughout the month of May 2019, a curated exhibition featuring the work of U of T Engineering students, staff, faculty and alumni was on display on Level 5 of the Myhal Centre. Through framed photographs, projections and installations, we invited members of our community and the wider public to explore a rare and intimate portrayal of the engineering spirit. More than 1,600 attendees viewed the exhibition, including guests invited to events such as Alumni Reunion and Doors Open Toronto.
- **Doors Open Toronto** — This city-wide event created an opportunity for thousands of residents from across the Greater Toronto Area to explore more than 150 of the most architecturally, historically, culturally and socially significant buildings across the city. Throughout the weekend, the Myhal Centre hosted a diverse range of activities and exhibits throughout its floors, including demonstrations from our Robotics Institute, talks by leading graduate students across all departments and institutes and demos by a range of student clubs and teams. Visitors had the opportunity to interact with students and volunteers, as well as share their impressions on social media. Doors Open Toronto attracted more than 1,200 in-person visitors and more than 1,400 viewers through various livestreams held throughout the weekend. The event garnered more than 1,100 engagements on social media.

Media Coverage

Earned media coverage enables us to reach valuable target audiences around the world, including prospective students, their parents and teachers, industry and academic partners and the wider engineering profession. We secure a greater share of coverage in national mainstream media outlets — including newspapers, radio, television and online platforms — than any other engineering school, outperforming peers such as the University of Waterloo, the University of British Columbia and the University of Michigan. We achieve this through strategic use of our owned media channels, cultivating strong relationships with journalists at priority organizations and focused media pitching of relevant stories.

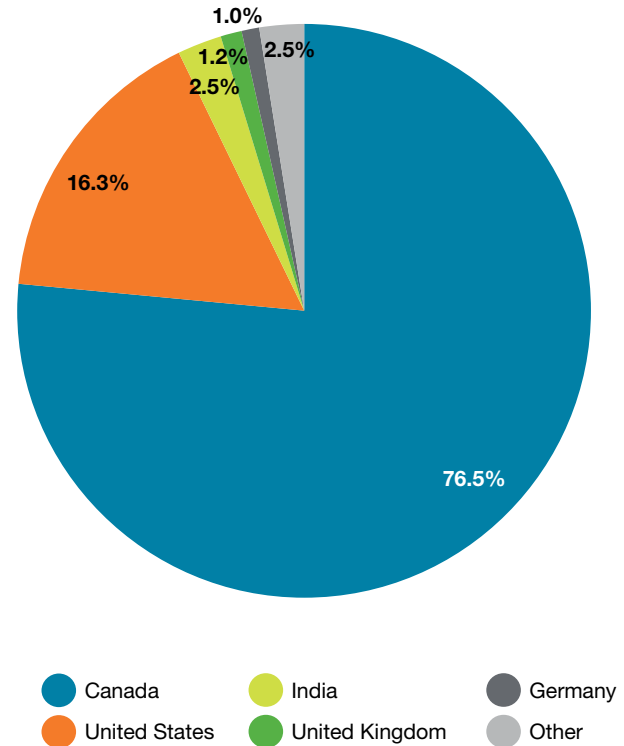
Between May 1, 2018 and April 30, 2019, we garnered 1,853 external media stories, generating a total of more than 149 million impressions — a measure of impact that describes the number of people who may have interacted with a story. On average, nearly one-quarter of impressions were earned outside of Canada; however, this proportion varied considerably by month: for example, 59.4% of impressions were international in October 2018, compared with 7.9% in March 2019. This reflects strong international pick-up of several specific stories, largely mirroring a surge of interest in artificial intelligence over the past year. Coverage was distributed across digital (64.3%), broadcast (22.9%) and print media (12.8%) including mainstream, specialty and industry-targeted outlets. Stories are also distributed relatively evenly among priority foci as identified in our *Academic Plan: 2017-2022*, and across U of T Engineering departments, divisions and institutes.

Selected earned media highlights included:

- Cooking oil coating prevents bacteria from growing on food processing equipment (*CTV News, Huffington Post Canada, Vancouver Sun, Toronto Star, Business Standard*)
- U of T Engineering opens the Myhal Centre for Engineering Innovation & Entrepreneurship (*CityNews Toronto, Design Engineering, Daily Commercial News*)
- Smarter cancer treatment: AI tool automates radiation therapy planning (*Forbes, MedIndia*)
- A sinkhole swallowed a TTC car — and it has experts flagging the city’s aging pipes (*Toronto Star*)
- Are Robots the Future of Dementia Care? (*TVO’s The Agenda*)
- First-year students bring engineering solutions to Toronto communities (*CTV News*)
- Low-cost catalyst from U of T Engineering boosts hydrogen production from water (*Chemistry World, The Engineer, R&D Magazine*)
- Fort McMurray homes have normal levels of indoor contaminants, U of T Engineering study reveals (*The Globe and Mail, Toronto Star, Global News, CTV News, CBC News, Fort McMurray Today*)

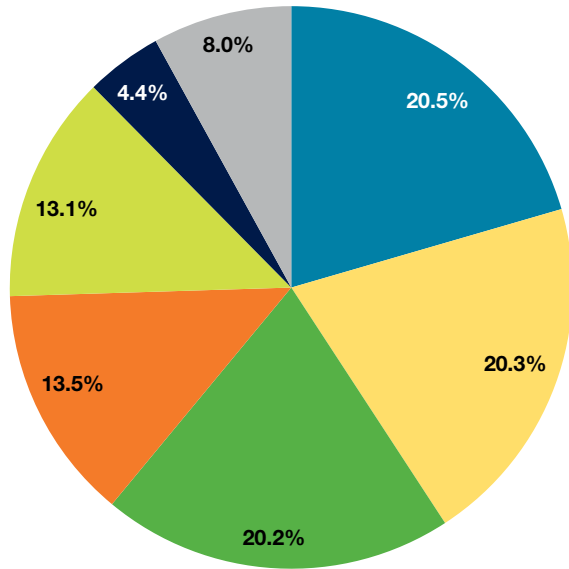
- These AI experts want to teach you how to program a self-driving car (*Digital Trends, Smart Cities Dive, VentureBeat, MobileSyrup, liveMint*)
- U of T Engineering researchers design ‘training gym’ for lab-grown heart cells (*Digital Journal, Scitech Europa, Medical Technology*)
- U of T startup raises \$3.25 million to eliminate prescription opioids after surgery (*Business Insider, Chicago Daily Herald, Finanzen, BioSpace, Pittsburgh Post-Gazette*)
- This U of T Engineering student is holding companies accountable for biased AI facial technology (*New York Times, Washington Post, The Verge, Toronto Star, National Post*)
- Made-in-Canada lab-grown meat on Toronto scientists’ menu after grant from U.S. (*National Post, The Globe and Mail, Edmonton Journal, Ottawa Citizen, CP24*)
- Canadian scientists develop ‘sperm obstacle course’ to ID strongest seed (*CTV News, CBC News*)
- ‘Filling in the missing pieces’: How AI is transforming drug discovery, development and innovation (*National Post*)

Figure 8.1a Proportion of U of T Engineering Media Stories by Outlet Location, 2018–2019



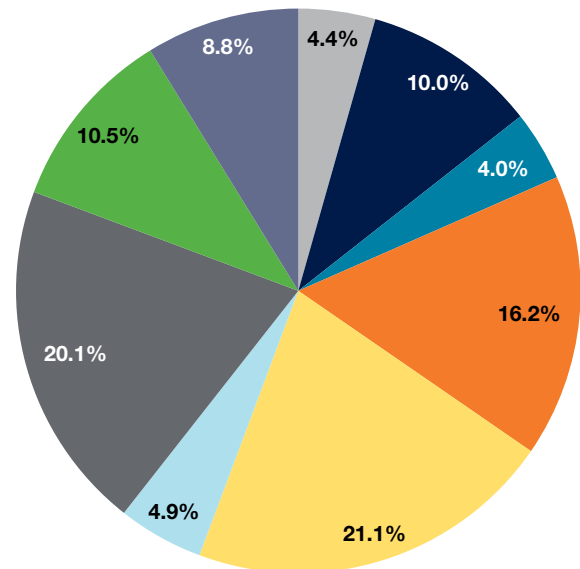
Note 8.1a: The impressions for one story may be included in the counts of multiple countries.

Figure 8.1b Proportion of U of T Engineering Impressions by Strategic Priority Area, 2018–2019



- Bioengineering & Health
- Data Analytics & Robotics
- Engineering Education
- Sustainability
- Entrepreneurship
- Advanced Manufacturing
- Other

Figure 8.1c Proportion of U of T Engineering Impressions by Academic Area, 2018–2019



- UTIAS
- IBBME
- ChemE
- CivMin
- ECE
- EngSci
- MIE
- MSE
- No Department Mentioned

Note 8.1b: One media story can reference multiple strategic priority areas. In those cases, the impressions are included in the counts for both areas.
Note 8.1c: One media story can reference multiple academic areas. In those cases, the impressions are included in the counts for both areas.

Social Media

Social media is one of the most powerful tools available for communicating our stories and messaging directly to our audiences in an engaging, authentic and interactive way. A well-crafted social media post has the potential to reach millions. Strategic use of social media enables us to target our messaging to current and prospective students, peer institutions, alumni, policymakers and select influencers, as well as faculty members and staff. As such, it has been a major area of growth in the past year.

Our Faculty maintains dedicated channels on three social media platforms: Facebook (www.facebook.com/uoftengineering), Twitter (www.twitter.com/uoftengineering) and Instagram (www.instagram.com/uoftengineering). These are supplemented and reinforced by more than 25 related feeds maintained by our departments, divisions, research centres and institutes, and at the University level. We also use a fourth, proprietary platform – U of T Engineering CONNECT (www.uoftengineeringconnect.ca) – to build strong

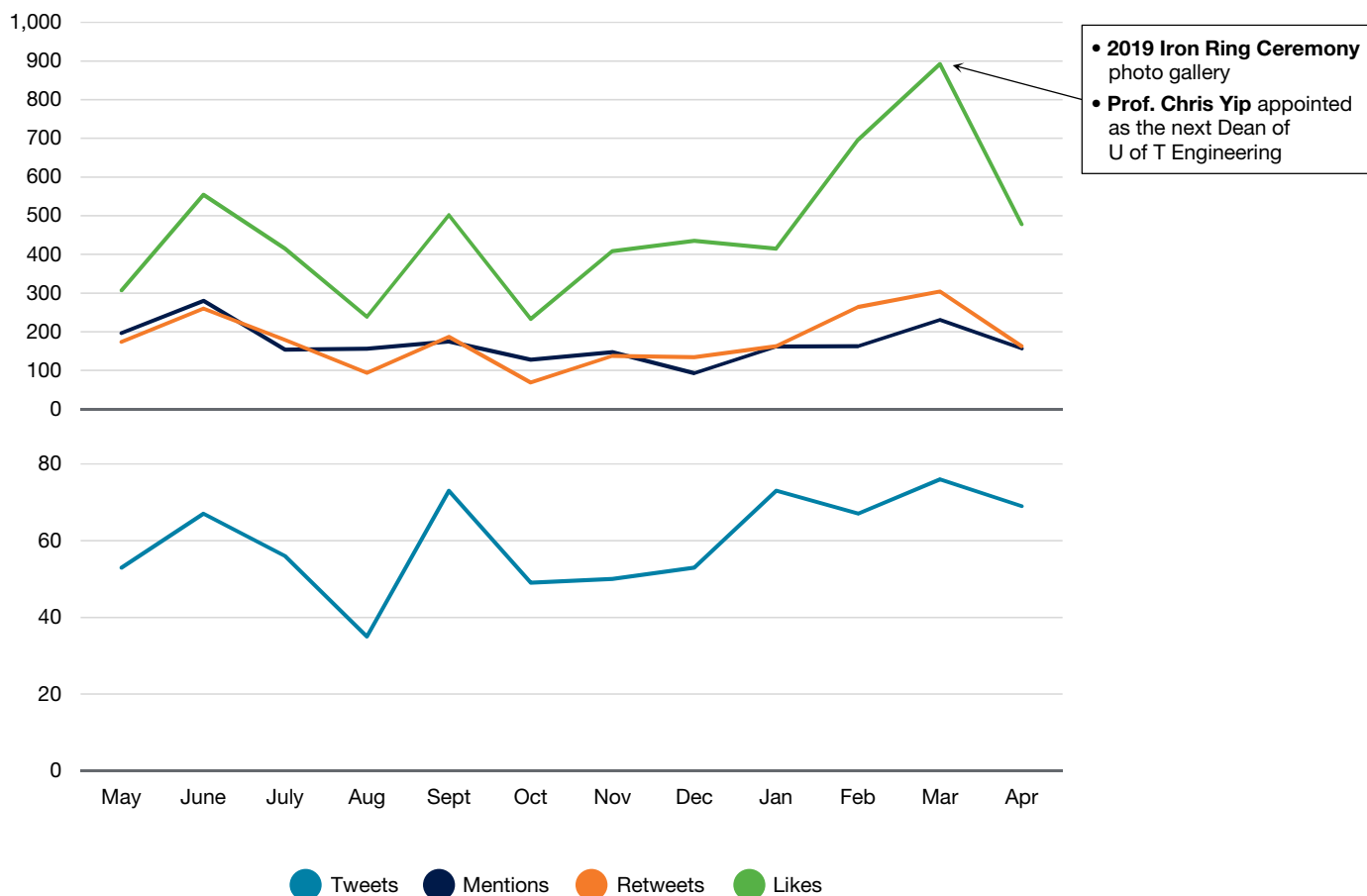
connections between current students and our vibrant, global network of alumni (*for more on CONNECT, see Chapter 7 – Advancement*).

The following sections outline activity on the three primary social media channels in the period from May 1, 2018 to April 30, 2019.

Twitter

We gained 533 new followers in the reporting period, surpassing 10,000 followers for the first time and achieving a total of 10,250. Our target audiences on Twitter include academics, government officials and agencies, professional associations and peer institutions. Some of our most influential followers include Kirsty Duncan (MP, Minister of Science), Chrystia Freeland (MP, Minister of Foreign Affairs) and Julie Payette (29th Governor General of Canada).

Figure 8.2a Audience Engagement on Twitter from May 1, 2018 to April 30, 2019



During May 2018 to April 2019, we shared 720 tweets, achieving a total engagement – likes, retweets, replies and mentions – of approximately 16,000. Total impressions (the number of Twitter users that see U of T Engineering tweets) reached 1.6 million over the reporting period. Twitter referred 5,220 users to the Faculty’s news site between May 2018 and April 2019, a 31.1% increase over the previous year.

Figure 8.2a presents engagement over the reporting period, including mentions, retweets and likes. February’s upward-trending engagement reflects stories on Molly Shoichet being named among Distinguished Women in Chemistry or Chemical Engineering, Deb Raji’s study on racial and gender biases in facial recognition systems and a short teaser video on Nanoleaf’s Valentine’s Day pop up. A subsequent spike in March was attributable to a photo gallery of students receiving their Iron Rings at the 2019 ceremony and the news of Professor Christopher Yip being appointed as the next Dean of U of T Engineering.

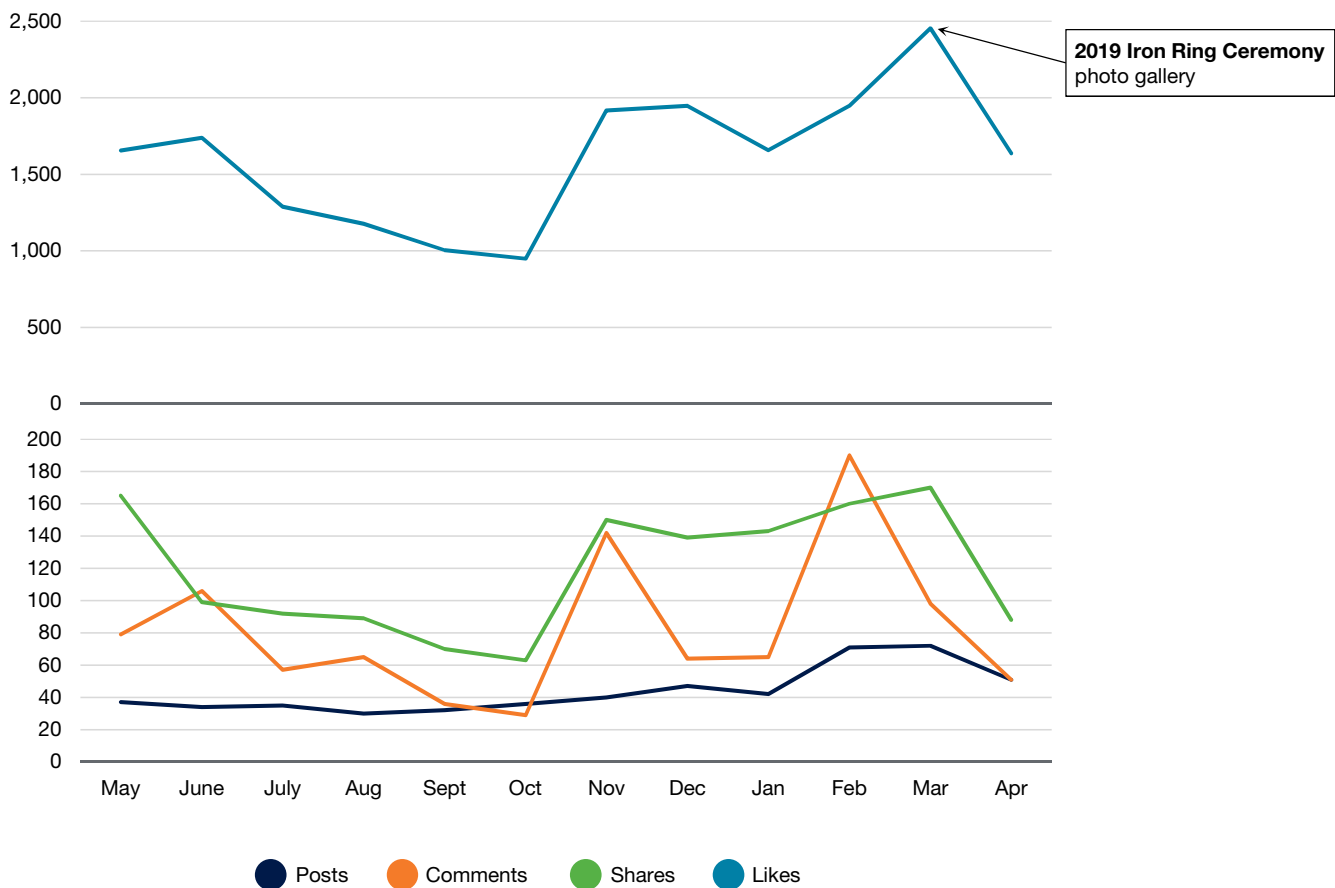
Facebook

Early in the reporting period, Facebook made several significant changes to its algorithm, reducing the reach of professional pages (such as U of T Engineering) and emphasizing content shared by the users’ family and friends. Despite this, our reach on Facebook exceeded 1.5 million in 2018–2019, our highest yet and a 36% increase over the previous year.

We gained 1,532 new followers over the reporting period, reaching 8,890 as of April 30, 2019. Demographic data shows that our followers are primarily current students between 18 to 24 years old.

We shared 527 posts and received 21,700 total engagements, including reactions, comments and shares. A live video of UTIAS’ new course on air accident investigation generated increased engagement in February, as did a feature on Black students’ experiences during Black History Month.

Figure 8.2b Audience Engagement on Facebook from May 1, 2018 to April 30, 2019



In March we saw another engagement peak following a photo gallery post featuring students showing off their new Iron Rings. This was our top-performing post this year, reaching over 60,600 people and garnering 931 reactions, comments and shares. Our top-performing video featured Kimberly Lai, a Year 4 EngSci student completing her PEY Co-op at Safran Landing Systems. The video received 2,065 views, 300 reactions, 25 comments and 13 shares.

Facebook is a significant source of traffic to our U of T Engineering News website: in 2018–2019, 16,632 users were directed to our news site from the platform, a 5.8% increase over the previous year.

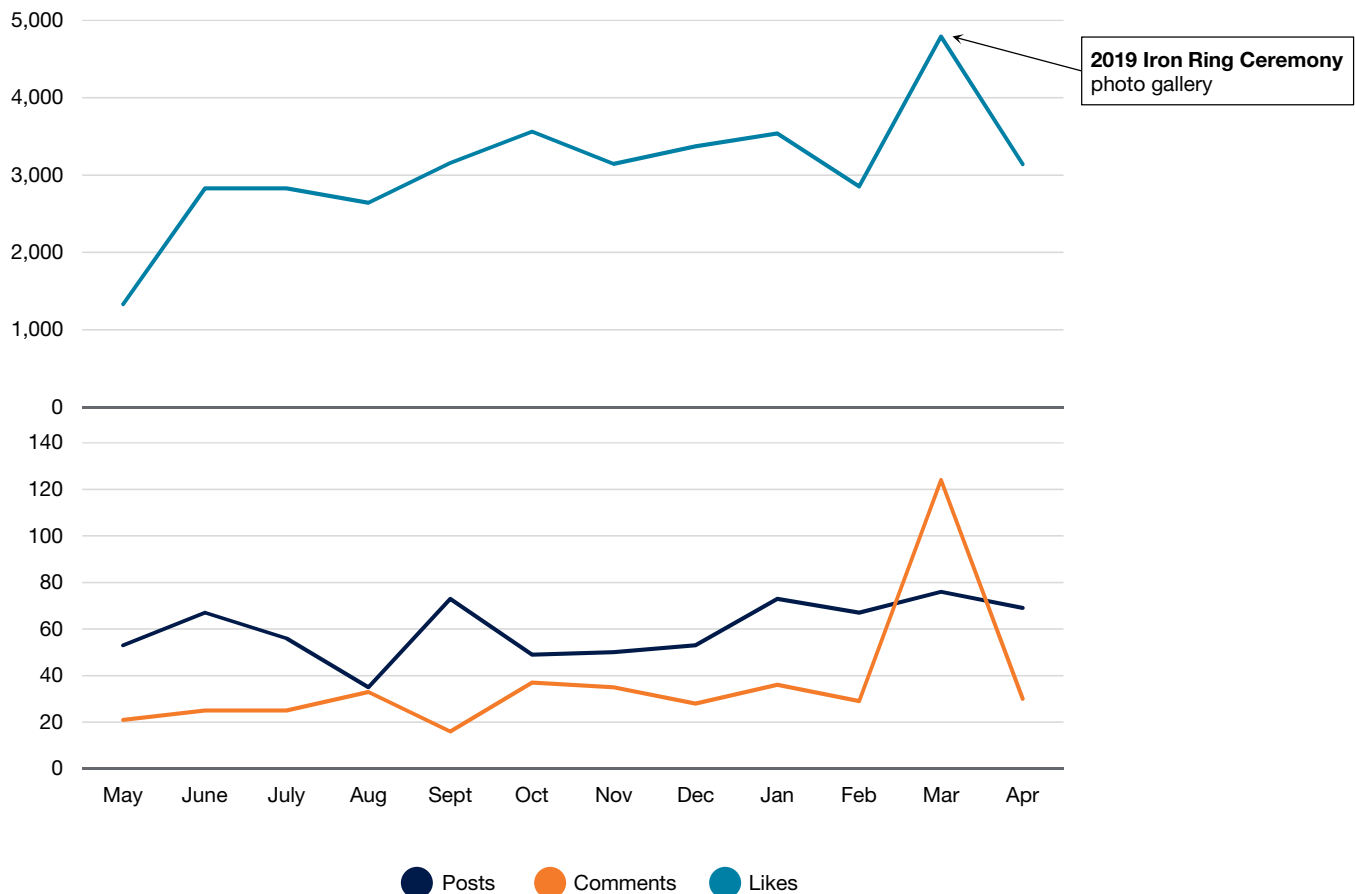
Instagram

Instagram is a key platform for reaching out to current students, who represent the vast majority of our audience on this platform. By focusing on relatable content that showcases the student experience, Faculty achievements

and posts that invite interaction (such as a giveaway contest as part of National Engineering Month) we gained 1,920 followers over the reporting period, a 46% increase from May 2018.

We shared 253 posts on Instagram during the reporting period and accumulated 37,400 in total engagements, including likes and comments, a 52% increase over the previous year. Our top-performing post was a picture of students showing off their Iron Rings that attracted 944 likes and 15 comments. Our top-performing Instagram story – a multi-framed post that is public for a 24-hour period – was an interactive “study break” Q&A during exam period that invited students to respond to questions about their study habits using GIFs – this received 1,521 views, with 78% of user reading all the way to the end.

Figure 8.2c Audience Engagement on Instagram from May 1, 2018 to April 30, 2019



Engineering News at U of T

The U of T Engineering News website (www.news.engineering.utoronto.ca) is the primary channel for our Faculty's news content, and the central source of material for social media, U of T Engineering CONNECT, print publications and reports. It captures the latest achievements in research, education, student experience and alumni success across our Faculty, and provides a robust archive of our accomplishments over the past several years.

We use Google Analytics to monitor traffic and data across the suite of Faculty-owned websites. From May 1, 2018 to April 30, 2019, our U of T Engineering News website received 309,608 pageviews (average 25,800 per month), a 33.4% increase over the previous year.

Figure 8.3 Summary of Analytics for U of T Engineering Faculty site and U of T Engineering News site, 2018–2019

| | Faculty site (engineering.utoronto.ca) | U of T Engineering News site (news.engineering.utoronto.ca) |
|---|--|--|
| Pageviews | 337,837 | 309,608 |
| Unique visitors | 136,750 | 189,721 |
| Average number of pageviews per session | 1.47 | 1.30 |
| Average amount of time spent on site | 1:46 min | 0:41 min |
| Cities of origin | 5,461 | 10,193 |
| Countries of origin | 197 | 197 |

Figure 8.4 Social Media Referrals for U of T Engineering News, 2018–2019

| Social Media Platform | Unique Users | Sessions |
|-----------------------|--------------|----------|
| Facebook | 16,716 | 22,865 |
| Twitter | 5,220 | 7,328 |
| Instagram | 481 | 522 |

Note 8.4: A session is the period of time a user was actively engaged with our website. All usage data (pageviews, events, etc.) are associated with a session.

In addition to the users who interacted with a story on the U of T Engineering News site, many of our stories are cross-posted to the central U of T News website (www.news.utoronto.ca). The best-performing stories from the past year across both of these sites are illustrated in Figure 8.5.

Figure 8.5 Top Stories on the Engineering News and U of T News Websites, 2018–2019

| Page Title | Date Posted | Pageviews (U of T Engineering News) | Pageviews (U of T News) | Total |
|---|--------------------|-------------------------------------|-------------------------|---------------|
| Cooking oil coating prevents bacteria from growing on food processing equipment | July 27, 2018 | 43,364 | 1,001 | 44,365 |
| U of T Engineering AI researchers design ‘privacy filter’ for your photos that disables facial recognition systems | May 31, 2018 | 27,302 | 2,337 | 29,639 |
| U of T Engineering researchers develop handheld 3D skin printer | May 2, 2018 | 453 | 12,671 | 13,124 |
| U of T Engineering launches Canada’s first engineering undergraduate program in Machine Intelligence | July 24, 2018 | 7,827 | 3,971 | 11,798 |
| More than half of drivers don’t look for cyclists when turning right, reveals U of T Engineering study | August 9, 2018 | 3,551 | 4,295 | 7,846 |
| She had a 99% average in high school. Here’s how one of Toronto’s top scholars prepares for her first day at U of T Engineering | September 5, 2018 | 1,165 | 6,368 | 7,533 |
| ‘Just keep going’: International student Eman Hammad juggled four kids and earned a PhD in engineering | June 11, 2018 | 573 | 6,046 | 6,619 |
| How IBBME’s Michael Garton forged a career in research after being paralyzed in climbing accident | October 4, 2018 | 234 | 5,632 | 5,866 |
| U of T Engineering Grads to Watch 2018 | June 19, 2018 | 5,617 | - | 5,617 |
| Christopher Yip appointed next dean of U of T’s Faculty of Applied Science & Engineering | March 29, 2019 | 2,037 | 3,426 | 5,463 |
| Run by brother-sister team, this U of T startup is leading Big Pharma out of the dark | March 21, 2019 | 149 | 5,166 | 5,315 |
| Smarter cancer treatment: AI tool automates radiation therapy planning | August 1, 2018 | 804 | 4,352 | 5,156 |
| First study of traffic-related pollution in Trinidad and Tobago reveals high levels of black carbon | November 27, 2018 | 4,475 | - | 4,475 |
| ‘Completely surreal’: Kristen Faccioli earns CSA/ NASA Robotics Flight Controller Certification | October 25, 2018 | 1,688 | 2,025 | 3,713 |
| This U of T Engineering student is holding companies accountable for biased AI facial technology | February 11, 2019 | 1,910 | 1,772 | 3,682 |
| U of T Engineering launches artificial intelligence minor and certificate | October 31, 2018 | 3,546 | - | 3,546 |
| How to wash your hands: U of T startup aims to solve major health-care problem | January 25, 2019 | 381 | 3,154 | 3,535 |
| Professor William Cluett receives the University of Toronto President’s Teaching Award | June 1, 2018 | 944 | 1,903 | 2,847 |
| These AI experts want to teach you how to program a self-driving car | January 30, 2019 | 1,467 | 1,028 | 2,495 |
| U of T Engineering partners with NRC to commercialize biomedical innovations | November 26, 2018 | 301 | 2,168 | 2,469 |
| Toward a future quantum Internet | January 28, 2019 | 775 | 1,470 | 2,245 |
| aUToronto team wins first AutoDrive Challenge | May 7, 2018 | 1,534 | 612 | 2,146 |
| Training artificial intelligence with artificial X-rays | July 6, 2018 | 851 | 1,186 | 2,037 |
| High performance: Meet two elite student athletes at U of T Engineering | October 1, 2018 | 2,000 | - | 2,000 |
| ‘Fantastic Voyage’: U of T Engineering researchers create nano-bot to probe inside human cells | March 13, 2019 | 1,517 | 475 | 1,992 |
| Bombardier invests in Toronto aerospace hub, creates U of T research centre on aircraft noise | June 21, 2018 | 422 | 1,531 | 1,953 |
| No assembly required: U of T Engineering researchers automate microrobotic designs | April 24, 2019 | 1,235 | 531 | 1,766 |
| U of T Engineering community experiences new Myhal Centre at interactive open house | September 14, 2018 | 999 | 688 | 1,687 |
| Meet the international Pearson Scholars starting in U of T Engineering this fall | September 5, 2018 | 1,679 | - | 1,679 |

Note 8.5: Data shown is as of May 1, 2019.

Recruitment and Admissions Websites

Our Discover Engineering website (www.discover.engineering.utoronto.ca) is the primary destination for prospective undergraduate students and their families seeking information about U of T Engineering programs, admissions processes and student culture. It is our first impression to this critical audience. This year, we increased the number of unique visitors to the site from 263,717 in 2017–2018 to 293,086, up 11.1% over the previous period. We also earned more than one million pageviews for the first time, achieving a total of 1,039,255, a 6.9% increase over the previous year's total 971,812. Users visited the site from 210 countries, illustrating the strong international draw of our programs.

Once students receive an offer of admission, they are provided exclusive access to our You Belong Here microsite (www.uoft.me/YouBelongHere). This vibrant site presents positive and congratulatory imagery and key messaging, as well as information on next steps for students to accept their

offers. The You Belong Here site is not indexed by Google, and is therefore exclusively viewed by admitted students, and their usage patterns provide valuable insight into students' actions and decision-making processes post-offer. In the 2018–2019 reporting period, this site received 30,769 pageviews, an 3.9% increase from the previous year. Women represent 43.4% of visitors to the site.

Over the past several years, we have implemented strategies to increase the number of talented students who apply to our graduate programs (*see Chapter 2 – Graduate Studies*). One measure of this enhanced interest in our programs is the traffic to our Graduate Studies website (www.gradstudies.engineering.utoronto.ca). In 2018–2019, the total number of pageviews on this site reached 211,483, up 9.4% over the previous year. During the reporting period, the site received 57,684 visitors from 2,823 cities in 175 countries.

Figure 8.6 Summary of Analytics for Discover Engineering, You Belong Here and Graduate Studies sites, 2018–2019

| | Discover Engineering (discover.engineering.utoronto.ca) | You Belong Here (news.engineering.utoronto.ca) | Graduate Studies (gradstudies.engineering.utoronto.ca) |
|---|--|---|--|
| Pageviews | 1,039,255 | 30,769 | 211,483 |
| Unique visitors | 293,086 | 5,641 | 57,684 |
| Average number of pageviews per session | 2.29 | 2.78 | 2.18 |
| Average amount of time spent on site | 2:14 min | 2:40 min | 2:19 min |
| Cities of origin | 7,697 | 689 | 2,823 |
| Countries of origin | 210 | 94 | 175 |



9

The practice of engineering transcends borders. The next generation of engineering leaders must be well versed in the social, economic and cultural contexts in which their innovations will be applied. It is equally important for engineering teams to include voices and perspectives from across the globe, both to strengthen creativity and to ensure that technological solutions truly address the needs of local populations.

Our community includes students, professors, alumni and partners from more than 100 countries. Through strategic recruitment initiatives, including our U of T Engineering International Scholarships, we attract talented individuals from outside of Canada who strengthen our leading-edge collaborative research and innovative educational programs.

We provide every student with boundless opportunities to study, work and conduct research abroad. These include exchanges coordinated by U of T's Centre for International Experience as well as programs specific to our Faculty, such as the Engineering Science Research Opportunities Program – Global (ESROP-Global). Participation in ESROP-Global in the summer of 2019 was 50% higher than the previous year.

Many students choose to work abroad through the Professional Experience Year Co-op Program. Programs such as Summer Research Abroad and our international capstone course provide opportunities for our students to gain cultural fluency by collaborating with students and faculty members from peer institutions around the world. Our Centre for Global Engineering (CGEN) facilitates international projects at both the undergraduate and graduate level. CGEN also offers multidisciplinary courses on topics in global engineering.

For the last three years, we have hosted Global Engineering Week, an initiative that now goes beyond U of T. It includes course partnerships, a hackathon, and panel discussions that challenge students to engage with international issues.

Through these and many other initiatives, our graduates gain the global fluency and perspectives that enable them to take their place as leaders in a global engineering environment.

International Students and Exchanges

We attract top students from around the world via our international reputation for excellence in research and education, as well as strategic recruitment initiatives in targeted regions. In 2018–2019, our Engineering Student Recruitment & Retention Office conducted school visits, applicant events and information sessions in Brazil, Colombia, Dubai (UAE), Ecuador, Indonesia, Panama, Singapore, Trinidad and Tobago, Turkey and the U.S.

In 2018–2019, international applications for undergraduate studies rose 10.8% over the previous year and international applications for graduate studies also remained strong. Currently, 27.6% of our undergraduate students and 36.5% of our graduate students come from outside of Canada.

We also offer a number of scholarships and structured degree partnerships with specific institutions, countries or regions. These include:

- **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 our Engineering Strategies & Practice course, these students continue into a Core 8 engineering program. Thirteen students are currently enrolled in IFP and are expected to join the Faculty in the fall of 2019.
- **U of T Engineering International Scholar Award:** We established this award in 2014, and over the next four years provided eight international students with full support throughout their undergraduate degrees. The recipients came from Jordan, India, New Zealand, Singapore, Trinidad and Tobago, Turkey and the U.S. In 2018, following the establishment of the Lester B. Pearson International Scholarship, we redesigned this award to support international students from underrepresented regions. The first cohort joined U of T Engineering in September 2018 and included students from Mexico, South Korea, Trinidad and Tobago and Vietnam.
- **Lester B. Pearson International Scholarship:** Established in 2017, this University-wide, four-year undergraduate scholarship recognizes exceptional academic achievement, creativity, leadership potential and community involvement. In 2018, seven students in our Faculty received this award, representing countries such as Colombia, Jamaica, India, Mexico, Nigeria, Trinidad and Tobago, and the U.S. A total of 11 U of T Engineering students have received this award since 2017.

We provide a comprehensive suite of programs through which students spend up to 16 months working, studying or conducting research abroad. These include:

- **Professional Experience Year Co-op (PEY Co-op) Program:** PEY Co-op students work for 12 to 16 months at companies and organizations across Canada and around the world. In 2018–2019, 85 of these work terms — approximately one in 10 — took place outside of Canada. These included 64 in the U.S and 21 in other countries such as Belgium, Botswana, China, Japan, Switzerland and the United Kingdom. (*For more information on PEY Co-op, see Chapter 4: Cross-Faculty Education & Experiential Learning.*)
- **Summer Research Abroad, Structured Exchange Pathways and other exchange programs:** We offer a wide variety of programs that enable our students to conduct research internships or pursue academic courses at partner institutions abroad. Some of these programs are administered by U of T's Centre for International Experience while others, such as the Engineering Science Research Opportunities Program – Global (ESROP-Global), are coordinated by the Faculty. In 2018–2019, 89 students participated in these exchange programs.
- **Cross-cultural design:** Since 2011, the Department of Mechanical & Industrial Engineering has offered an international capstone course in which students collaborate with their peers at leading institutions worldwide on design projects brought forward by industry. Current partners include Shanghai Jiao Tong University and Tsinghua University, while past partners have included Beihang University, Peking University, Penn State University, the National University of Singapore and the University of California, Irvine.

The office of the Vice-President, International has set a goal to increase the number of U of T students who participate in at least one outbound international experience by the time they graduate, from 19% in 2016 to 30% by 2022. We are well on our way to meeting this target, with 237 graduating students (22%) meeting this criterion in 2018–2019, up 20% from 197 students in 2017–2018.

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

International Agreements

Our strategic partnerships with peer institutions around the world create pathways for students to gain international experience and enhance their global fluency. These include course-based and research exchanges, as well as cross-cultural engineering design courses, dual-degree programs and opportunities for international students to streamline their applications to our graduate programs, such as the professional master's (MEng). As of June 2019, our Faculty has more than 25 active international agreements, with access to other top institutions through University-wide partnerships.

International Doctoral Clusters (IDCs) are research and doctoral education arrangements in well-defined areas that bring together a critical mass of complementary talent at U of T and partner institutions to form collaborations that further foster research innovation. In 2018–2019, we entered into new agreements to create International Doctoral Clusters (IDCs) with:

- Utrecht University and Chinese University of Hong Kong — IDC on Public Health and Cities
- National University of Singapore — Urban Water, Waste and Energy Solutions

In partnership with the Centre for International Experience, we continue to expand the number of leading institutions worldwide where our students can complete course-based or research exchanges. In 2018–2019 we signed new agreements with:

- Chulalongkorn University, Thailand
- École Polytechnique, France
- Pontifical Catholic University (PUC), Chile
- Sorbonne University, France
- University of Barcelona, Spain
- Università Cattolica del Sacro Cuore, Italy

Global Engineering

Our Centre for Global Engineering (CGEN) was founded in 2009 to empower faculty and students to develop transformative solutions to the profound engineering challenges that affect the lives of billions of people around the world. Through course offerings, capstone design projects, and immersive research initiatives, CGEN encourages students to engage with issues such as food security, water and sanitation, energy, infrastructure, and public health in low-income countries, as well as in resource-constrained communities in Canada. CGEN also offers fellowships for research with global impact.

With the support of the Dean's Strategic Fund (DSF), CGEN launched its first set of Global Engineering capstone design projects in 2018. These projects are carried out in partnership with social enterprises and NGOs working to address critical issues. Our students gain valuable international experience, and the partner organizations gain technical expertise they would not otherwise be able to access. Through collaborations, CGEN has identified 14 projects with 12 clients worldwide. These include:

- **Coconut paring for medium-scale production (Samar, Philippines)** — This partnership with Coco-Asenso social enterprise applies engineering innovation to enhance the efficiency of a coconut processing facility that uses a combination of manual and machine-assisted techniques. Students identified peeling as the rate-limiting step and are developing a low-cost, ergonomic solution that speeds up the process.
- **Solar dehydrator for cricket consumption (Siem Reap, Cambodia)** — Dehydrated cricket powder is being used by World Vision as a source of micronutrients for malnourished children in this community. A team of U of T Engineering students is developing a solar-powered system to quickly dehydrate crickets, enabling production to be localized and further reducing costs.

In 2018–2019, CGEN launched the Reconciliation Through Engineering Initiative (RTEI). The initiative's objectives are to build strong relationships with geographically disparate Indigenous communities across Canada. Together, we identify pressing engineering challenges facing those communities, and work with members of those communities to co-design sustainable solutions, build technical capacity and enable pathways for future participatory action research. *(For more on RTEI, please see Chapter 10 – Equity, Diversity and Inclusion)*

Selected International Education and Research Partnerships

U of T Engineering celebrates third annual Global Engineering Week

From March 11-17, 2019 Global Engineering Week (GE Week) challenged students at U of T Engineering and across Ontario to think critically about how they can make a difference on the world stage. Founded by alumnus Malik Ismail (EngSci 1T6 + PEY), now an associate at the Boston Consulting Group (BCG), GE Week was co-hosted by CGEN as well as the U of T Engineering chapters of Engineers Without Borders, Women in Science and Engineering and the Sustainable Engineers Association. Other partners included leading tech companies and NGOs, such as LEAP at the Pecaut Centre for Social Impact. Events during GE Week at U of T included a speaker panel on the role of artificial intelligence in global development, hosted by Professor Timothy Chan (MIE), as well as a student hackathon called “Hack the Globe.” In addition, we also hosted a global engineering fair and presentations in classes across all years of study. In its third year, GE Week has expanded to peer institutions including the University of Waterloo, Concordia University and Western University.

Engineers in Action build footbridge in Bolivia

In June 2018, the University of Toronto Engineers in Action team (formerly Bridges to Prosperity) constructed a 64-metre suspended footbridge over the Gonchu Mayu river in Bolivia, their third bridge project since 2016. The latest project began in January 2018 when Engineers in Action was asked to design and build a bridge for Tablas Monte, a village of 140 families located on the tropical slopes of the Andes. To complete the bridge, students faced a 40-minute commute to the site, requiring them to wake before sunrise and work until after sunset each day. Challenges included the river profile, which varied greatly from the survey that they originally received; and the necessity to use an anchor in dynamited rock. Despite these unexpected developments, the team completed the bridge as scheduled, working alongside a local engineer and masons.

UTIAS professor addresses global demand for robotics and AI education

In March 2019, Professor Jonathan Kelly (UTIAS) travelled to Yangon, Myanmar, where he partnered with a startup accelerator to teach robotics to 25 local university students. The teaching opportunity was part of an initiative by Phandeeyar, an organization that aims to expand the pool of tech talent in Myanmar in order to accelerate the country’s social and economic development. Rapid growth in Myanmar has given rise to a new generation of aspiring engineers, computer scientists and entrepreneurs who have been empowered to become part of the country’s technology sector, including fields such as robotics. Kelly’s week-long course included an introduction to robotics and a few days dedicated to artificial intelligence and how to program software for self-driving vehicles. In January 2019, Kelly, along with Professor Steven Waslander (UTIAS) partnered with Coursera to develop and deliver an online four-course specialization in self-driving car technology. Of the more than 4,800 learners the specialization has attracted so far, 97% are from outside of Canada.

Engineering Education for Sustainable Cities in Africa (EESC-A)

EESC-A is supported by the Dean’s Strategic Fund and began in 2016. Our goal is to explore U of T Engineering’s role in helping to educate future “sustainable cities engineers” who will shape the direction of Africa’s growing megacities. The project involves both community building and the creation of flexible, adaptable course materials that can be delivered online. The Toronto-based EESC-A team members travel frequently to various African countries to build and maintain a network of institutions and academics with expertise in sustainable cities. Collectively, they have visited approximately 30 engineering schools in 10 countries since 2016. The program has also funded four African “roaming scholars” to travel within the continent, further strengthening these bonds through interactions and collaboration. In fall 2018, three of these four scholars — along with their students — participated in a project known as the Global Classroom, through which an online course was delivered simultaneously across multiple institutions. Students moved through the content with their respective professors, then met once a week via videoconference with the entire team. The team has received very positive feedback about the first iteration of the course, which was run as a not-for-credit trial. Future online courses may offer full course credit, either at U of T or the partner institutions.

First study of traffic-related pollution in Trinidad and Tobago reveals high levels of black carbon

A new U of T Engineering study has measured significant concentrations of traffic-related air pollution near major roadways in Trinidad and Tobago, reaching levels comparable to highways in Toronto and Detroit. The research was led by Kerolyn Shairsingh (ChemE OT8, PhD 1T8) under the supervision of Professor Greg Evans (ChemE, ISTEP). Shairsingh was motivated to research local concentrations of black carbon in Trinidad and Tobago after years of experiencing asthma attacks every time she travelled back to her home country. When she visited in February 2018 she brought air-quality monitoring equipment with her, setting up 10 monitoring sites across Trinidad and Tobago over a three-week period, including near oil and gas refineries, urban residences, and major roads. She found that levels of black carbon around industrial areas on the islands were elevated to levels comparable to the Macdonald-Cartier Freeway outside of Toronto, one of the busiest highways in North America. Levels near major roads in Trinidad and Tobago were significantly higher. Although the country passed air pollution legislation in 2014, the guidelines do not include monitoring of vehicles. Shairsingh's research, which was published in *Science of the Total Environment*, will be the first step toward improving air quality, either through cleaner fuel sources or through retrofitting of large vehicles such as buses and trucks.

Putting power in the hands of the people

Olugbenga Olubanjo (CivE MASc candidate) and his collaborators have created a startup designed to bring clean, affordable and portable power to places where the electricity grid is either unavailable or unreliable. Olubanjo was inspired by the experience of calling relatives in his native Nigeria from Toronto; calls would often be cut off due to a loss of power. His startup, Reeddi Inc., envisions a standalone, solar-powered structure with removable, rechargeable lithium-ion battery packs. Customers would rent the packs for periods of up to 24 hours, returning them when depleted. Olubanjo has received support and mentorship from The Entrepreneurship Hatchery as well from Professor Yu-Ling Cheng (ChemE, CGEN) and other colleagues across U of T Engineering. The startup has won a number of awards, including the North American Regional Award for the Best Emerging Startups in Decentralised Energy Track at the IEEE Empower a Billion Lives Challenge held at Georgia Tech in February, 2019, and the MIT 2019 Clean Energy Prize (National Grid Energy Delivery Track). In May 2019, Reeddi Inc. was a runner-up in the Cisco Global Problem Solver Challenge. The team aims to have a micro-scaled pilot with five interactive Reeddi capsule prototypes in Nigeria by August 2019.



10

Our engineering profession must reflect the diversity of the society we serve. A wide range of voices enhances creativity and ensures innovations are designed with inclusion in mind. Our Faculty is committed to fostering an environment in which each member of our community can excel, contribute and benefit from different perspectives. We also take pride in championing diversity across all domains of science, technology, engineering and mathematics.

For the last three consecutive years, our incoming undergraduate cohort has included approximately 40% women, and a similar proportion will join us in September 2019. Across all years of study, in 2018–2019 women represented 35.4% of our undergraduate population, well above the national average of 21.8% reported in the most recent (2017) data from Engineers Canada. We continue to drive Engineers Canada’s efforts to raise the percentage of newly licensed women engineers to 30% by the year 2030.

The proportion of women faculty members is more than 21%, and the number of women professors has nearly tripled from 21 in 2005–2006 to 57 today. Women engineers lead many of our multidisciplinary research centres and institutes, and hold positions of senior leadership at the University level. More than one third of our Canada Research Chairs are women.

Our Engineering Equity, Diversity, and Inclusion Action Group (EEDIAG) strives to foster a community at U of T Engineering where students, staff and faculty are genuinely acknowledged, respected and represented. The efforts of EEDIAG are complemented by our newly appointed Assistant Dean and Director of Diversity, Inclusion and Professionalism.

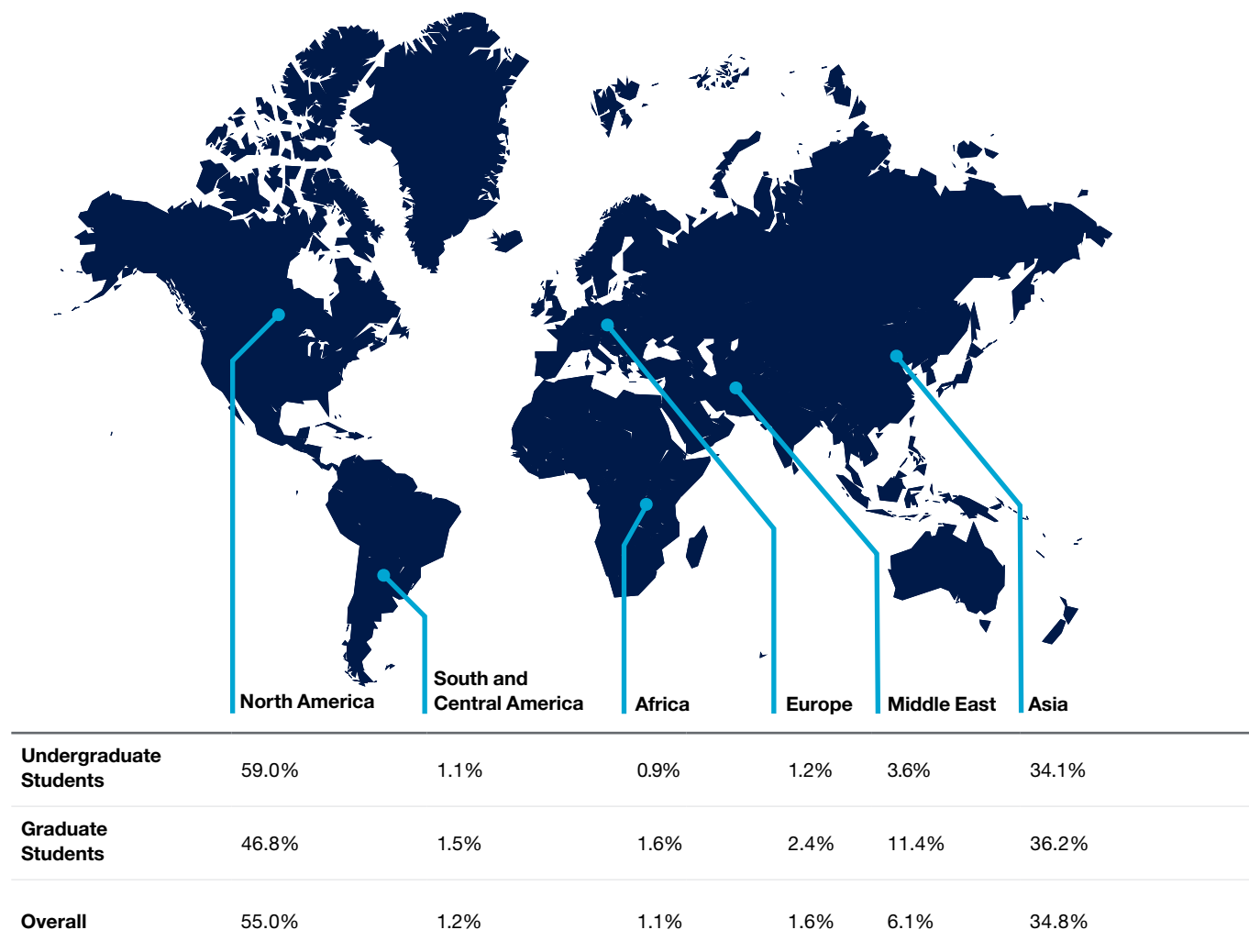
Through our Dean’s Advisor on Indigenous Initiatives, our Eagles’ Longhouse Indigenous Initiatives Steering Committee, our Dean’s Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor, and our Anti-Black Racism Committee, we work to recognize and challenge power dynamics that may lead to exclusion and discrimination, and to increase the representation of Black students, Indigenous students and other historically underrepresented groups within our community.

Measures of Progress

International Diversity

We have grown our proportion of international undergraduate students from 14.6% in 2009–2010 to 27.5% in 2018–2019. Among graduate students, 36.5% are from outside of Canada, up from 16.6% in 2009–2010. Our strategic recruitment efforts in key regions have attracted talented students from a wider range of countries than ever before, including Brazil, Colombia, Dubai (UAE), Ecuador, Indonesia, Panama, Singapore, Trinidad and Tobago, Turkey and the U.S. *(For more information about our international recruitment initiatives, please see Chapter 9: International Initiatives.)*

Figure 10.1 Continent of Origin: Undergraduate and Graduate Students, Fall 2018



Data and highlights in this chapter are from September 2018 to August 2019.

Note 10.1: Not shown — 0.1% of undergraduate students from Oceania, which includes Australia, New Zealand and other countries in the Pacific Ocean. Country of origin is derived from a combination of citizenship, location of previous studies (e.g. elementary school, high school and university) and permanent address. This information does not indicate current Canadian immigration status, which is used to determine domestic/international student status for tuition and funding purposes.

Outreach and Inclusivity

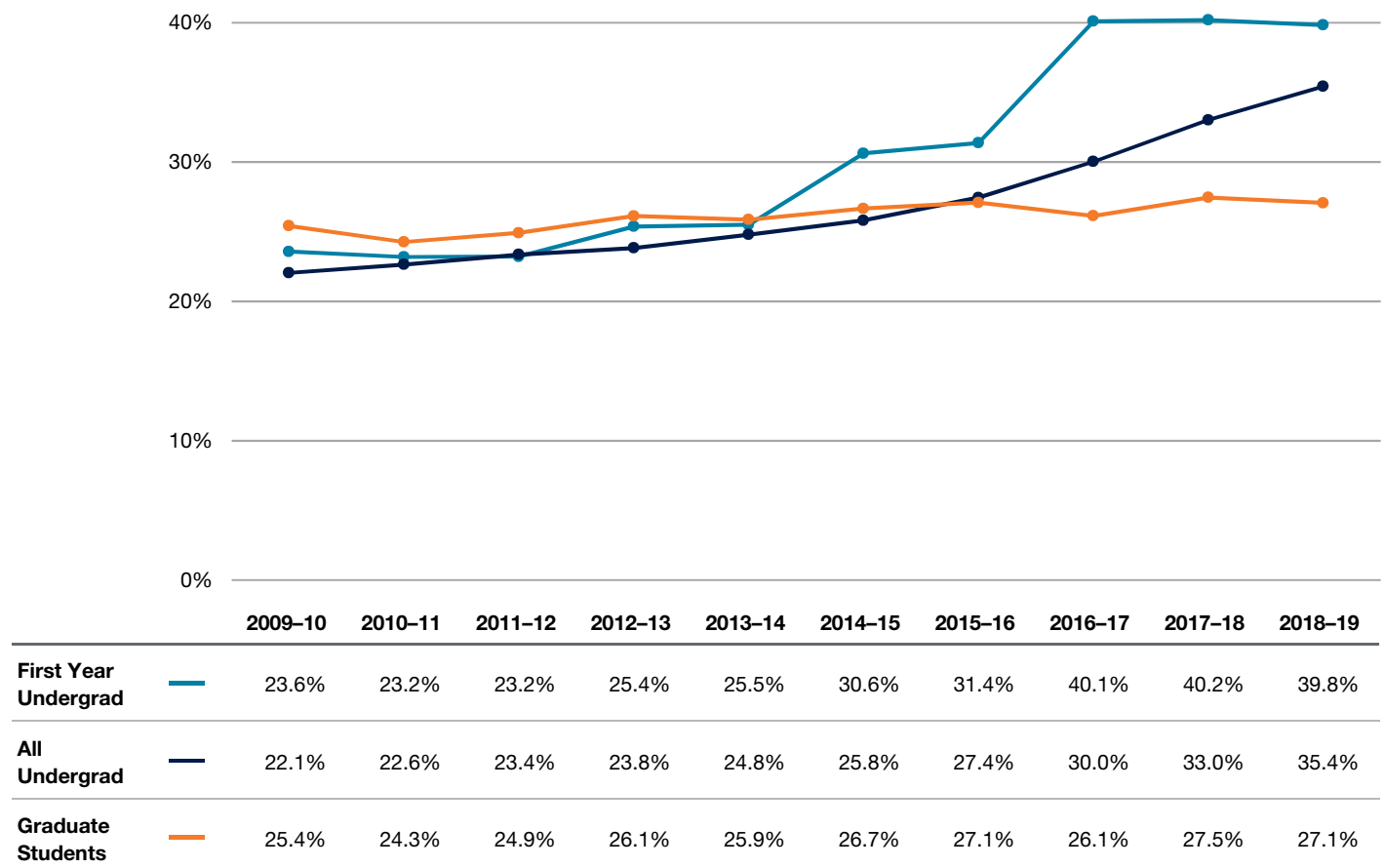
We continue to grow the proportion of women in our undergraduate and graduate programs and to provide a rich environment that supports diversity and inclusion in all forms.

In the 2018–2019 undergraduate cohort, women accounted for 39.8% of incoming students, up from 23.6% a decade ago. Across all years of study, the undergraduate population is now 35.4% women, and 27.1% of graduate students are women. We play a leading role in advancing Engineers Canada’s 30-by-30 campaign to raise the percentage of newly licensed women engineers to 30% by the year 2030.

Through strategic outreach and recruitment, we strive to inspire talented women to choose engineering. Our programs increase awareness of the engineering profession and the positive impact of our graduates across a wide range of fields, from medicine to sustainable development. These programs include:

- Girls’ Leadership in Engineering Experience (GLEE):** This program brings together talented young women from across Canada who have been offered admission to our programs for a weekend to meet students, faculty members and alumni and learn more about engineering. In 2018, 91 of GLEE’s 117 participants accepted our offer of admission, a yield of 78%. In 2019, GLEE was split into two events, one for students from Ontario and one for students from elsewhere, including other Canadian provinces, the U.S. and Latin America. In April, 24 out-of-province students participated in GLEE, with a further 86 Ontario students attending in May.
- Young Women in Engineering Symposium (YWIES):** Now in its sixth year, YWIES invites top Grade 11 high school students from the Greater Toronto Area to learn about engineering and our undergraduate programs early in their decision-making process. We attracted 84 students to our fifth annual symposium in May 2018, and an additional 54 in May 2019.

Figure 10.2 Percentage of Women Students, 2009–2010 to 2018–2019



Engineering Outreach also offers a range of programs aimed at cultivating an interest in science, technology, engineering and math among girls in elementary and high school, such as:

- **Girls Jr. DEEP:** These one-week courses inspire students to tackle fun and fascinating STEM activities and challenges. Participants conduct experiments, work on engineering design projects and collaborate in an all-girls environment, taught by women undergraduates from U of T Engineering.
- **Launch! Girls Saturday Program:** Hosted at GTA public schools, this program welcomes female students currently in Grades 3–5. Through immersive science and engineering activities, Launch! Girls Saturday inspires confidence in problem-solving strategies, teamwork, and a range of STEM topics.

Since 2010, we have partnered with the U of T chapter of the National Society of Black Engineers (NSBE) to deliver ENGage, a week-long day camp for students in Grades 3 – 8 that provides participants with on-campus activities that demonstrate engineering principles and practices. We reached more than 60 students through ENGage camps held in July of 2018, and anticipate increased participation in summer 2019.

LAUNCH: Science & Engineering Community Camps, are one-week camps in schools and community centres located in neighbourhoods that have been identified as under-served. Like all ENGage programs, LAUNCH operates on a barrier-breaking model and is open to all participants. LAUNCH reached more than 220 students this year through our offerings at Dundas Jr. Public School and John Polanyi Collegiate Institute.

In addition to ENGage programs offered through our Engineering Outreach Office, the Faculty delivers the Urban In-School Workshop program (ISW). In operation for more than 20 years, the program provides more than 100 STEM-related workshops led by U of T Engineering students each May and June in schools within under-served communities.

We also visit schools throughout the province each year through programs such as the Engineering Society's Hi-Skule outreach group and Women in Science and Engineering (WISE).

- **Hi-Skule:** In 2018-2019, Hi-Skule hosted five major outreach events for more than 600 high school students, including a Welcome to Engineering event on campus, a Mentorship Coffee House, and the University of Toronto High School Design Competition. Hi-Skule also sent mentors back to 10 high schools across the GTA to speak to students, and collaborated with the National Society of Black Engineers U of T Chapter on Designapalooza, an event which hosted over 100 students in Grades 5–8.
- **Women in Science and Engineering (WISE):** Our U of T Engineering chapter of WISE recruited 27 student ambassadors and delivered a total of 26 presentations in high schools and through public-facing initiatives such as Science Rendezvous. Elementary school students also had the opportunity to attend Girls in STEM workshops run by WISE in collaboration with U of T's Department of Mathematics. WISE also led a successful high school mentorship program with 20 mentors and 40 mentees, and organized events such as the on-campus event "STEM Student for a Day," a high school conference "Step up with STEM," and a design challenge bringing 200 high school students to campus. In total, WISE reached more than 1,500 students in 2018-2019.

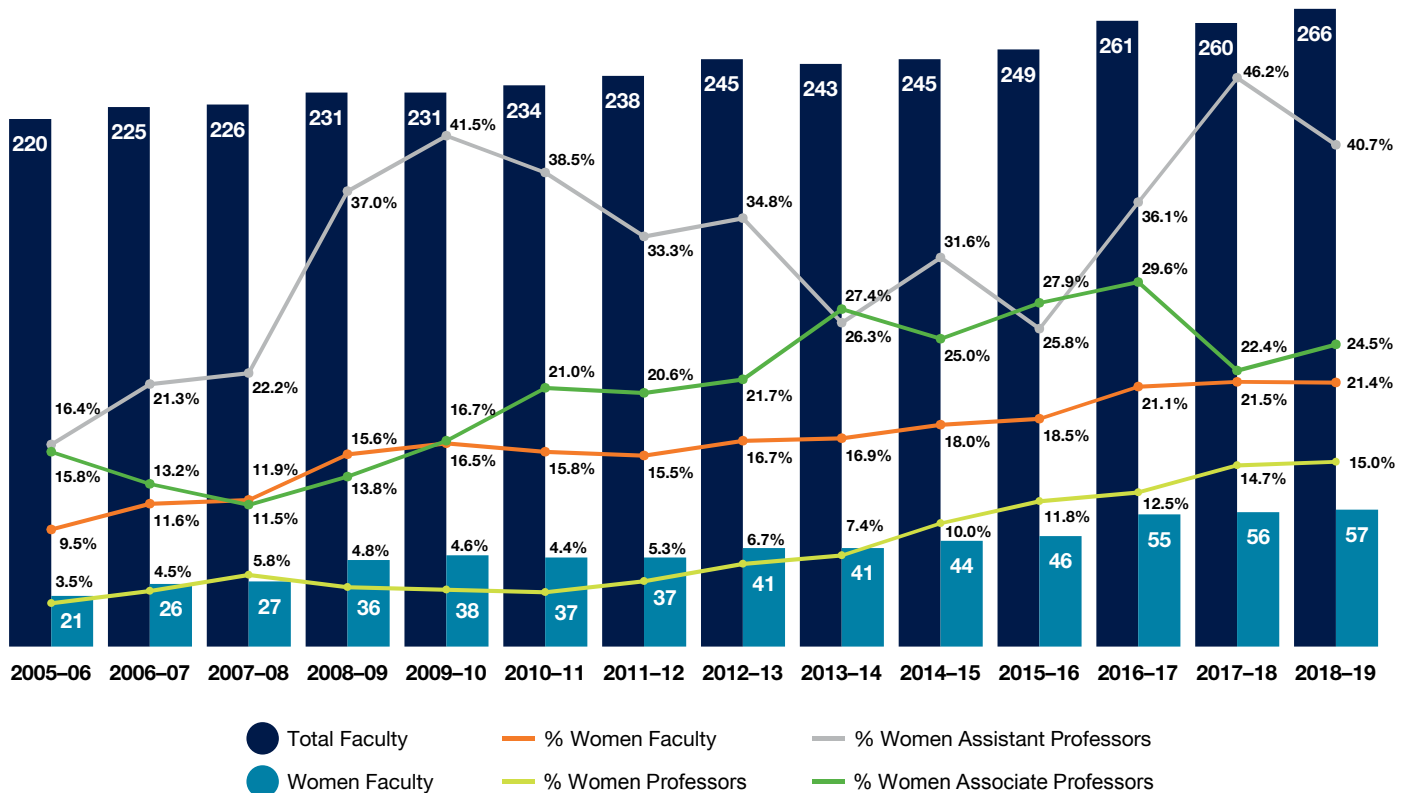
Since 2017, the U of T Engineering Society has appointed an Equity and Inclusivity Director who coordinates with clubs and university services to facilitate discussion and support around these issues. They also work with the Ombudsperson to respond to the needs of students and promote awareness of equity and inclusivity within the Skule™ community.

Outreach and Inclusivity

As part of our ongoing commitment to fostering an inclusive environment, we have significantly increased the proportion of women among our faculty members over the last 10 years. This proportion now stands at 21.4%. While the latest comparison data from Engineers Canada is not yet available, our proportion is higher than any other Canadian engineering school in the U15 group of research-intensive institutions as reported in 2017.

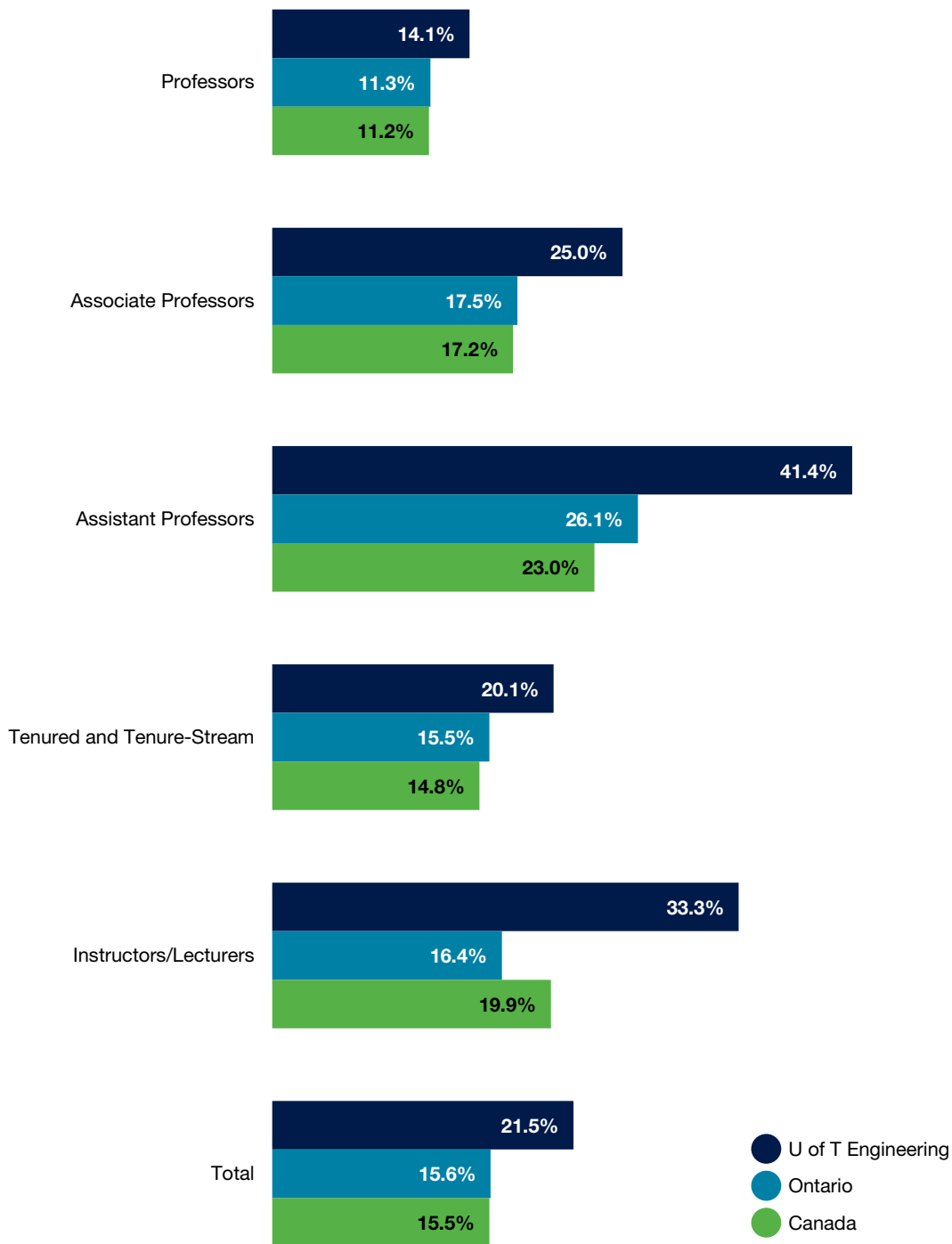
Women hold senior leadership roles across many of the departments and divisions of our Faculty. These include the Chair of our Edward S. Rogers Sr. Department of Electrical & Computer Engineering and the Directors of several of our multidisciplinary research centres and institutes, such as BioZone, the Centre for Global Engineering and Troost ILead.

Figure 10.3 Total Number of Faculty with Percentage of Women Overall and by Academic Rank, 2005–2006 to 2018–2019



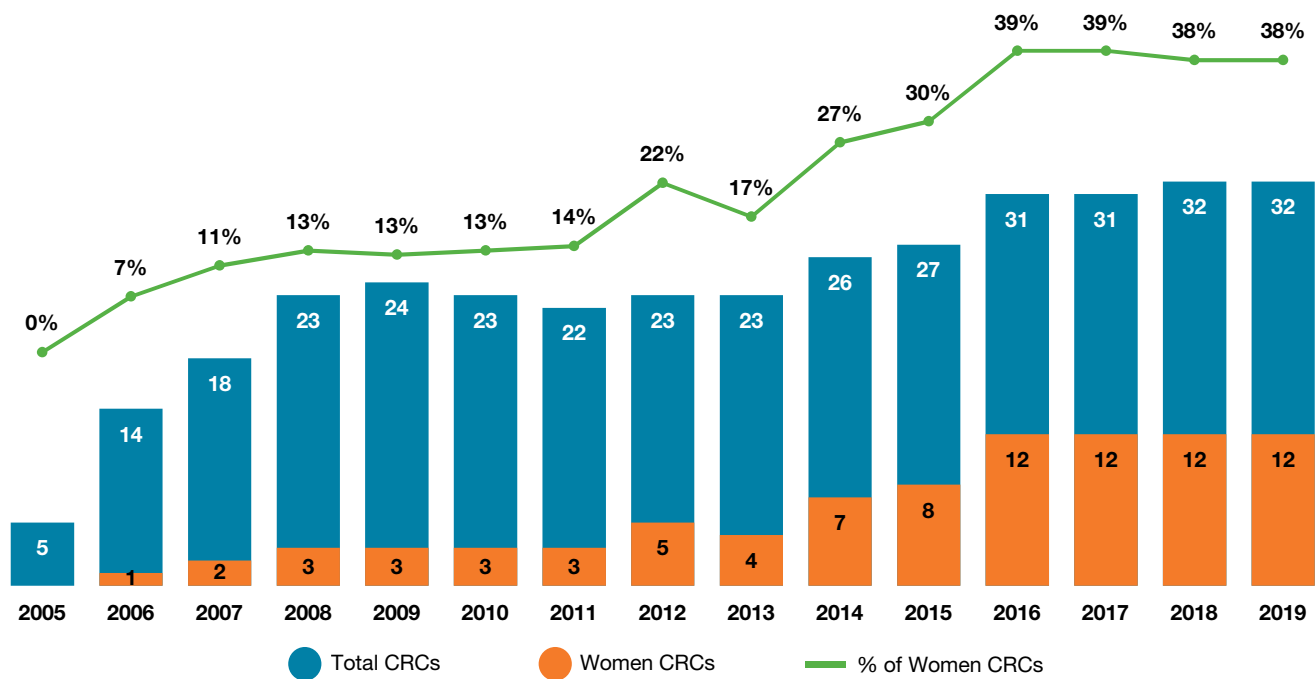
Note 10.3: Data for this figure are based on headcount.

Figure 10.4 Percentage of Women Faculty at U of T Engineering Compared with Women Faculty in Ontario and Canadian Engineering Faculties, 2017–2018



Note 10.4: Data for this figure comes from Canadian Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded, Engineers Canada, 2017. Counts are based on full-time equivalent faculty.

Figure 10.5 Canada Research Chairs with Number and Percentage of Women Chairholders, 2005 to 2019



Programs and Initiatives

Equity, Diversity and Inclusion Action Group

The Engineering Equity, Diversity and Inclusion Action Group (EEDIAG) was established in 2018 to advance our Faculty’s commitment to fostering an environment in which each member of our community can excel, contribute and benefit from different perspectives. With representation from students, staff and faculty, the group works to identify barriers to access and inclusion of underrepresented groups in engineering, as well as to build more inclusive spaces within our Faculty.

In 2018–2019, EEDIAG has led several initiatives and events, including:

- **Addressing Root Causes: Power, Privilege and Injustice in Engineering Education & Practice:** An invited talk from Professor Donna Riley of Purdue University, this workshop was co-hosted by Troost ILead as part of the Engineering Leadership Seminar series.
- **Monthly Open Conversations:** This event series invites all U of T Engineering community members to discuss issues in equity, diversity and inclusion (EDI). Topics have included: understanding bias, barriers to equity and inclusion, imposter syndrome and making our faculty more inclusive.

- **Towards Inclusive Practices Series (TIPS):** Workshops and seminars on EDI issues in engineering education. Topics have included Foundations for an Inclusive Community, and Understanding & Supporting Students Who Experience Imposter Syndrome. In April 2019 we hosted a session on Accessibility & Accommodations with a particular focus on team work.

The EEDIAG also worked with Engineering Strategic Communications to develop an EDI webpage and implemented a new EDI online suggestion box for receiving community feedback. These resources can be found at uoft.me/EngEDI.

Enhancing Black Inclusivity

Dean’s Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor

In March 2018, we appointed Mikhail Burke (MSE 1T2, IBBME PhD 1T8) to the new role of Dean’s Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor at U of T Engineering. In 2018–2019, Burke formed the Black Inclusion Steering Committee (BISC), which consists of staff, student and faculty members both within

U of T Engineering and from other divisions of the University. BISC has produced an interim report, providing an initial set of recommendations to the Faculty. It notes that the Faculty has shown progress towards the execution of its recommendations, including:

- Formalization of Faculty presence at events such as the NSBE National Convention and the Collaborative Network for Engineering and Computing Diversity (CoNECD) conference hosted by the American Society for Engineering Education;
- Creation and launch of its first anti-Black racism campaign and acknowledgement of Black History Month (see “*Anti-Black Racism Committee*” later in this section);
- Establishment of a new EDI role/office (see “*Equity, Diversity and Inclusion Action Group*” earlier in this section);
- Collection of more disaggregated data, feedback and communication pathways.

BISC continues its consultation and the committee’s final report is expected by end of summer 2019.

Addressing Anti-Black Racism

In Fall 2018, we established the Anti-Black Racism Committee (ABRC) to take meaningful action in raising awareness of anti-Black biases in our Faculty, and improve the experience of students, staff, faculty and alumni who identify as Black in our community. We launched our first campaign during Black History Month in February, capitalizing on the enhanced attention to achieve two goals: creating a sense of empowerment, community and support among Black students, and highlighting unconscious bias as a barrier to advancing anti-racism. The campaign featured two primary pillars: a news story sharing the personal experiences of students and alumni who identify as Black, and a poster series designed to enhance inclusivity of Black community members, and call attention to pervasive unconscious bias. The news story generated a total reach of 10.4K and 331 engagements on Facebook, and 8.7K reach and 332 engagements on Twitter.

Indigenous Partnerships and STEM Outreach

We are working with U of T’s First Nations House and with Indigenous communities to increase the number of Indigenous students who apply to and enrol in U of T Engineering programs, and to ensure a welcoming, supportive and inclusive environment for all students, faculty and staff.

Following the Truth and Reconciliation Commission of Canada’s call to eliminate educational gaps between Indigenous and non-Indigenous peoples, the University of Toronto published a report, *Answering the Call: Wecheehetowin*, which outlined proposed actions in six key areas:

- Indigenous spaces
- Indigenous faculty and staff

- Indigenous curricula
- Indigenous research ethics and community relationships
- Indigenous students and co-curricular education, and institutional leadership and implementation

In 2017, we established the Eagles’ Longhouse, our Engineering Indigenous Initiatives Steering Committee, which includes members from across our Faculty and the Oneida Nation. The mandate of the Eagles’ Longhouse is to engage Indigenous representatives and engineering educators to design a *Blueprint for Action* to ensure a welcoming and supportive environment and to intensify engineering outreach to these underrepresented communities. The committee is chaired by Professor Jason Bazylak (MIE), who was also appointed the Dean’s Advisor on Indigenous Initiatives.

The *Blueprint for Action* was delivered in June 2018 and is available online (www.uoft.me/BlueprintforAction). Its recommendations are divided into four areas with immediate, short-term and long-term actions, including:

- **Indigenous Spaces:** Form an ongoing Indigenous Space Committee, involving Indigenous community members, to develop or redevelop existing spaces as Indigenous spaces, commission Indigenous artwork and create educational installations.
- **Indigenous Curriculum:** Integrate Indigenous content into existing curricula.
- **Indigenous Student Access:**
 - Tailor recruitment activities to Indigenous students, including scholarship opportunities and a website with specific content for Indigenous students.
 - Create a network of Indigenous engineers and educators to support mentorship and outreach programs.
 - Initiate an engineering outreach program for Indigenous high school students, and create a transition program for Indigenous students in Grade 10 math to enter U of T Engineering.
- **Indigenous Faculty and Staff Recruitment and Hiring:** Support a program focused on the recruitment and hiring of Indigenous faculty and staff.

We have also initiated three Indigenous community outreach projects, with support through the Dean’s Strategic Fund (DSF):

Engineering outreach in Labrador

Led by Professors Erin Bobicki (MSE, ChemE) and Naomi Matsuura (IBBME, MSE), the Labrador Engineering Awareness Program (LEAP) aims to alleviate the geographic challenges faced by Indigenous high school students in accessing engineering education in Labrador, and to spark interest in engineering as a career path. The program was offered in October 2018 for students aged 13 to 18 in five communities across the region. Nearly 100 students engaged with the program, working on design projects that addressed engineering challenges relevant to their communities, in

areas such as mining, snowmobiling, sustainable housing and ice safety. Funding has been secured to continue the program for the next three years, with the number of communities expanding from five to 11.

Drone design at high schools

Partnering with the Dennis Franklin Cromarty High School in Thunder Bay, this project aims to teach science students to design and build drones, providing insight into the many applications that could benefit their communities. The project is led by UTIAS professors Craig Steeves and Jonathan Kelly.

Reconciliation Through Engineering Initiative (RTEI)

This multidisciplinary project, led by the Centre for Global Engineering (CGEN), takes a community-based collaborative approach to infrastructure-related challenges faced by Indigenous communities across Canada.

In June 2019, a CGEN team led by research associates Shakya Sur and Sonia Molodecky visited Sioux Lookout, Ontario to explore a collaboration with the town's proposed Innovation Station. They were joined by representatives from many other First Nations in Northern Ontario, including Slate Falls First Nation, Cat Lake First Nation, Lac Seul First Nation, and Kitchenuhmaykoosib Inninuwug First Nation. Together, they are looking to set priorities for future technology development projects.

The team is also working closely with the Tahltan First Nation in British Columbia, as well as the Nishnabe Aski Nation in Northern Ontario, where they plan to develop techniques in artificial intelligence and operations research to re-design and optimize the operations of the Nation's air transport network.

Selected Highlights

Assistant Dean and Director, Diversity, Inclusion and Professionalism

In May 2019, we created the new position of Assistant Dean and Director, Diversity, Inclusion and Professionalism. They work towards ensuring that every member of the U of T Engineering community can study and work in an environment free of biases based on race, ancestry, place of origin, colour, ethnic origin, citizenship or creed, sexual diversity, age, gender and ability. Working collaboratively with the senior academic and administrative leaders across the Faculty, and with equity officers at the University, the Director develops, leads and implements initiatives to promote diversity and inclusion within the learning and working environments for faculty, staff, and students in Engineering. The position includes extensive collaboration with the Vice-Dean, First Year, and liaison with organizations such as Professional Engineers Ontario, and the Canadian Council of Professional Engineers, to lead and implement training and awareness initiatives to prepare students on critical aspects of ethics and professionalism in the field of engineering.

The inaugural Assistant Dean and Director, Diversity, Inclusion and Professionalism is Marisa Sterling, P.Eng., who brings more than 20 years of experience working and volunteering in the engineering field, in both the private and public sectors. She previously served as Assistant Dean, Inclusivity and Diversity, at York University's Lassonde School of Engineering, where her work with students, staff and faculty resulted in improved workplace culture and better inclusion of all people.

NSBE U of T Chapter hosts first student-run Black hackathon in GTA

On January 26, 2019, the U of T chapter of the National Society of Black Engineers (NSBE) hosted NSBEHacks, the first student-run Black hackathon in the Greater Toronto Area in the Myhal Centre for Engineering Innovation & Entrepreneurship. More than 100 attendees had 12 hours to design innovative solutions to challenges posed by the organizers and the event's sponsors, including Google, Shopify, Bloomberg and U of T Engineering.

NSBE conferences build new pathways for Black engineering students

In November 2018, U of T Engineering provided travel grants to three graduate students to attend the National Society of Black Engineers (NSBE) Fall Region 1 Conference (FRC) in Danvers, Mass. The project was initiated by the graduate office as well as Mikhail Burke, Dean's Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Mentor. Burke travelled alongside the three students: Shane Arnold (CivMin MEng candidate), Oluwasegun Modupe (ChemE PhD candidate) and Mohammad Shoaib (ChemE PhD candidate). The students had the opportunity to build their professional leadership skills, gather career advice, participate in case competitions and network with nearly 1,000 engineering students from across the east-coast regions of the U.S. and Canada.

We also provided support for 18 undergraduate students to attend the 45th NSBE National Convention, held March 27-31 in Detroit, Mich. In addition to this funding, our Faculty had a formal presence at the convention, with Vice-Dean, Undergraduate Tom Coyle attending strategic roundtable meetings and networking with the engineering education community. We also became the first Canadian institution to staff a recruitment booth at this conference. The learnings from this event will further inform our efforts to increase Black student, staff and faculty access, inclusion and success within our community.

The Voice of Engineering survey

The Voice of Engineering survey aims to take the pulse of the Faculty regarding the impressions and experiences of our students toward our institutional climate, diversity and wellness. It is designed for both undergraduate and graduate students from all departments and divisions. By providing baseline data, the survey serves as an important first step to identify underrepresented groups and issues of marginalization, discrimination, disparagement or alienation and to inform policies and initiatives as needed to support these groups.

The Voice of Engineering survey was developed by the Community Affairs and Gender Issues (CAGI) Standing Committee of Faculty Council in partnership with Dr. Glenys Babcock, a researcher and data scientist in the University of Toronto's Faculty of Medicine. The creation of the survey also included wide-ranging consultation across the Faculty on the scope of the questions asked.

The online survey was available to be completed in March and April 2019. Highlights from the report will be provided in Annual Report 2020.

U of T Engineering sends two students to the Arctic Youth Ambassador Caucus

In March 2019, U of T Engineering provided support that enabled two students to attend the Arctic Youth Ambassador Caucus, organized by Global Vision. Lia Codrington (Year 3 EngSci) and Natalie Enriquez-Birch (TrackOne) were among 22 youth leaders, including 11 from Canada's North, selected to visit Iqaluit as part of the program. Over the course of four days, they met with Inuit Elders to learn about the rich history of Nunavut and participate in round

tables on Northern issues, such as food security, health care, environment and education. Codrington founded the Indigenous Allyship program within U of T's chapter of Engineering Without Borders, which Enriquez-Birch joined this year. Together with several other students, they have been engaged in self-driven learning about Indigenous culture and history in Canada, as well as working to bring more awareness of reconciliation to campus. In collaboration with the Eagles' Longhouse, they are discussing projects that could focus the efforts of their Indigenous Allyship program. The personal connections they made during the conference will further inform those future plans.

Catalysts for change: U of T Engineering hosts WISE National Conference 2019

The Women in Science and Engineering (WISE) National Conference took place on January 26–27, 2019 at Toronto's Westin Harbour Castle. The event empowered, inspired and connected more than 500 science, technology, engineering and math (STEM) students and professionals from across Canada. The annual two-day conference, founded seven years ago by the U of T chapter of WISE, enabled participants to learn from notable speakers, network with industry professionals and expand their skills in technical competitions and workshops. Featured speakers included physician-surgeon Shawna Pandya; physicist and fashion designer Kitty Yeung; and former CEO of the MaRS Discovery District Ilse Treurnicht.

QueerSphere's gingerbread bridge building competition

U of T Engineering is home to QueerSphere, the student chapter of EngiQueers Canada, which promotes and advocates for the inclusion of LGBTQ+ students and their allies in engineering schools across Canada. The group coordinates initiatives such as constructing a float for Toronto's internationally celebrated Pride Parade. This year, Queer Sphere started 2019 on a sweet note by hosting a student and faculty gingerbread bridge building competition. Teams were given 100 gingerbread cookies, icing and skewers and were tasked to build a bridge across two elevated platforms within 30 minutes. The bridges were then subjected to a stress test of increasing wooden weights. Ultimately, the CivMin's faculty team beat out four other teams with an arch design that withstood over 11 wooden weights before meeting its crumbly end.

11

We continue to strengthen our leading-edge educational and research programs through prudent management of our financial and physical resources — funding, space, infrastructure and talent — and strategic investment in new initiatives.

The Myhal Centre for Engineering Innovation & Entrepreneurship is the most ambitious capital project to be completed in many years, for which our Faculty fundraised and invested more than \$90 million. Its technology-enhanced active learning spaces, fabrication facilities and design studios are setting a new standard in experiential education and research. The Myhal Centre catalyzes collaborations among students, faculty, staff, alumni and external partners, and strengthens our commitment to driving innovation, facilitating entrepreneurship and preparing the next generation of global engineering leaders.

Over the past two years, we have also invested \$19.1 million (matched by \$13.4 million from the federal government's Strategic Investment Fund) in renovations to 89 laboratory facilities across our Faculty through the Lab Innovation for Toronto (LIFT) project. This includes everything from a new bunkhouse for students at the site of our Civil and Mineral Practicals (CAMP) at Gull Lake to renovated labs in the Rosebrugh and Wallberg buildings.

In 2018–2019, we committed \$11.4 million to new Dean's Strategic Fund (DSF) projects that support multidisciplinary research collaborations, new experiential learning programs and other projects with broad impact on our Faculty. The Engineering Instructional Innovation Program (EIIP), an extension of the DSF, continues to foster curriculum innovation through strategic investments aimed at enhancing teaching, learning and the overall student experience.

We have also invested in student support and success, with a further \$4.5 million to match donations toward the Decanal Chair in Innovation, the Frank Leslie Haviland Scholarship, and the Troost Institute for Leadership Education in Engineering.

Total Revenue and Central Costs

The Faculty's total revenue and associated costs are reflected in Figures 11.1 and 11.2. Revenue in 2018–2019 grew to \$238.0 million, an increase of 1.7% over 2017–2018, with a compound annual growth rate of 6.6% since 2009–2010.

With the completion of many of the major infrastructure projects that were covered by operating funds in 2019, and the funds in place for several upcoming projects — including the new building at Gull Lake, the landscaping on the St. George frontage of the Galbraith Building, and the upgrades to the Engineering and Computer Science Library — we have strategically planned to reduce the undergraduate student population, with the goal of achieving our target undergraduate-to-graduate ratio of 60:40.

Total central costs for 2018–2019 rose to \$112.2 million, a 6.3% increase over 2017–2018, with a compound annual growth rate of 5.9% since 2009–2010. Central costs include the student aid levy, University fund contributions and University-wide costs, which experienced year-over-year increases of 5.4%, 2.0% and 7.5%, respectively (Figures 11.2 and 11.3). Major drivers of the costs for this year included the new occupancy cost of the Myhal Centre, new acquisitions at U of T Libraries, and service level increases in student recruitment, registrarial and research administration functions.

Figure 11.1 Total Revenue, 2009–2010 to 2018–2019

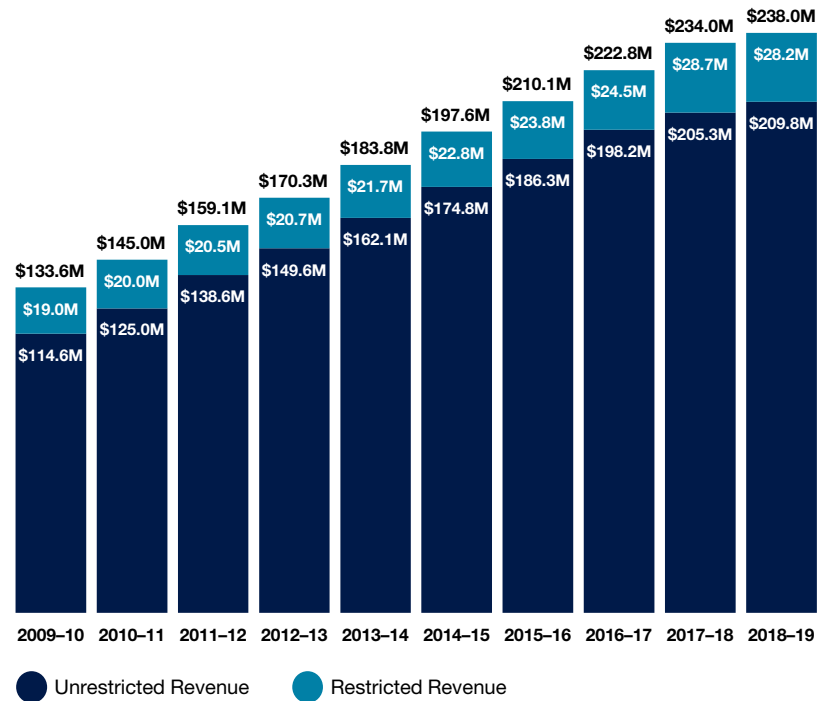
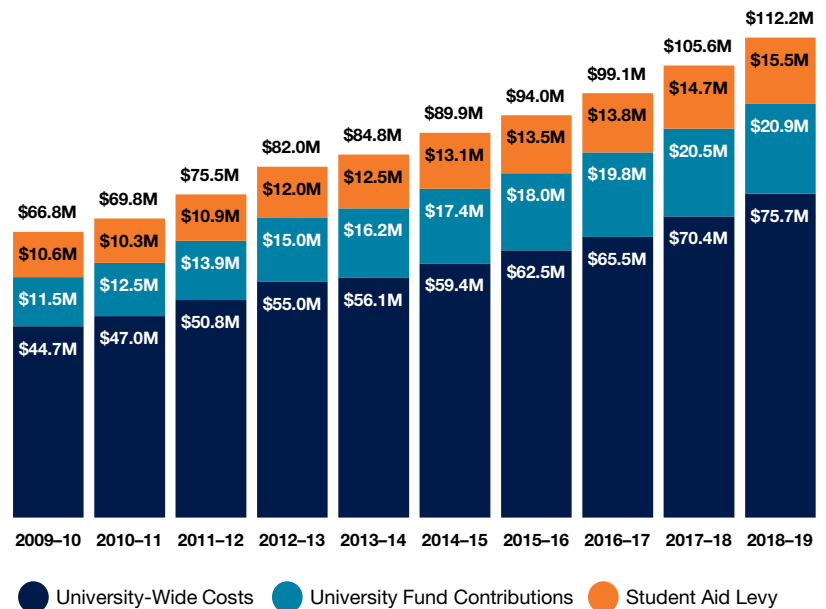


Figure 11.2 Total Central Costs, 2009–2010 to 2018–2019



Data in this chapter are presented by fiscal year (May to April).

The rise in our student aid levy is part of our commitment to providing need-based assistance to all students. U of T's Student Access Guarantee makes this goal clear: "No student offered admission to a program at the University of Toronto should be unable to enter or complete the program due to lack of financial means." Student aid ensures we continue to attract the very best students regardless of their financial situations, and includes centrally administered awards, such as the Pearson Scholarships, as well as internal Faculty awards, such as the International Scholar Awards.

University-wide costs include caretaking, utilities, central human resources, student services, information technology, central library, advancement and research services.

Key spending initiatives included:

- Increased funding toward reducing deferred maintenance
- Upgrades and revitalization of classrooms
- Electronic acquisitions for our libraries
- Additional support for inventions and commercialization
- Development of a new student information system
- Improved on-campus Wi-Fi connectivity
- Completing the Boundless fundraising campaign

Figure 11.3 Budget Data, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Unrestricted Revenue | \$114,602,697 | \$124,966,518 | \$138,597,605 | \$149,615,656 | \$162,048,175 | \$174,819,446 | \$186,298,686 | \$198,246,669 | \$205,332,615 | \$209,797,947 |
| Restricted Revenue | \$18,969,092 | \$20,009,763 | \$20,483,566 | \$20,726,973 | \$21,737,177 | \$22,751,425 | \$23,766,755 | \$24,525,299 | \$28,686,839 | \$28,225,383 |
| Total Revenue | \$133,571,789 | \$144,976,282 | \$159,081,170 | \$170,342,629 | \$183,785,352 | \$197,570,871 | \$210,065,441 | \$222,771,967 | \$234,019,454 | \$238,023,330 |
| Inter-Divisional Teaching Revenue Transfer | | | | | | | \$6,042,335 | \$5,084,764 | \$5,028,443 | \$5,174,097 |
| University-Wide Costs | \$44,693,620 | \$47,027,056 | \$50,817,454 | \$55,028,273 | \$56,089,556 | \$59,390,462 | \$62,461,112 | \$65,553,462 | \$70,384,637 | \$75,690,514 |
| University Fund Contributions | \$11,460,270 | \$12,496,652 | \$13,859,760 | \$14,961,566 | \$16,167,220 | \$17,443,377 | \$17,985,353 | \$19,787,234 | \$20,496,107 | \$20,943,690 |
| Student Aid Levy | \$10,614,513 | \$10,313,864 | \$10,859,371 | \$11,995,084 | \$12,539,417 | \$13,093,888 | \$13,541,938 | \$13,793,571 | \$14,716,594 | \$15,542,692 |
| Total Central Costs | \$66,768,403 | \$69,837,572 | \$75,536,585 | \$81,984,923 | \$84,796,193 | \$89,927,727 | \$93,988,403 | \$99,134,267 | \$105,597,337 | \$112,176,896 |
| Net Revenue | \$66,803,386 | \$75,138,710 | \$83,544,584 | \$88,357,706 | \$98,989,159 | \$107,643,144 | \$110,034,703 | \$118,552,936 | \$123,393,674 | \$120,672,337 |

Budget Overview

Our revenue sources, attributed central costs and budget breakdown for 2018–2019 are shown in Figures 11.4, 11.5 and 11.6, respectively. Net revenues are down by 2.2% year-over-year, driven primarily by the year-over-year increase in our share of University-wide costs. The provincial grant per domestic student has not increased in a number of years, and a more selective admissions process coupled with lower overall undergraduate student enrolment targets have effectively offset the impact of tuition increases.

Major strategic initiatives pursued over the last several years include the Myhal Centre for Engineering Innovation & Entrepreneurship construction and matching for the Lab Innovation for Toronto (LIFT) project, which upgraded infrastructure in several facilities across the Faculty.

Prudent budgeting and fiscal management across the Faculty have allowed us to grow our reserves and invest in upgrades to existing classrooms and laboratories, the Dean's Strategic Fund (DSF) and the Dean's Infrastructure Improvement Fund (DIIF) initiatives.

We still maintain an internal loan of \$4.0 million with the University, which was used to aid their purchase of the neighbouring Centre for Addiction and Mental Health (CAMH) facility, an investment that will benefit future generations of faculty and students.

Figure 11.4 Revenue Sources, 2018–2019

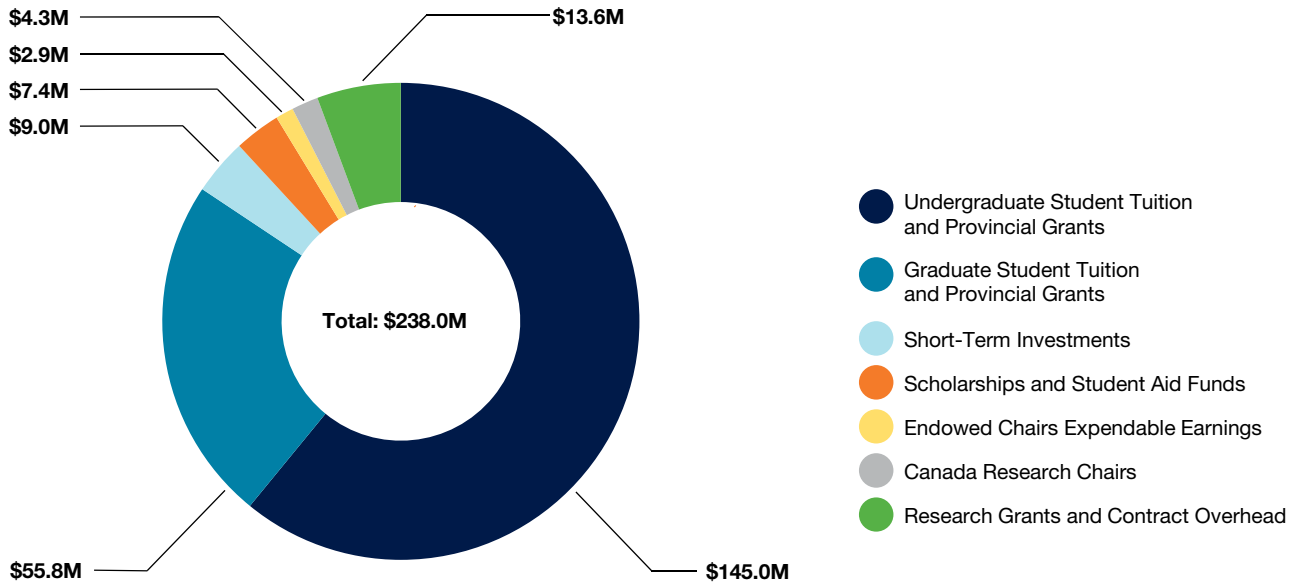


Figure 11.5 Revenue Distribution, 2018–2019

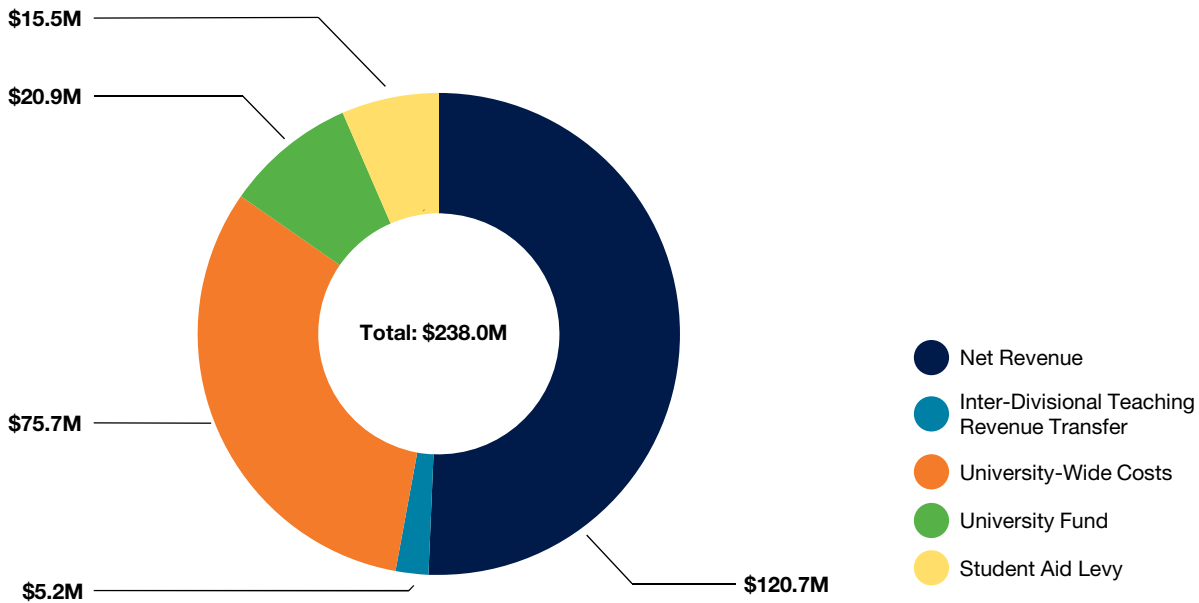
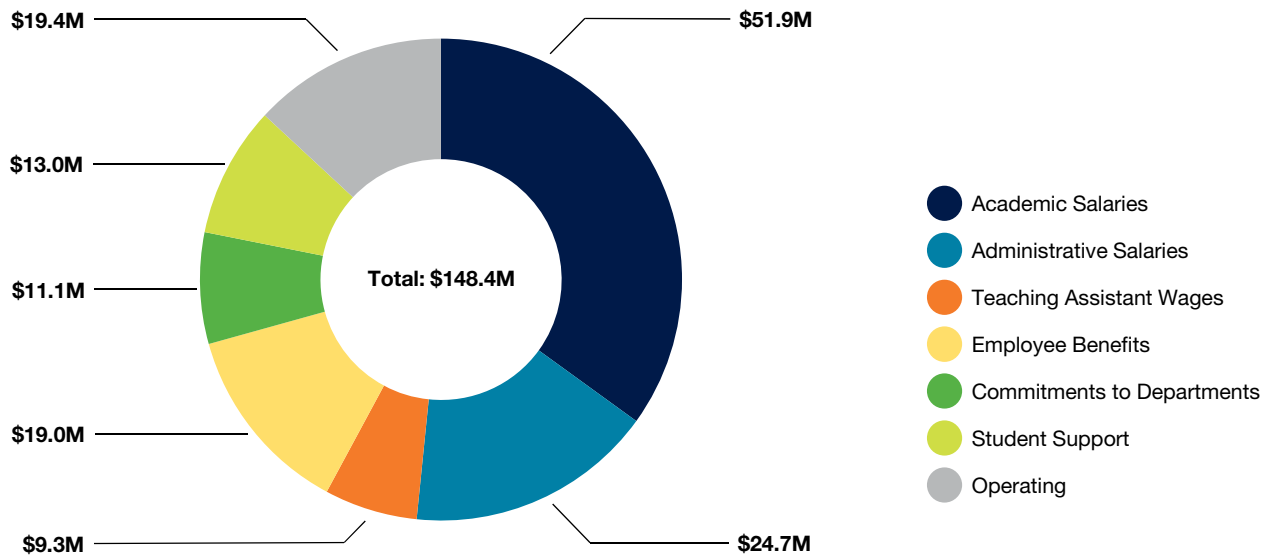


Figure 11.6 Total Operating Budget: Breakdown by Expense, 2018–2019 (net of central university costs)



Dean’s Strategic Fund

The Dean’s Strategic Fund (DSF) was created in 2010 to provide seed funding for projects and initiatives with broad impact within the Faculty. Over the past nine years, we have supported more than 130 projects with a collective total funding of more than \$47 million.

In 2018–2019, we received a large number of submissions. Both the number of projects and the amount of funding were our highest single-year totals to date, at 34 projects and \$11.4 million, respectively. Shown in Figure 11.7 below, the projects cover a wide range of areas, from the revitalization of machine shops for student clubs and teams to new laboratory equipment and research facilities.

Figure 11.7 Dean’s Strategic Fund Projects, 2018–2019

| Project | Primary Unit |
|---|--------------------------|
| The Engineering Entrepreneurship Hatchery - Forming Student, Faculty and Alumni Entrepreneurs | Faculty Level |
| Machine Shop Access for All Engineering Students | MIE |
| LEAP: UofT Engineering Outreach in Labrador | MSE |
| Engineering Campus Experience Officer (CEO) Pilot Program | Vice-Dean, Undergraduate |
| U of T Engineering Leadership to Inspire Further Education (U of T Eng LIFE) | Engineering Outreach |
| Lassonde Institute: Global Mining Initiatives | CivMin, MSE |
| Unleashing the Power of Student-Data Analytics: A Pilot Project to Track and Assess Student Experience and Competency Development | ISTEP |
| Research and project execution skills for graduate research students | ChemE |
| Development of Online MEng Courses in Mineral Engineering | CivMin |

| Project | Primary Unit |
|---|--------------------------------------|
| Smart Freight Centre (SFC): A Centre of Excellence in Goods Movement | CivMin |
| WB25/125 Fumehood Exhaust Ventilation | ChemE |
| Blue Sky Solar Workshop Renovation (EA104) | ECE |
| Special Opportunity on Micro-Electrical Mechanical Systems (MEMS) Fabrication Equipment Acquisition for The Toronto Nanofabrication Centre (TNFC) | ECE |
| Supporting effective provisioning of social services with the Social Needs Marketplace | MIE |
| Urban Water, Waste and Energy Solutions: A Global Research Alliance with National University of Singapore | Faculty Level |
| Establishment of “Low Carbon Renewable Materials Centre” at the Faculty of Applied Science and Engineering | ChemE, MIE |
| Campus Magnetic Resonance Imaging Facility (CMRIF) | IBBME |
| Centre for Urban Mining Innovations | ChemE |
| Understanding the Experiences of Female Engineering Students: From Recruitment to Retention, Influence & Belonging | Troost ILead |
| Sustainable Peri-Urbanization (SPUr) Initiative | CGEN |
| Towards U of T Centre on 2D Materials, with Application to Infrastructure, Aerospace, Transportation, and Energy Technologies | MIE |
| Cross-department pre-tenure faculty retreat | ChemE |
| Towards Quieter Green Aviation Technology | UTIAS |
| BioZone: Enhancing Partnerships, Impact, and Training | BioZone |
| Infrastructure for Genomic Engineering Research | IBBME |
| Additive Manufacturing Work Cell | MIE |
| Enabling Multi-Disciplinary Electric Vehicle Research on the St. George Campus: Tackling EV Accessibility in Engineering Annex | ECE |
| A Centre of Excellence for Anaerobic Digestion | ChemE |
| Seeking to understand and evaluate to what extent we teach, or should teach, “Integrated Risk Management” in engineering education | CivMin |
| From the Macro to the Micro: Leveraging Macroscale Robotics Algorithms for Microscale Systems | UTIAS |
| Enhancing FASE Engineering Education Scholarship and Research Activity | ISTEP |
| CEM (Clean Energy Materials - Toronto-Mexico) | ChemE |
| The Centre for Quantum Information and Quantum Control | ECE |
| WSeed: Strengthening cohesion and impact through cross-departmental collaboration | Institute for Water Innovation (IWI) |

In addition to these, many other projects supported by past commitments through the DSF continue to operate. One of these is XSeed, which stimulates and expands opportunities for research collaboration between U of T Engineering and other divisions of the University of Toronto, including UTM, UTSC, OISE and the Faculties of Arts & Science and Kinesiology & Physical Education. *(For more information on XSeed and the related EMHSeed program, see Chapter 3 – Research under “Catalyzing Multidisciplinary Collaboration”)*

Infrastructure and Facilities

Our Engineering Precinct encompasses 19 buildings across U of T's St. George campus and north of the campus at Downsview, from modern structures such as the Myhal Centre for Engineering Innovation & Entrepreneurship, to buildings of historical significance such as the Sandford Fleming Building and Lassonde Mining Building, both of which date back more than a century. (*Appendix I provides a map of the Engineering Precinct.*) Each of these contain unique research and educational spaces that are critical to our position as the top-ranked engineering school in Canada and among the best in the world.

Figure 11.8 Summary of Buildings and Areas Occupied by the Faculty of Applied Science & Engineering, 2018–2019

| Code | Building | Office of the Dean | EngSci | UTIAS | ChemE | CivE & MinE | ECE | IBBME | MIE | MSE | Total NASMs |
|---|------------------------|--------------------|------------|--------------|--------------|--------------|---------------|--------------|---------------|--------------|---------------|
| AS | Aerospace (Downsview) | | | 5,293 | | | | | | | 5,293 |
| BA | Bahen Centre | 1,351 | 561 | | 67 | | 5,744 | | 1,388 | | 9,111 |
| DC | Donnelly CCBR | | | | 667 | | | 889 | | | 1,556 |
| ES | Earth Sciences | | | | 164 | | | | | | 164 |
| EA | Engineering Annex | 328 | | | | | 936 | | | | 1,264 |
| EL | Electrometal | | | | | | | | | 149 | 149 |
| FI | Fields Institute | 325 | | | | | | | | | 325 |
| GB | Galbraith | 1,667 | | | | 5,042 | 4,143 | | | | 10,852 |
| HA | Haultain | | | | 198 | 110 | | | 646 | 721 | 1,675 |
| | MaRS West Tower | | | | | | 136 | 791 | 183 | | 1,110 |
| MB | Lassonde Mining | | | | | 1,205 | | 1,362 | 1,891 | 831 | 5,289 |
| MC | Mechanical Engineering | 63 | | | | | | | 5,398 | | 5,461 |
| MY | Myhal Centre | 4,860 | | | | | | | | | 4,860 |
| PT | D.L. Pratt | | | | | | 1,327 | | | 1,488 | 2,815 |
| RS | Rosebrugh | | | | | | | 818 | 2,096 | | 2,914 |
| SF | Sandford Fleming | 766 | | 692 | | 1,558 | 3,547 | | | | 6,563 |
| WB | Wallberg | 375 | | | 8,275 | | 130 | | | 1,381 | 10,161 |
| RM | 256 McCaul | 528 | | | | | | | | | 528 |
| | 704 Spadina | 240 | | | | | | | | | 240 |
| | Total Area | 10,503 | 561 | 5,985 | 9,371 | 7,915 | 15,963 | 3,860 | 11,602 | 4,570 | 70,330 |
| 70,330 NASMs (Net Assignable Square Metre) | | | | | | | | | | | |

Current Projects



Myhal Centre for Engineering Innovation & Entrepreneurship

The Faculty's newest building lies at the heart of our vibrant community. We hosted the official opening of the Myhal Centre in April 2018, with dedication ceremonies for the named spaces within the building taking place throughout the summer and fall of 2018. In September 2018, the MY Open House event enabled faculty, staff, students, alumni and friends to engage with the state-of-the-art facilities and learning spaces, as well as its multidisciplinary institutes and centres. In May 2019, U of T Engineering participated in two city-wide events that invited the general public to explore the Myhal Centre: the month-long Scotiabank CONTACT Photography Festival and Doors Open Toronto on May 25 and 26. Both events welcomed visitors to learn about our Faculty's rich history and how we are shaping the future through innovations in engineering research and education. *(For more information on these initiatives, see Chapter 8 – Communications.)*

All occupants — including staff in Engineering Advancement, the Troost Institute for Leadership Education in Engineering, the University of Toronto Institute for Multidisciplinary Design & Innovation and many other centres and institutes — are fully established in their new spaces. Classes have been taking place in the building since September 2018, and the Fabrication Facility on Level 4 is now fully staffed and operational Monday through Friday, as well as on Sundays. The Myhal Centre is being well used by students, faculty, staff, alumni and external partners, with many events being held in the public spaces along with visits by other universities.

Wallberg Building Rooftop Expansion for the Sustainability Lab

This ChemE project will create a multidisciplinary lab focusing on energy capture, storage, conversion and integration on the roof of the Wallberg Building. We have retained the services of an architect and the detailed design is under review. We are currently focusing on securing full funding, with a target start date set for the end of 2019 and completion in 2020.

Galbraith Building West Side Landscaping

We are renewing and improving this public space amenity and community-building area along the west side of the Galbraith Building, facing St. George Street. Included within the scope of this project is the refurbishment and repositioning of "Becca's H," a sculpture by Robert Murray celebrating the Faculty's 1973 centennial. The project will also improve accessibility into the Galbraith Building's lobby from the street. The project is expected to be complete by September 2019.

Galbraith Building All-gender Washroom Conversion & Renovations

To enhance inclusivity, we are converting two washrooms on the first floor of the Galbraith Building into one large, modern and accessible all-gender, multi-stall washroom. An architect has been retained to begin the design for this project, which will require coordination with other capital projects being undertaken this year in and around the Galbraith Building. Construction is expected to begin in May 2020.

New Bunkhouse at Gull Lake Survey Camp

We are repairing, renovating and expanding the site of Civil and Mineral Practicals (CAMP) on Gull Lake, which will celebrate its centenary in 2020. The project includes the construction of a new bunkhouse and a washroom and shower facility, along with common space for undergraduate students. An architect has been retained and schematic design revisions are underway. Construction is expected to be complete for use in the summer of 2021.

Transformation of the Engineering & Computer Science Library Spaces

For several years, we have been engaged in a transformation of our library space on the second floor of the Sandford Fleming Building to enhance innovative learning activities. In 2016 we created space for more individual study carrels and enhanced the overhead lighting in the main area. Going forward, the library's two floors will be renovated, with the mezzanines removed and upgrades to HVAC, electrical facilities and audiovisual equipment. An architect has been selected and the master plan has been completed, with construction anticipated to start in December 2019. This project is supported jointly by U of T Engineering, the University of Toronto Libraries and U of T Facilities & Services.

Mechanical Engineering Building Lobby Renovations

To improve the student experience, we have renovated the lobby of the Mechanical Engineering Building, making it larger and improving access to the auditorium. The project included enhanced accessibility features as well as new flooring, lighting and seating. The project was substantively completed in the fall of 2018, and the installation of the remaining component, an outdoor snow and ice melt system, began in spring 2019 and is expected to be complete by the summer.

Gas Turbine Combustion Research Lab at the University of Toronto Institute for Aerospace Studies

In 2014, we began construction of this unique facility at UTIAS, which uses lasers and a pressurized combustion chamber to enable advanced analysis of the gases and fuels used in aircrafts and power generation plants. This research informs the design of next-generation turbines that could

improve efficiency or be adapted to run on renewable fuels, all without compromising performance or safety. The construction of this multi-year project is expected to be complete this summer.

Laboratory Upgrades to Wallberg 232

This facility is supported by a Canada Foundation for Innovation grant received by Professor Nikolai DeMartini (ChemE). The exhaust ventilation improvements will enable further expansion of his research into recovery of "black liquor" waste products from pulp and paper plant processes, thereby enhancing their efficiency. Construction began in April 2019 and is expected to be complete this summer.

Laboratory Redevelopment – Rosebrugh Building

The Institute of Biomaterials & Biomedical Engineering is embarking on a program to redesign the lab and office spaces in the Lassonde Mining Building and the Rosebrugh Building. The first group of spaces to be redeveloped are RS422, RS404, and RS420; with the University's Design & Engineering staff completing the schematic design of the latter two in anticipation of their construction being complete for the summer of 2020. Concurrently, the Department of Mechanical & Industrial Engineering is also undertaking the renovation of RS104A with the schematic now nearing completion.



Faculty of Applied Science & Engineering Academic Area Terms

| | |
|----------------------|--|
| Academic Area | For the purpose of this annual report, Academic Area refers to the following departments, divisions and institutes: UTIAS, IBBME, ChemE, CivMin, ECE, EngSci, MIE and MSE. While TrackOne is not an academic unit, it is also included as an academic area in specific contexts in Chapter 1: Undergraduate Studies. |
| ChemE | Department of Chemical Engineering & Applied Chemistry Graduates who studied the discipline of Chemical Engineering are also designated as ChemE. |
| CivE | Graduates who studied the discipline of Civil Engineering from the Department of Civil & Mineral Engineering (CivMin) |
| CivMin | Department of Civil & Mineral Engineering |
| CompE | Graduates of The Edward S. Rogers Sr. Department of Electrical & Computer Engineering (ECE) who studied the discipline of Computer Engineering. |
| ElecE | Graduates of The Edward S. Rogers Sr. Department of Electrical & Computer Engineering (ECE) who studied the discipline of Electrical Engineering. |
| ECE | The Edward S. Rogers Sr. Department of Electrical & Computer Engineering Graduates of Electrical Engineering are designated as ElecE; graduates of Computer Engineering are designated as CompE. |
| EngSci | Division of Engineering Science Graduates of this Division are also designated as EngSci. |
| IBBME | Institute of Biomaterials & Biomedical Engineering Graduates who studied the discipline of Biomedical Engineering are referred to as BioMedE. |
| IndE | Graduates of the Department of Mechanical & Industrial Engineering (MIE) who studied the discipline of Industrial Engineering. |
| MechE | Graduates of the Department of Mechanical & Industrial Engineering (MIE) who studied the discipline of Mechanical Engineering. |
| MIE | Department of Mechanical & Industrial Engineering Graduates of Mechanical Engineering are designated as MechE; graduates of Industrial Engineering are designated as IndE. |
| MinE | Graduates from the Department of Civil & Mineral Engineering (CivMin) who studied the discipline of Mineral Engineering. |
| MSE | Department of Materials Science & Engineering Graduates who studied the discipline of Materials Engineering are also designated as MSE. |
| TrackOne | Undeclared first-year undergraduate studies in Engineering. Upon successful completion of TrackOne, students choose from one of the Engineering undergraduate programs, excluding Engineering Science. |
| UTIAS | University of Toronto Institute for Aerospace Studies Graduates who studied the discipline of Aerospace Engineering within this Institute are designated as AeroE. |

Additional Terms

| | | | |
|----------------------------|---|----------------------|---|
| AAAS | American Association for the Advancement of Science | ELITE | Entrepreneurship, Leadership, Innovation & Technology in Engineering |
| AAU | Thomson Reuters Association of American Universities | Endowed Chair | Fixed-term chairs created through donor support |
| ARWU | Academic Ranking of World Universities | EngEd | Engineering Education, graduate-level programs |
| ASEE | American Society for Engineering Education | ESIP | Engineering Summer Internship Program |
| BASc | Bachelor of Applied Science | ESOO | Engineering Student Outreach Office |
| BizSkule | Alumni speaker series | ESROP | Engineering Science Research Opportunities Program |
| CCR | Co-Curricular Record | FTE | Full-time equivalent |
| CFI | Canada Foundation for Innovation | GEARS | Guided Engineering Academic Review Sessions |
| CGEN | Centre for Global Engineering | GECoS | Graduate Engineering Council of Students |
| CHE | Centre for Healthcare Engineering | GLEE | Girls' Leadership in Engineering Experience |
| CHRP | Collaborative Health Research Projects | Gratitude | Fundraising campaign for students |
| CIE | Centre for International Experience | GTA | Greater Toronto Area |
| CIHR | Canadian Institutes of Health Research | H-index | A measurement of both the productivity and impact of published work based on citations |
| CONNECT | U of T Engineering's online community for alumni, staff, faculty and students | HC | Headcount, or number of degree-seeking students |
| CRC | Canada Research Chair; the Canadian government invests \$300M per year in Tier 1 renewable chairs held for seven years and Tier 2 chairs held for five years and renewable once | HRIS | Human Resources Information System |
| CREATE | NSERC Collaborative Research and Training Experience program | IEEE | Institute of Electrical and Electronics Engineers |
| DEEP Summer Academy | Da Vinci Engineering Enrichment Program Summer Academy | IRC | Industrial Research Chair; funded jointly by NSERC and industry to enable universities to build on existing strengths or develop research capacity in areas of interest to industry |
| DIIF | Dean's Infrastructure Improvement Fund | ISE | Institute for Sustainable Energy |
| DSF | Dean's Strategic Fund | ISTEP | Institute for Studies in Transdisciplinary Engineering Education and Practice |
| Eagles' Longhouse | The name of the Faculty's Engineering Indigenous Initiatives Steering Committee | IWI | Institute for Water Innovation |
| ECN | Engineering Communications Network | LIFT | Lab Innovation for Toronto |
| ECP | Engineering Communication Program | MASc | Master of Applied Science |
| EDU | Extra-Departmental Unit | MCP | Multidisciplinary Capstone Projects |
| EEDIAG | Engineering Equity, Diversity and Inclusion Action Group | MEng | Master of Engineering |
| EIIP | Engineering Instructional Innovation Program | | |

| | | | |
|------------------|---|---------------------------------------|--|
| MEngCEM | MEng in Cities Engineering & Management | STEM | Science, Technology, Engineering and Mathematics |
| MHSc | Master of Health Science (Clinical Engineering) | SwB | Science without Borders |
| MY | Myhal Centre for Engineering Innovation & Entrepreneurship | TBEP | Translational Biology and Engineering Program |
| NASM | Net Assignable Square Metre | TEAL | Technology Enhanced Active Learning |
| NCE | Networks of Centres of Excellence | THE | Times Higher Education–Thomson Reuters World University Ranking |
| NCDEAS | National Council of Deans of Engineering and Applied Science | TIAM | Toronto Institute for Advanced Manufacturing |
| NSBE | National Society of Black Engineers | T-Program | Transition Program |
| NSERC | Natural Sciences and Engineering Research Council of Canada | TRCHR | Ted Rogers Centre for Heart Research |
| NTU | National Taiwan University | Tri-Agency | Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC) and Social Sciences and Humanities Research Council (SSHRC) |
| OGS | Ontario Graduate Scholarship | Troost ILead | Troost Institute for Leadership Education in Engineering |
| OISE | Ontario Institute for Studies in Education | U15 | Group of 15 leading, research-intensive universities in Canada, including: University of Alberta, University of British Columbia, University of Calgary, Dalhousie University, Université Laval, University of Manitoba, McGill University, McMaster University, Université de Montréal, University of Ottawa, Queen's University, University of Saskatchewan, University of Toronto, University of Waterloo, Western University |
| OPTIONS | Opportunities for PhDs: Transitions, Industry Options, Networking and Skills | UnERD | Undergraduate Engineering Research Day |
| ORF | Ontario Research Fund | University Professor | The highest possible rank at U of T, awarded to a maximum of 2% of tenured faculty |
| OSAP | Ontario Student Assistance Program | UT-IMDI | University of Toronto Institute for Multidisciplinary Design & Innovation |
| OVPRI | Office of the Vice President, Research & Innovation | UTAPS | University of Toronto Advanced Planning for Students |
| PASS | Peer-Assisted Study Sessions | U of T Distinguished Professor | Designed to advance and recognize faculty with highly distinguished accomplishments. This chair is limited to no more than 3% of tenured faculty |
| PEY Co-op | Professional Experience Year Co-op Program | UTTRI | University of Toronto Transportation Research Institute |
| PhD | Doctor of Philosophy | WISE | Women in Science & Engineering |
| PPIT | Prospective Professors in Training Program | YWIES | Young Women in Engineering Symposium |
| PyschEng | Cross-Faculty Collaborative Master's Specialization in Psychology and Engineering | | |
| QS | QS World University Rankings | | |
| ROSI | Repository of Student Information | | |
| RIS | Research Information System | | |
| RTI | Research Tools and Instruments Grants Program (NSERC) | | |
| SGS | University of Toronto School of Graduate Studies | | |
| Skule™ | Refers to the U of T Engineering community | | |
| SSHRC | Social Sciences and Humanities Research Council | | |

Appendices

Appendix A: Outreach Programs

Between July 2018 and June 2019, we offered the following pre-university outreach programs, reaching more than 7,600 students from across Ontario, Canada and the world.

| Program | Date | Total # of Participants | Female | Male | Other or Gender Not Disclosed | Audience |
|--|--------------------------------|-------------------------|--------------|--------------|-------------------------------|-------------|
| SUMMER | | | | | | |
| DEEP Spring Seminar Series | June 17 - June 30, 2018 | 7 | 0 | 5 | 2 | Grades 9-12 |
| Jr. DEEP Math Camp | July 3-6, 2018 | 61 | 21 | 40 | 0 | Grades 3-8 |
| LAUNCH at Dundas Jr. PS & John Polanyi | July 3-27, 2018 | 223 | 82 | 62 | 79 | Grades 2-8 |
| DEEP Summer Academy | July 4 - August 4, 2018 | 984 | 77 | 161 | 746 | Grades 9-12 |
| Girls' Jr. DEEP | July 9-13, 2018 | 63 | 63 | 0 | 0 | Grades 3-8 |
| ENGage | July 9-13, 2018 | 61 | 25 | 36 | 0 | Grades 3-8 |
| DEEP Leadership Camp | July 14 - July 28, 2018 | 28 | 3 | 5 | 20 | Grades 9-12 |
| Jr. DEEP | July 16 - August 17, 2018 | 611 | 228 | 383 | 0 | Grades 3-8 |
| Jr. DEEP Coding | July 16 - August 24, 2018 | 229 | 68 | 161 | 0 | Grades 3-8 |
| 3-Day Leadership Retreat | July 30 - August 1, 2018 | 21 | 21 | 0 | 0 | Grades 7-9 |
| University of Toronto Engineering Academy (UTEA) | August 6-17, 2018 | 84 | 21 | 18 | 45 | Grades 9-12 |
| FALL | | | | | | |
| Go ENG Girl | October 13, 2018 | 63 | 63 | 0 | 0 | Grades 7-9 |
| Girls' Jr. DEEP Saturdays (Fall) | October 27 - November 10, 2018 | 65 | 65 | 0 | 0 | Grades 3-8 |
| Jr. DEEP Saturdays (Fall) | November 17 - December 1, 2018 | 72 | 23 | 49 | 0 | Grades 3-8 |
| High School Saturdays (Fall) | October 27 - December 1, 2018 | 152 | 27 | 44 | 81 | Grades 9-12 |
| WINTER | | | | | | |
| Girls' Jr. DEEP Saturdays (Winter) | January 19 - February 2, 2019 | 50 | 50 | 0 | 0 | Grades 3-8 |
| Jr. DEEP Saturdays (Winter) | February 9 - March 2, 2019 | 70 | 14 | 56 | 0 | Grades 3-8 |
| High School Saturdays Winter | January 19 - March 2, 2019 | 85 | 11 | 21 | 53 | Grades 9-12 |
| LAUNCH Girls' Saturday Program | February 9 - March 2, 2019 | 24 | 24 | 0 | 0 | Grades 3-5 |
| SPRING | | | | | | |
| In-School and On-Campus Workshops | May 8 - June 28, 2019 | 3,664 | 1,832 | 1,832 | 0 | Grades 3-8 |
| Go North | May 10, 2019 | 939 | 468 | 471 | 0 | Grades 3-8 |
| TD Girls' Digital Literacy | May 29, 2019 | 109 | 109 | 0 | 0 | Grades 3-10 |
| Skule™ Kids | June 1, 2019 | 30 | 15 | 15 | 0 | Grades 3-8 |
| Total | | 7,695 | 3,310 | 3,359 | 1,026 | |

Appendix B: Time to Completion for Graduate Students

The following figures indicate the median time to completion for graduating cohorts in each master's and doctoral degree program by academic area for the past decade. Time to graduation represents the length of time between a student's initial enrolment in a graduate program and meeting all the requirements for graduation. The data only includes terms in which a student is registered, excluding leaves, lapses and (in most cases) the term in which convocation occurs. Where a student is fast-tracked from the MASc into a PhD, the total time for both programs is counted. Distinguishing full-time, extended full-time and part-time MEng students provides greater clarity.

Figure B.1 **University of Toronto Institute for Aerospace Studies**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 6.0 | 7.0 | 4.7 | 5.3 | 5.3 | 5.7 | 6.3 | 5.3 | 5.0 | 5.8 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.2 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| MEng (FT) | 1.2 | 1.3 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| MEng (PT) | 1.8 | | | 1.7 | 1.3 | 2.0 | 2.3 | 3.0 | 3.0 | |

Figure B.2 **Institute of Biomaterials & Biomedical Engineering**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 4.3 | 6.0 | 5.7 | 5.0 | 5.0 | 6.0 | 5.7 | 5.2 | 5.3 | 5.5 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.3 | 2.0 | 2.0 | 2.3 | 2.0 |
| MEng (FT) | | | | | | | | | 1.0 | 1.0 |
| MEng (PT) | | | | | | | | | | 1.3 |
| MHSc (FT) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

Figure B.3 **Department of Chemical Engineering & Applied Chemistry**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 5.3 | 6.0 | 5.3 | 5.2 | 5.5 | 5.7 | 5.7 | 5.5 | 5.8 | 5.5 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.3 | 2.0 | 2.0 | 2.0 |
| MEng (FT) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.5 | 1.7 | 1.7 | 1.7 | 1.7 |
| MEng (PT) | 2.2 | 1.8 | 1.3 | 2.0 | 2.0 | 1.8 | 1.5 | 2.0 | 1.7 | 1.7 |

Figure B.4 **Department of Civil & Mineral Engineering**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|-------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 5.0 | 5.3 | 5.3 | 5.3 | 5.0 | 5.3 | 5.3 | 5.7 | 5.0 | 5.2 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| MEng (FT) | 1.0 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.3 | 1.7 | 1.3 | 1.3 | 1.3 |
| MEng (PT) | 2.0 | 2.3 | 1.8 | 2.0 | 2.0 | 1.7 | 2.0 | 2.2 | 2.0 | 1.7 |
| MEngCEM (FT) | | | | | | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| MEngCEM (Ext FT) | | | | | | | | | 1.3 | 1.5 |

Figure B.5 **The Edward S. Rogers Sr. Department of Electrical & Computer Engineering**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 4.7 | 5.0 | 5.2 | 5.5 | 5.3 | 5.0 | 5.0 | 5.3 | 5.0 | 5.3 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.3 | 2.0 | 2.0 | 2.3 | 2.3 |
| MEng (FT) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.3 | 1.3 | 1.3 | 1.7 | 1.3 |
| MEng (PT) | 3.0 | 2.7 | 2.0 | 2.2 | 2.0 | 2.0 | 2.0 | 2.3 | 2.7 | 2.3 |

Figure B.6 **Department of Mechanical & Industrial Engineering**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 4.0 | 4.7 | 5.0 | 5.7 | 5.0 | 4.8 | 5.0 | 4.7 | 5.0 | 4.7 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| MEng (FT) | 1.3 | 1.0 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| MEng (PT) | 2.3 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1.7 | 2.3 | 2.0 | 1.7 |
| MEngDM (PT) | 2.7 | 2.3 | 2.7 | 2.5 | 2.7 | 2.3 | 3.5 | 2.8 | 3.0 | |

Figure B.7 **Department of Materials Science & Engineering**
Time to Completion for Graduate Students, 2009–2010 to 2018–2019

| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PhD | 5.3 | 6.0 | 6.3 | 5.7 | 4.7 | 5.3 | 5.5 | 5.8 | 5.3 | 5.3 |
| MASc | 2.0 | 2.0 | 2.0 | 2.0 | 2.3 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| MEng (FT) | 1.7 | | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MEng (Ext FT) | | | | | | 1.3 | 1.7 | 1.7 | 1.7 | 1.7 |
| MEng (PT) | 2.0 | 2.3 | 2.3 | 2.0 | 2.7 | 2.8 | | | | 2.0 |

Note: Based on Ontario Council of Graduate Studies (OCGS) data from ROSI. Data reflects median values based on the total number of terms in which a student is registered.

Appendix C: Chairs and Professorships

Our Faculty is home to 120 chairs and professorships, held by 109 individual chairholders. The following list reflects several types of chairs and professorships, including: Canada Research Chairs; Endowed Chairs; Industrial Research Chairs; U of T Distinguished Professors; University Professors; Dean's Catalyst Professors; Dean's Emerging Innovation in Teaching Professors; and Dean's Spark Professors.

Figure C.1 Research Chairs, 2018–2019

| Title | Chairholder | Sponsor | Tier | Dept. |
|--|----------------------------|---------|--------|---------------|
| Alumni Chair in Bioengineering | Cristina Amon | Endowed | | MIE |
| Bahen/Tanenbaum Chair in Civil Engineering | Jeffrey Packer | Endowed | | CivMin |
| Bahen/Tanenbaum Chair in Civil Engineering | Michael Collins | Endowed | | CivMin |
| Bell Canada Chair in Multimedia | Kostas Plataniotis | Endowed | | ECE |
| Bell Canada Chair in Software Engineering | Michael Stumm | Endowed | | ECE |
| Bell University Labs Chair in Computer Engineering | Baochun Li | Endowed | | ECE |
| Canada Research Chair in Advanced Catalysis for Sustainable Chemistry | Cathy Chin | NSERC | Tier 2 | ChemE |
| Canada Research Chair in Anaerobic Biotechnology | Elizabeth Edwards | NSERC | Tier 1 | ChemE |
| Canada Research Chair in Cellular Hybrid Materials | Glenn Hibbard | NSERC | Tier 2 | MSE |
| Canada Research Chair in Collaborative Robotics | Jonathan Kelly | NSERC | Tier 2 | UTIAS |
| Canada Research Chair in Computational Modelling and Design Optimization Under Uncertainty | Prasanth Nair | NSERC | Tier 2 | UTIAS |
| Canada Research Chair in Computer Architecture | Natalie Enright Jerger | NSERC | Tier 2 | ECE |
| Canada Research Chair in Diffusion-Wave Sciences and Technologies | Andreas Mandelis | NSERC | Tier 1 | MIE |
| Canada Research Chair in Endogenous Repair | Penney Gilbert | NSERC | Tier 2 | IBBME |
| Canada Research Chair in Engineered Soft Materials and Interfaces | Arun Ramchandran | NSERC | Tier 2 | MIE |
| Canada Research Chair in Environmental Engineering and Stable Isotopes | Elodie Passeport | NSERC | Tier 2 | ChemE, CivMin |
| Canada Research Chair in Freight Transportation and Logistics | Matthew Roorda | NSERC | Tier 2 | CivMin |
| Canada Research Chair in Functional Cardiovascular Tissue Engineering | Milica Radisic | NSERC | Tier 2 | IBBME, ChemE |
| Canada Research Chair in Human Factors and Transportation | Birsen Donmez | NSERC | Tier 2 | MIE |
| Canada Research Chair in Information Processing and Machine Learning | Brendan Frey | NSERC | Tier 1 | ECE |
| Canada Research Chair in Information Theory and Wireless Communications | Wei Yu | NSERC | Tier 1 | ECE |
| Canada Research Chair in Machine Learning for Robotics and Control | Angela Schoellig | NSERC | Tier 2 | UTIAS |
| Canada Research Chair in Micro and Nano Engineering Systems | Yu Sun | NSERC | Tier 2 | MIE |
| Canada Research Chair in Microfluidics and Energy | David Sinton | NSERC | Tier 1 | MIE |
| Canada Research Chair in Modelling of Electrical Interconnects | Piero Triverio | NSERC | Tier 2 | ECE |
| Canada Research Chair in Nano- and Micro-Structured Electromagnetic Materials and Applications | George Eleftheriades | NSERC | Tier 1 | ECE |
| Canada Research Chair in Nanobioengineering | Warren Chan | NSERC | Tier 1 | IBBME |
| Canada Research Chair in Nanotechnology | Edward Sargent | NSERC | Tier 1 | ECE |
| Canada Research Chair in Network Information Theory | Ashish Khisti | NSERC | Tier 2 | ECE |
| Canada Research Chair in Novel Optimization and Analytics in Health | Timothy Chan | NSERC | Tier 2 | MIE |
| Canada Research Chair in Organic Optoelectronics | Zheng-Hong Lu | NSERC | Tier 1 | MSE |
| Canada Research Chair in Power Electronic Converters | Olivier Trescases | NSERC | Tier 2 | ECE |
| Canada Research Chair in Quantitative Cell Biology and Morphogenesis | Rodrigo Fernandez-Gonzalez | NSERC | Tier 2 | IBBME |
| Canada Research Chair in Robots for Society | Goldie Nejat | NSERC | Tier 2 | MIE |

| Title | Chairholder | Sponsor | Tier | Dept. |
|---|---------------------------|---------|--------|--------------|
| Canada Research Chair in Seismic Resilience of Infrastructure | Constantin Christopoulos | NSERC | Tier 2 | CivMin |
| Canada Research Chair in Thermofluidics for Clean Energy | Aimy Bazylak | NSERC | Tier 2 | MIE |
| Canada Research Chair in Tissue Engineering | Molly Shoichet | NSERC | Tier 1 | ChemE, IBBME |
| Canada Research Chair in Transportation and Air Quality | Marianne Hatzopoulou | NSERC | Tier 2 | CivMin |
| Celestica Chair in Materials for Microelectronics | Doug Perovic | Endowed | | MSE |
| Chair in Information Engineering | Joseph Paradi | Endowed | | MIE |
| Clarice Chalmers Chair of Engineering Design | Greg Jamieson | Endowed | | MIE |
| Claudette MacKay-Lassonde Chair in Mineral Engineering | Lesley Warren | Endowed | | CivMin |
| Dusan and Anne Miklas Chair in Engineering Design | Paul Chow | Endowed | | ECE |
| Dean's Catalyst Professor | Amy Bilton | | | MIE |
| Dean's Catalyst Professor | Arthur Chan | | | ChemE |
| Dean's Catalyst Professor | Kinnor Chattopadhyay | | | MSE |
| Dean's Catalyst Professor | Eric Diller | | | MIE |
| Dean's Catalyst Professor | Jennifer Drake | | | CivMin |
| Dean's Catalyst Professor | Jonathan Kelly | | | UTIAS |
| Dean's Catalyst Professor | Edmond W.K. Young | | | MIE |
| Dean's Emerging Innovation in Teaching Professor | Chris Bouwmeester | | | IBBME |
| Dean's Emerging Innovation in Teaching Professor | Ariel Chan | | | ChemE |
| Dean's Emerging Innovation in Teaching Professor | Jennifer Farmer | | | ChemE |
| Dean's Emerging Innovation in Teaching Professor | Dawn Kilkenny | | | IBBME |
| Dean's Emerging Innovation in Teaching Professor | Elham Marzi | | | ISTEP |
| Dean's Emerging Innovation in Teaching Professor | Patricia Sheridan | | | ISTEP |
| Dean's Emerging Innovation in Teaching Professor | Hamid Timorabadi | | | ECE |
| Dean's Emerging Innovation in Teaching Professor | Chirag Variawa | | | ISTEP |
| Dean's Spark Professor | Fae Azhari | | | CivMin, MIE |
| Dean's Spark Professor | Giselle Azimi | | | ChemE |
| Dean's Spark Professor | Erin Bobicki | | | MSE, ChemE |
| Dean's Spark Professor | Merve Bodur | | | MIE |
| Dean's Spark Professor | Hai-Ling (Margaret) Cheng | | | IBBME, ECE |
| Dean's Spark Professor | Mason Ghafghazi | | | CivMin, MIE |
| Dean's Spark Professor | Alison Olechowski | | | MIE, ISTEP |
| Dean's Spark Professor | Daniel Posen | | | CivMin |
| Dean's Spark Professor | Scott Sanner | | | MIE |
| Dean's Spark Professor | Shoshanna Saxe | | | CivMin |
| Dean's Spark Professor | Marianne Touchie | | | CivMin, MIE |
| Dean's Spark Professor | Yu Zou | | | MSE |
| Decanal Chair in Innovation | Christopher Yip | Endowed | | ChemE, IBBME |
| Edward S. Rogers Sr. Chair in Engineering | Brendan Frey | Endowed | | ECE |
| Erwin Edward Hart Professor in Chemical Engineering and Applied Chemistry | Alison McGuigan | Endowed | | ChemE |
| Erwin Edward Hart Professor in Civil Engineering | Daman Panesar | Endowed | | CivMin |
| Erwin Edward Hart Professor in Materials Science and Engineering | Chandra Veer Singh | Endowed | | MSE |
| Erwin Edward Hart Professor in Mechanical and Industrial Engineering | Tobin Filleter | Endowed | | MIE |
| Eugene V. Polistuk Chair in Electromagnetic Design | Costas Sarris | Endowed | | ECE |
| Frank Dottori Chair in Pulp and Paper Engineering | Honghi Tran | Endowed | | ChemE |
| Gerald R. Heffernan Chair in Materials Processing | Mansoor Barati | Endowed | | MSE |
| J. Armand Bombardier Foundation Chair in Aerospace Flight | Chris Damaren | Endowed | | UTIAS |

| Title | Chairholder | Sponsor | Tier | Dept. |
|---|------------------------|-------------------------|------|--------------|
| L. Lau Chair in Electrical and Computer Engineering | Reza Iravani | Endowed | | ECE |
| Michael E. Charles Chair in Chemical Engineering | Michael Sefton | Endowed | | ChemE, IBBME |
| Nortel Institute Chair in Emerging Technology | J. Stewart Aitchison | Endowed | | ECE |
| Nortel Institute Chair in Network Architecture and Services | Jörg Liebeherr | Endowed | | ECE |
| NSERC Chair in Multidisciplinary Engineering Design | Kamran Behdinan | NSERC | | MIE |
| NSERC Industrial Research Chair in Nanomaterials and Nanomedicine (with Johnson & Johnson Medical Products) | Frank Gu | NSERC | | ChemE |
| NSERC Industrial Research Chair in Source Water Quality Monitoring and Advanced/Emerging Technologies for Drinking Water Treatment | Robert Andrews | NSERC | | CivMin |
| NSERC Industrial Research Chair in Technologies for Drinking Water Treatment | Ron Hofmann | NSERC | | CivMin |
| NSERC Industrial Research Chair in the Role and Fate of Inorganics in the Industrial Processing of Woody Biomass | Nikolai DeMartini | NSERC | | ChemE |
| NSERC/Altera Industrial Research Chair in Programmable Silicon | Vaughn Betz | NSERC/Altera | | ECE |
| NSERC/Cement Association of Canada Industrial Research Chair in Concrete Durability and Sustainability | Doug Hooton | NSERC/CAC | | CivMin |
| NSERC-Energi Simulation Industrial Research Chair and Foundation CMG Industrial Research Chair in Fundamental Petroleum Rock Physics and Rock Mechanics | Giovanni Graselli | NSERC/Energi Simulation | | CivMin |
| NSERC/NanoXplore Industrial Research Chair in Multifunctional Graphene-based Nanocomposites and Foams | Chul Park | NSERC/NanoXplore | | MIE |
| NSERC/P&WC Industrial Research Chair in Aviation Gas Turbine Combustion/Emissions Research and Design System Optimization | Sam Sampath | NSERC/P&WC | | UTIAS |
| NSERC/UNENE Industrial Research Chair in Corrosion Control and Materials Performance in Nuclear Power Systems | Roger Newman | NSERC/UNENE | | ChemE |
| Percy Edward Hart Professor in Aerospace Engineering | Philippe Lavoie | Endowed | | UTIAS |
| Percy Edward Hart Professor in Biomaterials and Biomedical Engineering | Jonathan Rocheleau | Endowed | | IBBME |
| Percy Edward Hart Professor in Electrical and Computer Engineering | Natalie Enright Jerger | Endowed | | ECE |
| Pierre Lassonde Chair in Mining Engineering | John Hadjigeorgiou | Endowed | | CivMin |
| Robert M. Smith Chair in Geotechnical Mine Design and Analysis | Kamran Esmaili | Endowed | | CivMin |
| Skoll Chair in Computer Networks and Enterprise Innovation | Elvino Sousa | Endowed | | ECE |
| Skoll Chair in Software Engineering | Jason Anderson | Endowed | | ECE |
| Stanley Ho Professorship in Microelectronics | Sorin Voinigescu | Endowed | | ECE |
| The Stanley L. Meek Chair in Advanced Nanotechnology | Harry Ruda | Endowed | | MSE |
| U of T Distinguished Professor of Digital Communications | Frank Kschischang | | | ECE |
| U of T Distinguished Professor of Mechanobiology | Craig Simmons | | | MIE, IBBME |
| U of T Distinguished Professor of Microcellular Engineered Plastics | Chul Park | | | MIE |
| U of T Distinguished Professor of Nanobioengineering | Warren Chan | | | IBBME |
| U of T Distinguished Professor of Urban Systems Engineering | Mark Fox | | | MIE |
| U of T Distinguished Professor of Computational Aerodynamics and Sustainable Aviation | David Zingg | | | UTIAS |
| U of T Distinguished Professor in Forest Biomaterials Engineering | Ning Yan | | | ChemE |
| University Professor | Michael Collins | | | CivMin |
| University Professor | Elizabeth Edwards | | | ChemE |
| University Professor | Edward Sargent | | | ECE |
| University Professor | Michael Sefton | | | ChemE |
| University Professor | Molly Shoichet | | | ChemE, IBBME |
| University Professor | Peter Zandstra | | | IBBME |
| Velma M. Rogers Graham Chair in Engineering | George Eleftheriades | Endowed | | ECE |
| W. M. Keck Chair in Engineering Rock Mechanics | John Harrison | Endowed | | CivMin |
| Wallace G. Chalmers Chair of Engineering Design | Li Shu | Endowed | | MIE |

Appendix D: Student Clubs and Teams

Below is a list of Engineering student clubs and teams, which is referenced in *Chapter 4: Cross-Faculty Education & Experiential Learning*. Beyond the groups presented here, our students also participate in clubs and teams across U of T.

Arts

- Fly with Origami, Learn to Dream (UTFOLD)
- Skule™ Arts Festival
- Skule™ Improv
- Skule™ Choir
- Skule™ Orchestra
- Skule™ Stage Band

Athletics

- U of T Engineering Iron Dragons
- Skule™ Badminton Club
- Skule™ Ski Club
- The University of Toronto Skateboarders Club
- U of T Iron Sports (UTIS)
- UTSG Cricket Club

Societal/Community/Charity

- Engineers in Action (formerly Bridges to Prosperity)
- Engineers Without Borders
- Power to Change - Engineers
- Project Include
- QueerSphere
- Volunteer Engineering Experience Program

Cultural

- Association of Chinese Engineers (ACE)
- Bangladeshi Student Association
- Indian Students' Society
- Muslim Students' Association

Design & Competition

- aUToronto
- Blue Sky Solar Racing
- Carbon Cutting Racers (formerly University of Toronto Supermileage)
- CECA U of T Student Chapter (Canadian Electrical Contractors Association)
- Future-Living Lab
- Human Powered Vehicles Design Team
- International Genetically Engineering Machines Toronto (iGEM Toronto)
- NeurotechUofT
- Robotics for Space Exploration
- Spark Design Club
- Troitsky Bridge Building
- U of T Baja Team
- University of Toronto Aerospace Team (UTAT)
- University of Toronto Chemical Vehicles (UTCV)
- University of Toronto Concrete Canoe Team
- University of Toronto Concrete Toboggan Team
- University of Toronto Formula Racing Team
- University of Toronto Microgravity Experiment Design Team
- University of Toronto Project Holodeck (UTOPH)
- University of Toronto Seismic Design Team
- University of Toronto Robotics Association (UTRA)
- UT BIOME
- Project Airlock Team
- Cain's Quest Design Team

Hobby & Special Interest

- Skule™ Dance Club
- Skule™ Juggling Club
- Skule™ Strategy Game Club
- SkuleCraft
- Skule™ Smash Club
- U of T Rubik's Cube Club
- University of Toronto Emergency First Responders (UTEFR)
- University of Toronto Engineering Finance Association (UTEFA)
- University of Toronto Outing Club
- University of Toronto Society for Information and Cyber Security (UT6)
- University of Toronto Sports Analytics Group (UTSPAN)

Professional Development & Industry

- Association for Leadership in Chemical Engineering (ALChemE)
- Bioengineering Student Association
- Canadian Association of Food Engineers (CAFE)
- Canadian Society for Chemical Engineering – U of T Student Chapter
- Canadian Society for Civil Engineering
- Club for Undergraduate Biomedical Engineering
- Global Engineering Club
- IEEE University of Toronto
- Institute of Industrial & Systems Engineers - University of Toronto Chapter
- Materials Industry Club
- MechEngage
- National Society of Black Engineers U of T Chapter
- Rational Capital Investment Fund
- SettleIn
- Society of Petroleum Engineers University of Toronto Student Chapter
- Suits U
- Sustainable Engineers Association
- TechXplore
- Toronto Students Advancing Aerospace
- University of Toronto Business Association
- University of Toronto CanIECA
- University of Toronto Consulting Association
- University of Toronto Earthquake Engineering Research Institute Student Chapter (UT-EERI)
- University of Toronto Engineering Toastmasters
- University of Toronto Industry Insights
- University of Toronto Machine Intelligence Student Team
- University of Toronto Ontario Water Works Association-Student Chapter
- University of Toronto Space Design Contest
- University of Toronto Student Branch of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- U of T Data Science Team
- Water Environment Association of Ontario - U of T Chapter
- Women in Science and Engineering (WISE), U of T Chapter

Appendix E: Research Funding by Academic Area

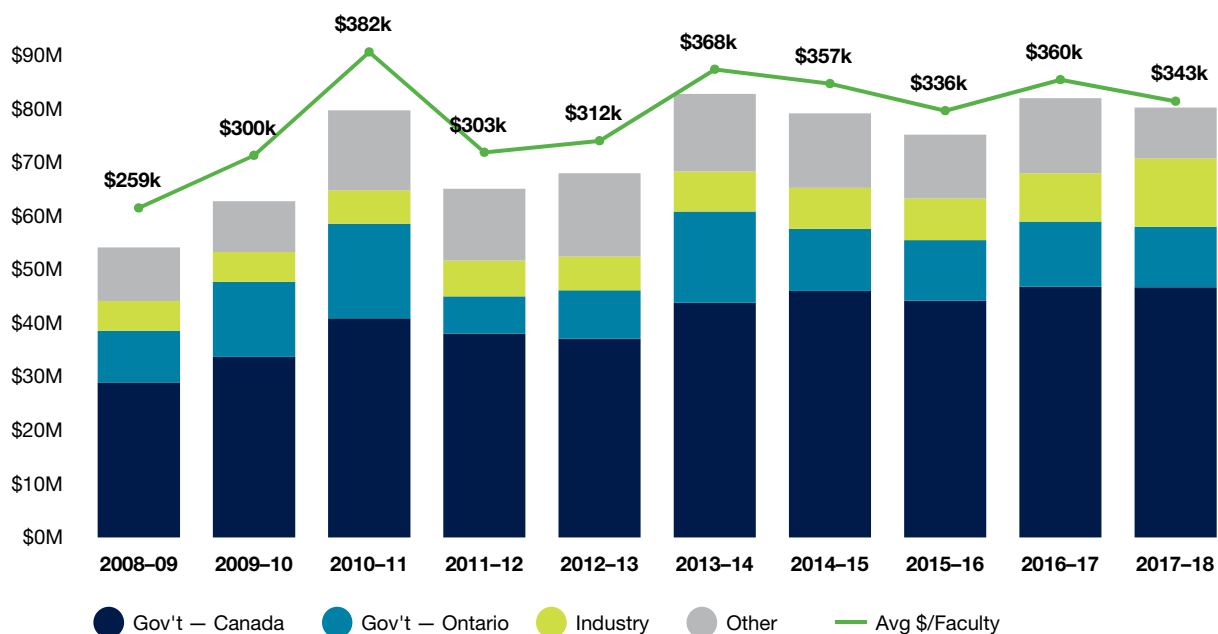
Figure E.1 shows our Faculty's total research funding, including operating and infrastructure.

Figures E.2 to E.8 in this appendix show research operating funding by department and institute over the last decade. This data excludes funding received under the following research infrastructure programs:

- Canada Foundation for Innovation (except the CFI Career Award)
- NSERC Research Tools & Instruments program for faculty
- Ontario Innovation Trust
- Ontario Research Fund – Research Infrastructure

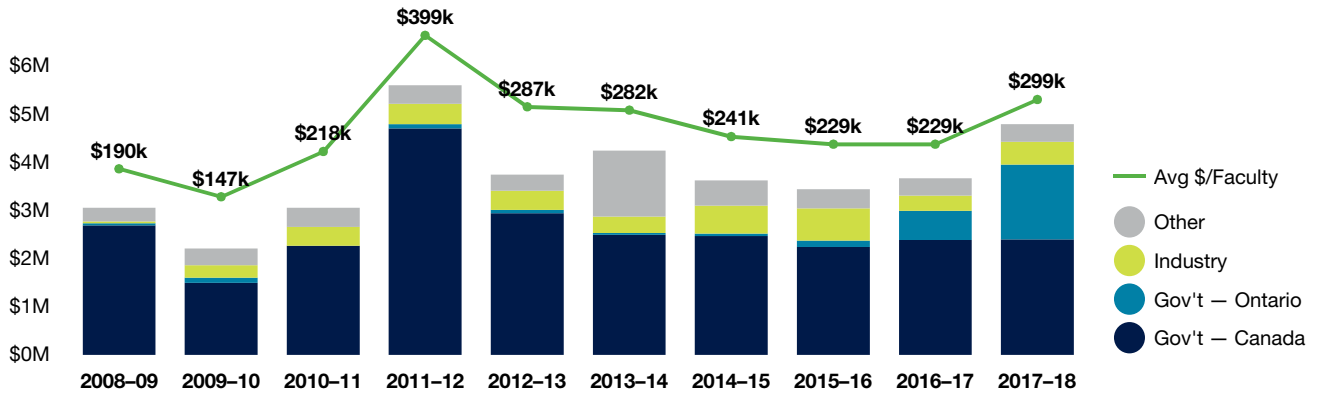
Data is based on grant years (April to March). For example, 2012–13 represents the granting cycle starting in April 2012 and ending in March 2013.

Figure E.1 University of Toronto Faculty of Applied Science & Engineering Total Research Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



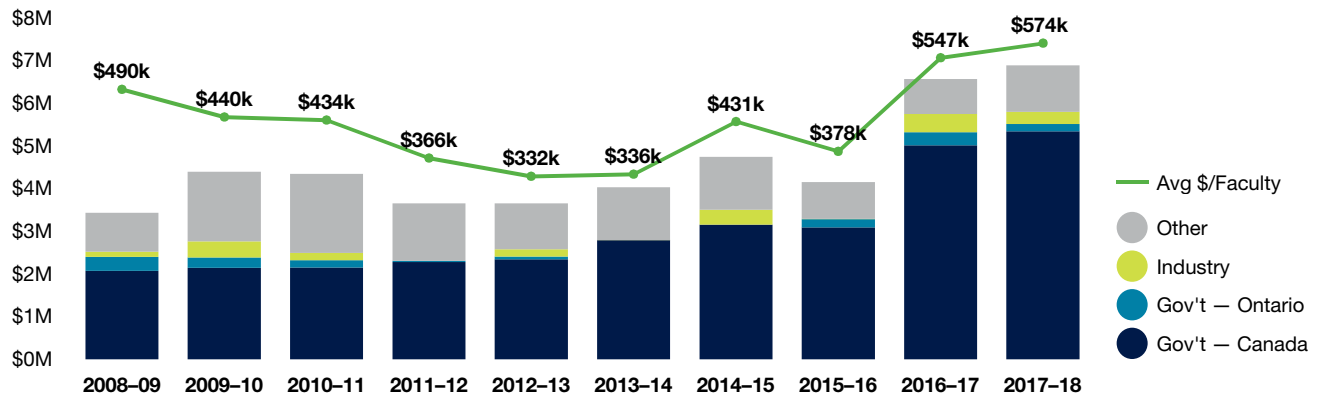
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|----------------|----------------|-----------------|--------------|--------------|---------------------|------------------|
| 2008–09 | \$28,915,195 | \$9,661,748 | \$5,574,261 | \$9,995,735 | \$54,146,938 | \$259,076 |
| 2009–10 | \$33,703,921 | \$14,040,320 | \$5,540,382 | \$9,466,322 | \$62,750,945 | \$300,244 |
| 2010–11 | \$40,893,725 | \$17,675,370 | \$6,212,252 | \$14,974,772 | \$79,756,119 | \$381,608 |
| 2011–12 | \$38,025,055 | \$6,969,732 | \$6,702,708 | \$13,384,957 | \$65,082,452 | \$302,709 |
| 2012–13 | \$37,117,563 | \$9,035,997 | \$6,284,318 | \$15,528,448 | \$67,966,326 | \$311,772 |
| 2013–14 | \$43,781,102 | \$17,068,393 | \$7,449,403 | \$14,521,924 | \$82,820,823 | \$368,093 |
| 2014–15 | \$45,995,710 | \$11,583,586 | \$7,658,866 | \$13,953,120 | \$79,191,282 | \$356,717 |
| 2015–16 | \$44,207,228 | \$11,286,280 | \$7,770,092 | \$11,906,204 | \$75,169,804 | \$335,579 |
| 2016–17 | \$46,809,364 | \$12,167,262 | \$9,028,158 | \$14,023,425 | \$82,028,210 | \$359,773 |
| 2017–18 | \$46,679,128 | \$11,323,523 | \$12,743,136 | \$9,514,682 | \$80,260,470 | \$342,993 |

Figure E.2 University of Toronto Institute for Aerospace Studies Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



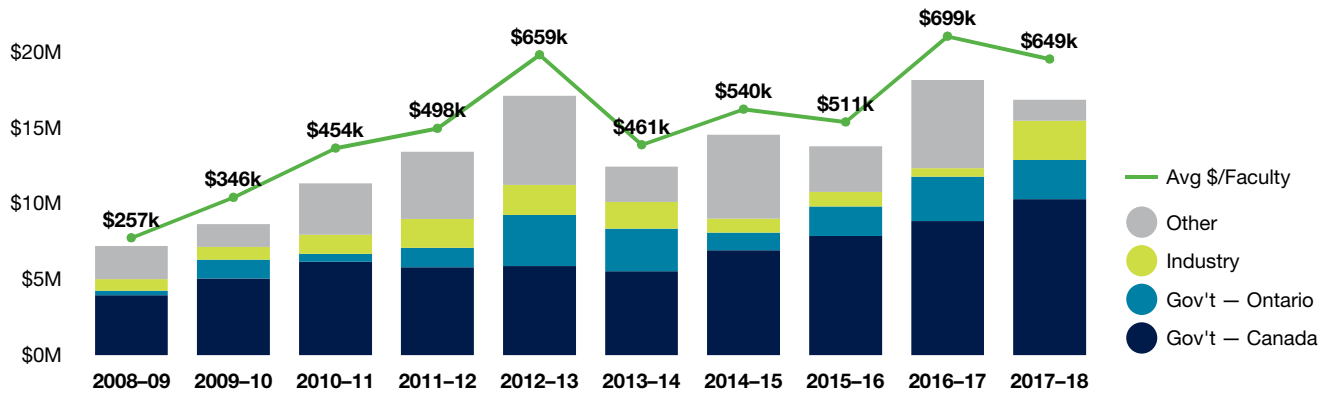
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-----------|-------------|-------------|----------------|
| 2008–09 | \$2,682,272 | \$45,000 | \$35,500 | \$282,966 | \$3,045,738 | \$190,359 |
| 2009–10 | \$1,486,736 | \$107,333 | \$259,200 | \$349,356 | \$2,202,626 | \$146,842 |
| 2010–11 | \$2,261,742 | | \$390,200 | \$396,929 | \$3,048,871 | \$217,776 |
| 2011–12 | \$4,692,107 | \$89,356 | \$420,400 | \$389,239 | \$5,591,103 | \$399,364 |
| 2012–13 | \$2,931,457 | \$70,157 | \$397,115 | \$337,561 | \$3,736,290 | \$287,407 |
| 2013–14 | \$2,485,293 | \$35,707 | \$342,396 | \$1,368,789 | \$4,232,186 | \$282,146 |
| 2014–15 | \$2,458,871 | \$50,000 | \$584,609 | \$518,655 | \$3,612,134 | \$240,809 |
| 2015–16 | \$2,232,872 | \$130,258 | \$674,557 | \$396,078 | \$3,433,764 | \$228,918 |
| 2016–17 | \$2,381,974 | \$603,570 | \$313,998 | \$362,281 | \$3,661,823 | \$228,864 |
| 2017–18 | \$2,390,069 | \$1,554,396 | \$474,246 | \$365,376 | \$4,784,087 | \$299,005 |

Figure E.3 Institute of Biomaterials & Biomedical Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



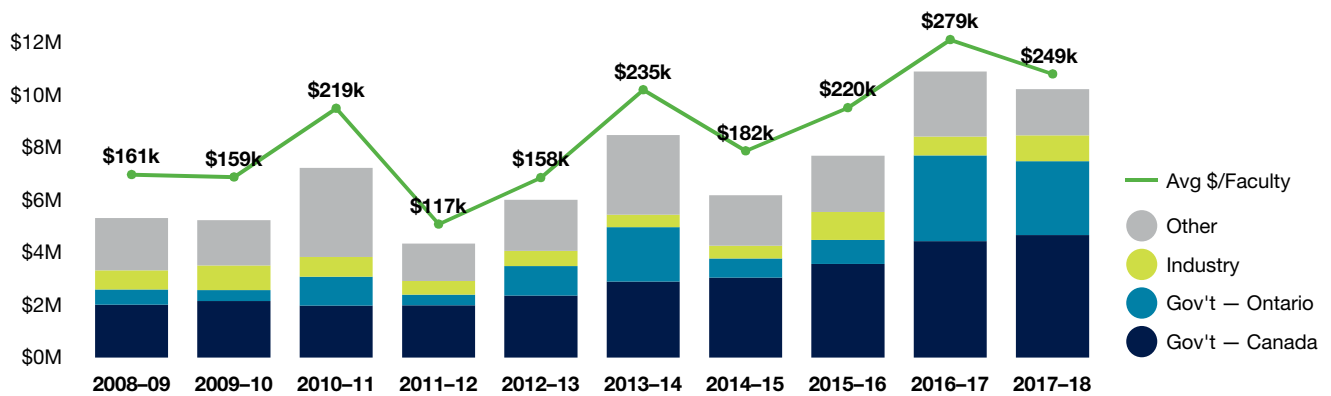
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-----------|-------------|-------------|----------------|
| 2008–09 | \$2,073,728 | \$326,140 | \$117,411 | \$915,635 | \$3,432,914 | \$490,416 |
| 2009–10 | \$2,144,759 | \$239,594 | \$375,037 | \$1,637,566 | \$4,396,956 | \$439,696 |
| 2010–11 | \$2,151,571 | \$170,685 | \$165,534 | \$1,856,560 | \$4,344,349 | \$434,435 |
| 2011–12 | \$2,275,392 | \$32,004 | | \$1,348,193 | \$3,655,589 | \$365,559 |
| 2012–13 | \$2,344,646 | \$61,148 | \$167,789 | \$1,080,669 | \$3,654,252 | \$332,205 |
| 2013–14 | \$2,790,844 | | \$1,301 | \$1,238,078 | \$4,030,223 | \$335,852 |
| 2014–15 | \$3,153,427 | | \$346,061 | \$1,245,302 | \$4,744,790 | \$431,345 |
| 2015–16 | \$3,090,390 | \$192,675 | \$4,802 | \$865,551 | \$4,153,418 | \$377,583 |
| 2016–17 | \$5,015,999 | \$306,359 | \$427,108 | \$818,499 | \$6,567,965 | \$547,330 |
| 2017–18 | \$5,338,091 | \$175,245 | \$285,487 | \$1,088,215 | \$6,887,039 | \$573,920 |

Figure E.4 Department of Chemical Engineering & Applied Chemistry Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



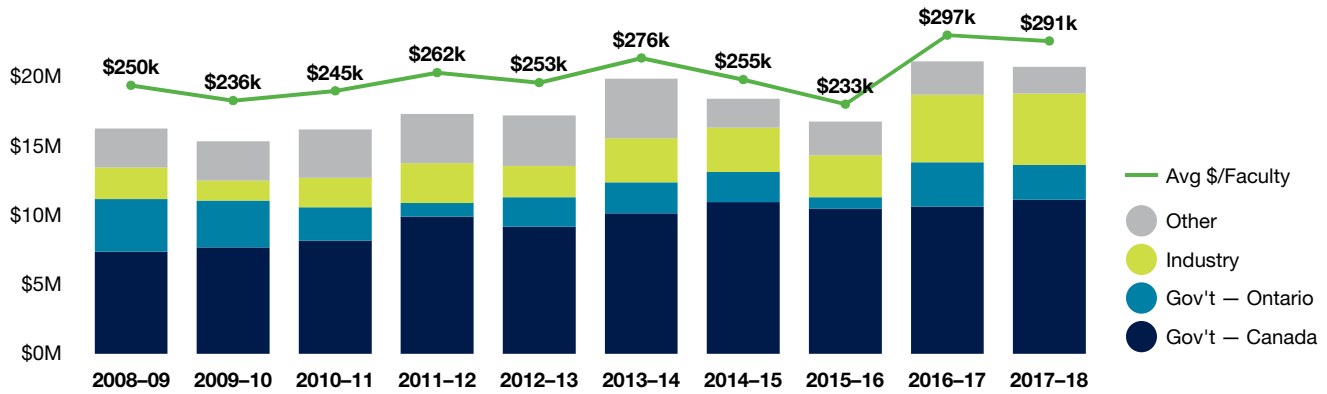
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-------------|-------------|--------------|----------------|
| 2008–09 | \$3,946,064 | \$307,134 | \$757,256 | \$2,186,232 | \$7,196,687 | \$257,025 |
| 2009–10 | \$5,042,379 | \$1,264,697 | \$835,642 | \$1,500,522 | \$8,643,240 | \$345,730 |
| 2010–11 | \$6,164,266 | \$514,057 | \$1,261,227 | \$3,401,818 | \$11,341,368 | \$453,655 |
| 2011–12 | \$5,802,379 | \$1,283,132 | \$1,897,761 | \$4,450,345 | \$13,433,618 | \$497,541 |
| 2012–13 | \$5,872,641 | \$3,374,496 | \$1,990,738 | \$5,895,731 | \$17,133,607 | \$658,985 |
| 2013–14 | \$5,526,121 | \$2,817,237 | \$1,770,656 | \$2,333,991 | \$12,448,005 | \$461,037 |
| 2014–15 | \$6,919,763 | \$1,174,433 | \$920,026 | \$5,555,113 | \$14,569,334 | \$539,605 |
| 2015–16 | \$7,869,414 | \$1,950,027 | \$962,888 | \$3,012,675 | \$13,795,004 | \$510,926 |
| 2016–17 | \$8,861,036 | \$2,918,193 | \$570,070 | \$5,831,698 | \$18,180,996 | \$699,269 |
| 2017–18 | \$10,297,454 | \$2,600,541 | \$2,584,168 | \$1,395,350 | \$16,877,513 | \$649,135 |

Figure E.5 Department of Civil & Mineral Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



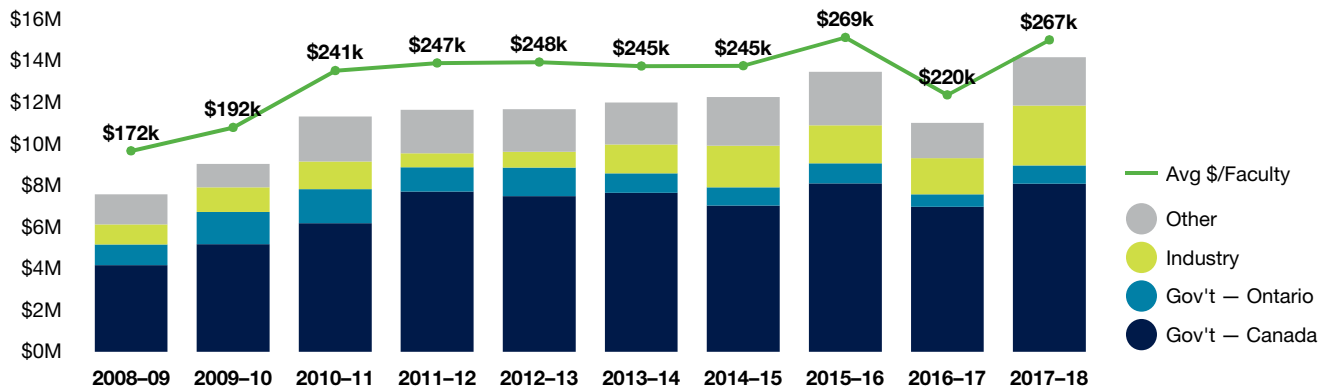
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-------------|-------------|--------------|----------------|
| 2008–09 | \$2,015,778 | \$572,670 | \$730,460 | \$1,988,914 | \$5,307,823 | \$160,843 |
| 2009–10 | \$2,154,607 | \$412,542 | \$931,988 | \$1,732,687 | \$5,231,825 | \$158,540 |
| 2010–11 | \$1,981,370 | \$1,097,073 | \$747,127 | \$3,399,792 | \$7,225,361 | \$218,950 |
| 2011–12 | \$1,991,794 | \$402,645 | \$515,246 | \$1,428,083 | \$4,337,768 | \$117,237 |
| 2012–13 | \$2,358,881 | \$1,121,005 | \$585,360 | \$1,941,535 | \$6,006,780 | \$158,073 |
| 2013–14 | \$2,892,286 | \$2,069,442 | \$470,776 | \$3,041,897 | \$8,474,400 | \$235,400 |
| 2014–15 | \$3,039,001 | \$727,715 | \$491,188 | \$1,915,944 | \$6,173,849 | \$181,584 |
| 2015–16 | \$3,567,335 | \$906,960 | \$1,072,331 | \$2,137,592 | \$7,684,218 | \$219,549 |
| 2016–17 | \$4,431,039 | \$3,266,681 | \$715,923 | \$2,480,030 | \$10,893,673 | \$279,325 |
| 2017–18 | \$4,660,922 | \$2,817,484 | \$981,529 | \$1,756,620 | \$10,216,555 | \$249,184 |

Figure E.6 The Edward S. Rogers Sr. Department of Electrical & Computer Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



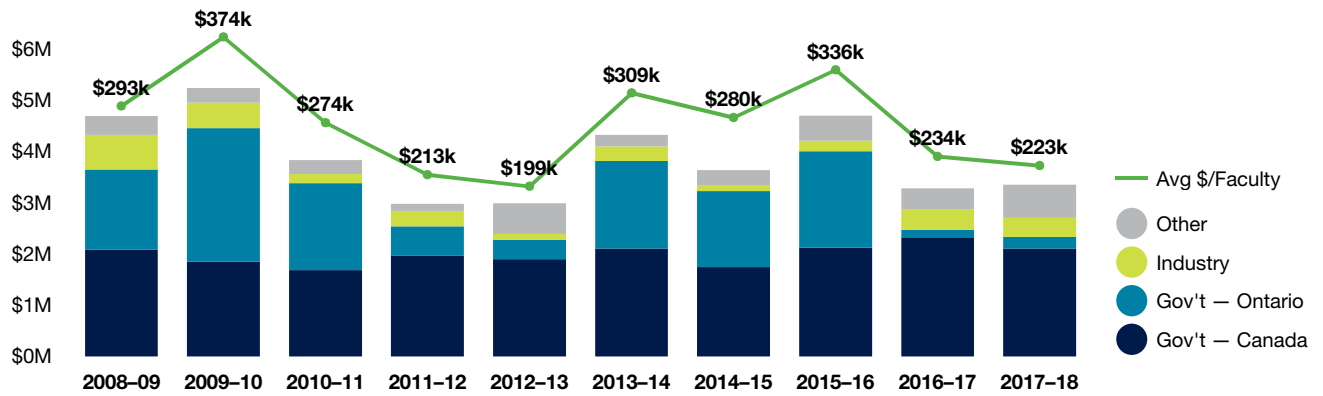
| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-------------|-------------|--------------|----------------|
| 2008–09 | \$7,355,799 | \$3,802,234 | \$2,275,934 | \$2,808,266 | \$16,242,233 | \$249,881 |
| 2009–10 | \$7,657,716 | \$3,371,903 | \$1,460,500 | \$2,836,755 | \$15,326,874 | \$235,798 |
| 2010–11 | \$8,146,160 | \$2,410,791 | \$2,134,524 | \$3,477,284 | \$16,168,758 | \$244,981 |
| 2011–12 | \$9,874,991 | \$977,439 | \$2,891,234 | \$3,546,234 | \$17,289,899 | \$261,968 |
| 2012–13 | \$9,147,947 | \$2,124,989 | \$2,275,124 | \$3,626,475 | \$17,174,534 | \$252,567 |
| 2013–14 | \$10,106,855 | \$2,250,783 | \$3,184,516 | \$4,295,429 | \$19,837,583 | \$275,522 |
| 2014–15 | \$10,937,884 | \$2,160,215 | \$3,203,168 | \$2,085,517 | \$18,386,785 | \$255,372 |
| 2015–16 | \$10,443,531 | \$843,513 | \$3,025,580 | \$2,430,366 | \$16,742,990 | \$232,542 |
| 2016–17 | \$10,605,077 | \$3,200,096 | \$4,870,089 | \$2,401,247 | \$21,076,509 | \$296,852 |
| 2017–18 | \$11,109,892 | \$2,487,824 | \$5,160,598 | \$1,925,904 | \$20,684,218 | \$291,327 |

Figure E.7 Department of Mechanical & Industrial Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|---------|----------------|-----------------|-------------|-------------|--------------|----------------|
| 2008–09 | \$4,154,784 | \$988,864 | \$976,457 | \$1,446,256 | \$7,566,361 | \$171,963 |
| 2009–10 | \$5,161,551 | \$1,554,477 | \$1,180,330 | \$1,125,847 | \$9,022,204 | \$191,962 |
| 2010–11 | \$6,181,418 | \$1,625,461 | \$1,337,641 | \$2,168,689 | \$11,313,210 | \$240,707 |
| 2011–12 | \$7,690,713 | \$1,170,375 | \$679,470 | \$2,082,577 | \$11,623,134 | \$247,301 |
| 2012–13 | \$7,473,427 | \$1,377,151 | \$757,191 | \$2,048,224 | \$11,655,993 | \$248,000 |
| 2013–14 | \$7,641,900 | \$929,834 | \$1,393,542 | \$2,019,869 | \$11,985,145 | \$244,595 |
| 2014–15 | \$7,016,883 | \$885,328 | \$2,007,844 | \$2,330,550 | \$12,240,605 | \$244,812 |
| 2015–16 | \$8,084,370 | \$975,760 | \$1,824,219 | \$2,576,412 | \$13,460,762 | \$269,215 |
| 2016–17 | \$6,967,616 | \$597,696 | \$1,740,732 | \$1,688,441 | \$10,994,485 | \$219,890 |
| 2017–18 | \$8,069,214 | \$877,882 | \$2,883,537 | \$2,325,098 | \$14,155,731 | \$267,089 |

Figure E.8 Department of Materials Science & Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2008–2009 to 2017–2018



| | Gov't – Canada | Gov't – Ontario | Industry | Other | Total | Avg \$/Faculty |
|----------------|----------------|-----------------|-----------|-----------|--------------------|------------------|
| 2008–09 | \$2,079,159 | \$1,568,009 | \$681,243 | \$367,466 | \$4,695,876 | \$293,492 |
| 2009–10 | \$1,847,850 | \$2,611,854 | \$497,685 | \$283,589 | \$5,240,977 | \$374,356 |
| 2010–11 | \$1,681,192 | \$1,702,731 | \$176,000 | \$273,700 | \$3,833,624 | \$273,830 |
| 2011–12 | \$1,960,014 | \$580,411 | \$298,597 | \$140,285 | \$2,979,307 | \$212,808 |
| 2012–13 | \$1,896,902 | \$382,077 | \$111,000 | \$598,253 | \$2,988,232 | \$199,215 |
| 2013–14 | \$2,102,486 | \$1,711,981 | \$286,216 | \$223,872 | \$4,324,555 | \$308,897 |
| 2014–15 | \$1,740,619 | \$1,488,791 | \$105,970 | \$302,039 | \$3,637,419 | \$279,801 |
| 2015–16 | \$2,123,510 | \$1,884,137 | \$205,715 | \$487,530 | \$4,700,892 | \$335,778 |
| 2016–17 | \$2,326,088 | \$146,050 | \$390,239 | \$415,974 | \$3,278,351 | \$234,168 |
| 2017–18 | \$2,103,851 | \$224,651 | \$373,571 | \$650,284 | \$3,352,356 | \$223,490 |

Appendix F: Spinoff Companies

| Est. | Company Name | Engineering Affiliation | Department |
|------|---|-----------------------------------|--------------|
| 2019 | Centadvisor | Mark Chignell | MIE |
| 2019 | Exactly Eyewear | Haonan "Alan" Li | ECE |
| 2019 | Micellae Delivery Systems Inc. | Mehdi Nouraei | ChemE |
| 2019 | YSCOPE | Ding Yuan | ECE |
| 2018 | BIM2Network | Tamir El-Diraby | CivMin |
| 2018 | Mesosil | Benjamin Hatton & Yoav Finer | IBBME |
| 2018 | Micromensio | Glenn Gulak | ECE |
| 2018 | Phenomic AI | Brendan Frey | ECE |
| 2018 | Phycus Biotechnologies | Vik Pandit | ChemE |
| 2017 | Quthero Inc. | Milica Radisic | IBBME |
| 2017 | Shield Crypto Systems Inc. | Glenn Gulak | ECE |
| 2016 | 2488138 Ontario Inc. | Roman Genov | ECE |
| 2016 | 3E Nano Inc. | Nazir Kherani | ECE |
| 2016 | AmacaThera Inc. (formerly Hammock Pharmaceuticals Inc.) | Molly Soichet & Michael Cooke | ChemE |
| 2016 | Ardra Bio Inc. | Radhakrishnan Mahadevan | ChemE |
| 2016 | Crowd2Know Inc. | Tamer El-Diraby | CivMin |
| 2016 | Interface Fluidics | David Sinton | MIE |
| 2016 | Knitt Labs, Inc. (formerly FlexCube Technology Inc.) | Shuze Zhao | ECE |
| 2016 | LegUp Computing Inc. | Jason Anderson & Stephen Brown | ECE |
| 2016 | Polumiros Inc. | Soror Sharifpoor & Kyle Battiston | IBBME |
| 2016 | Sheba Microsystems Inc. | Ridha Ben Mrad & Faez Ba-Tis | MIE |
| 2016 | Sonare Inc. | David Steinman & Luis Aguilar | MIE |
| 2015 | Appulse Inc. (formerly ICE3 Power Technologies Inc.) | Aleksander Prodic | ECE |
| 2015 | Deep Genomics Inc. | Brendan Frey | ECE |
| 2015 | Enhanced Biomodulation Technologies Inc. | Paul Yoo | IBBME |
| 2015 | ExCellThera Inc. | Peter Zandstra | IBBME |
| 2015 | Onyx Motion Inc. | Marissa Wu | IBBME |
| 2015 | Rheo Technologies | Craig Simmons | MIE |
| 2015 | Tara Biosystems, Inc. | Milica Radisic | IBBME, ChemE |
| 2014 | Arrowonics Inc. | Hugh Liu | UTIAS |
| 2014 | Enceladeus Imaging | Steve Mann | ECE |
| 2014 | IQBiomedical | David Sinton | MIE |
| 2014 | Pragmatek Transport Innovations, Inc. | Baher Abdulhai | CivMin |
| 2014 | QD Solar Inc. | Sjoerd Hoogland and Ted Sargent | ECE |
| 2014 | Toronto Nano Instrumentation Inc. (TNi Inc.) | Yu Sun | MIE |
| 2014 | XCellPure Inc. | Milica Radisic | IBBME, ChemE |
| 2014 | XTouch Inc. | Parham Aarabi | ECE |
| 2013 | CoursePeer | Hadi Aladdin | ECE |
| 2013 | eQOL Inc. | Binh Nguyen | ECE |
| 2013 | Kydo Engineering | John Ruggieri | ChemE |
| 2013 | Lullyn Technologies Inc. | Michael Joy | IBBME |
| 2013 | Sonas Systems Inc. | Joyce Poon | ECE |
| 2013 | SpineSonic Medical Inc. | Richard Cobbold | IBBME |
| 2013 | Whirlscape Inc. | Will Walmsley | MIE |
| 2012 | Kinetica Dynamics Inc. | Constantin Christopoulos | CivMin |
| 2012 | MyTrak Health Systems | Sean Doherty | CivMin |
| 2012 | OTI Lumionics Inc. | Zheng-Hong Lu | MSE |
| 2012 | XTT | Parham Aarabi | ECE |
| 2011 | Aereus Technologies Inc. (formerly Aereus Wood) | Javad Mostaghimi | MIE |
| 2011 | Bionym Inc. | Karl Martin | ECE |
| 2011 | Filaser Inc. | Peter Herman | ECE |

| | | | |
|------|--|--|-----------------|
| 2011 | Luminautics Inc. (formerly Ensi Solutions) | Graham Murdoch | MSE |
| 2011 | Nymi (formerly Bionym Inc.) | Karl Martin | ECE |
| 2011 | Ojiton Inc. | Tom Chau | IBBME |
| 2011 | PRISED Solar Inc. | Wahid Shams-Kolahi | ECE |
| 2011 | RenWave | Mohamed Kamh | ECE |
| 2011 | Sense Intelligent | Brian Hu | ECE |
| 2011 | Xagenic Canada Inc. | Ted Sargent | ECE |
| 2010 | Arda Power Inc. | Peter Lehn | ECE |
| 2010 | FOTA Technologies | Tony Chan Carusone | ECE |
| 2009 | Chip Care Corp. | J. Stewart Aitchison | ECE |
| 2009 | Cytodiagnosics | Warren Chan | IBBME |
| 2009 | Peraso Technologies Inc. | Sorin Voinigescu | ECE |
| 2008 | Ablazeon Inc. | Javad Mostaghimi | MIE |
| 2008 | Arch Power Inc. | Mohammad (Reza) Iravani | ECE |
| 2008 | AXAL Inc. | Milos Popovic and Egor Sanin | IBBME |
| 2008 | Incise Photonics Inc. | Peter Herman | ECE |
| 2008 | Quantum Dental Technologies | Andreas Mandelis | MIE |
| 2008 | Simple Systems Inc. | Milos Popovic, Aleksandar Prodic and Armen Baronijan | ECE, IBBME |
| 2007 | 002122461 Ontario Inc. | Harry Ruda | MSE |
| 2007 | Cast Connex Corp. | Jeffrey Packer and Constantin Christopoulos | CivMin |
| 2007 | Elastin Specialties | Kimberly Woodhouse | ChemE |
| 2007 | Inometrix Inc. | Michael Galle | ECE |
| 2007 | Modiface Inc. | Parham Aarabi | ECE |
| 2007 | Neurochip Inc. | Berj Bardakjian | IBBME |
| 2007 | Viewgenie Inc. | Parham Aarabi | ECE |
| 2006 | Anviv Mechatronics Inc. (AMI) | Andrew Goldenberg | MIE |
| 2006 | InVisage Technologies Inc. | Ted Sargent | ECE |
| 2006 | Metabacus | Jianwen Zhu | ECE |
| 2006 | Vennsa Technologies Inc. | Andreas Veneris and Sean Safarpour | ECE |
| 2005 | Greencore Composites | Mohini Sain | Forestry, ChemE |
| 2004 | Field Metrica Inc. (FMI) | Tim DeMonte, Richard Yoon | IBBME |
| 2004 | Tissue Regeneration Therapeutics Inc. (TRT) | J.E. Davies | IBBME |
| 2003 | 1484667 Ontario Inc. | Brad Saville | ChemE |
| 2003 | ArchES Computing Systems Corp. | Paul Chow | ECE |
| 2003 | Norel Optronics Inc. | Zheng-Hong Lu | MSE |
| 2003 | Vocalage Inc. | Mark Chignell | MIE |
| 2002 | Information Intelligence Corporation (IIC) | Burhan Turksen | MIE |
| 2002 | MatRegen Corp. | Molly Shoichet | IBBME, ChemE |
| 2002 | OMDEC Inc. | Andrew K.S. Jardine | MIE |
| 2002 | SiREM | Elizabeth Edwards | ChemE |
| 2001 | Fox-Tek | Rod Tennyson | UTIAS |
| 2001 | Insception Biosciences | Peter Zandstra | IBBME |
| 2001 | Interface Biologics | Paul Santerre | IBBME |
| 2000 | Biox Corporation | David Boocock | ChemE |
| 2000 | Photo-Thermal Diagnostics Inc. | Andreas Mandelis | MIE |
| 2000 | Simulent Inc. | Javad Mostaghimi | MIE |
| 2000 | Virtek Engineering Science Inc. | Andrew Goldenberg | MIE |
| 1999 | Accelight Networks Inc. | Alberto Leon-Garcia and Paul Chow | ECE |
| 1999 | em2 Inc. | J.E. Davies | IBBME |
| 1999 | Soma Networks | Michael Stumm and Martin Snelgrove | ECE |
| 1999 | Vivosonic Inc. | Yuri Sokolov and Hans Kunov | IBBME |
| 1998 | 1208211 Ontario Ltd. (affiliate: Regen StaRR) | Robert Pilliar, Rita Kandel and Marc Grynepas | IBBME |
| 1998 | BANAK Inc. | Andrew K.S. Jardine | MIE |
| 1998 | BoneTec Corp. (now owned by subsidiary of TRT) | J.E. Davies and Molly Shoichet | IBBME |
| 1998 | Right Track CAD Corp. | Jonathan Rose | ECE |
| 1998 | SMT HyrdaSil | Rod Tennyson | UTIAS |
| 1998 | Snowbush Microelectronics | Kenneth Martin and David Johns | ECE |
| 1997 | Rimon Therapeutics | Michael Sefton | IBBME, ChemE |

Appendix G: Descriptions of Major Awards

Chapter 5: Awards and Honours summarizes the international, national and provincial awards our faculty and alumni received. Below are descriptions of some of those awards and honours.

International

American Association for the Advancement of Science (AAAS) Fellowship – Engineering Section

Recognition of extraordinary achievements across disciplines by a member whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished.

MIT Top 35 Under 35

Awarded to world's top 35 young innovators under the age of 35 by *MIT Technology Review* magazine.

National Academy of Inventors

Awarded to academic inventors who have demonstrated a prolific spirit of innovation through inventions with tangible impact.

Royal Academy of Engineering

Recognition of exceptional contributions in engineering research, innovation, entrepreneurship and more.

U.S. National Academies

The National Academies serve (collectively) as the scientific national academy for the United States.

National

Brockhouse Prize

Recognition of outstanding Canadian interdisciplinary research teams for internationally significant achievement in the natural sciences and engineering.

Canadian Academy of Engineering (CAE) Fellowship

Recognition for distinguished achievements and career-long service to the engineering profession.

Engineering Institute of Canada (EIC) Fellowship

Recognition for exceptional contributions to engineering in Canada and for service to the profession and to society.

Engineering Institute of Canada (EIC) Awards

Recognition of outstanding engineers for exemplary contributions to engineering achievement in Canada and the world.

Engineers Canada Awards

Recognition of outstanding Canadian engineers, teams of engineers, engineering projects and engineering students.

Governor General's Innovation Awards

Recognition of outstanding trailblazers and creators who contribute to Canada's success.

Killam Prize

Awarded to distinguished Canadian scholars conducting research in one of five fields of study, including engineering, by the Canada Council for the Arts.

Killam Research Fellowship

Awarded to an established scholar who has demonstrated outstanding research ability and has published research results in substantial publications in their field by the Canada Council for the Arts.

Manning Innovation Award

Recognition of Canadian innovators who are improving the lives of Canadians and others around the world through their commercialized innovations.

Order of Canada

Awarded to individuals who enrich the lives of others and made a difference in Canada. This is the second-highest honour for merit in Canada.

Royal Society of Canada (RSC) Fellowship

Highest Canadian honour a scholar can achieve in the arts, humanities and sciences.

Royal Society of Canada (RSC) College of New Scholars, Artists and Scientists

Members are Canadian scholars who, at an early stage in their career, have demonstrated a high level of achievement and excellence.

Steacie Fellowship

Awarded to enhance the career development of outstanding and highly promising scientists and engineers by the Natural Sciences and Engineering Research Council (NSERC).

Steacie Prize

Awarded to a scientist or engineer 40 years of age or less for outstanding scientific research carried out in Canada.

Synergy Award for Innovation

Recognition for university-industry collaboration that stands as a model of effective partnership.

Provincial

Ontario Professional Engineers Awards

Awarded to Professional Engineers Ontario members who have contributed substantially to the advancement of the engineering profession in any of its branches.

Ontario Confederation of University Faculty Associations (OCUFA) Teaching Award

Recognition of individuals with exceptional contributions to the higher education community in Ontario.

Order of Ontario

The province's highest honour recognizes an Ontarian who has shown outstanding qualities of individual excellence and achievement.

Appendix H: Academic Staff by Academic Area

The figures in Appendix H show the composition of our academic staff from 2009–2010 to 2018–2019. Figures H.1a and H.1b provide a Faculty overview and H.2 to H.8 present a detailed analysis by academic area.

Figure H.1a Total Academic Staff by Academic Area, 2009–2010 to 2018–2019

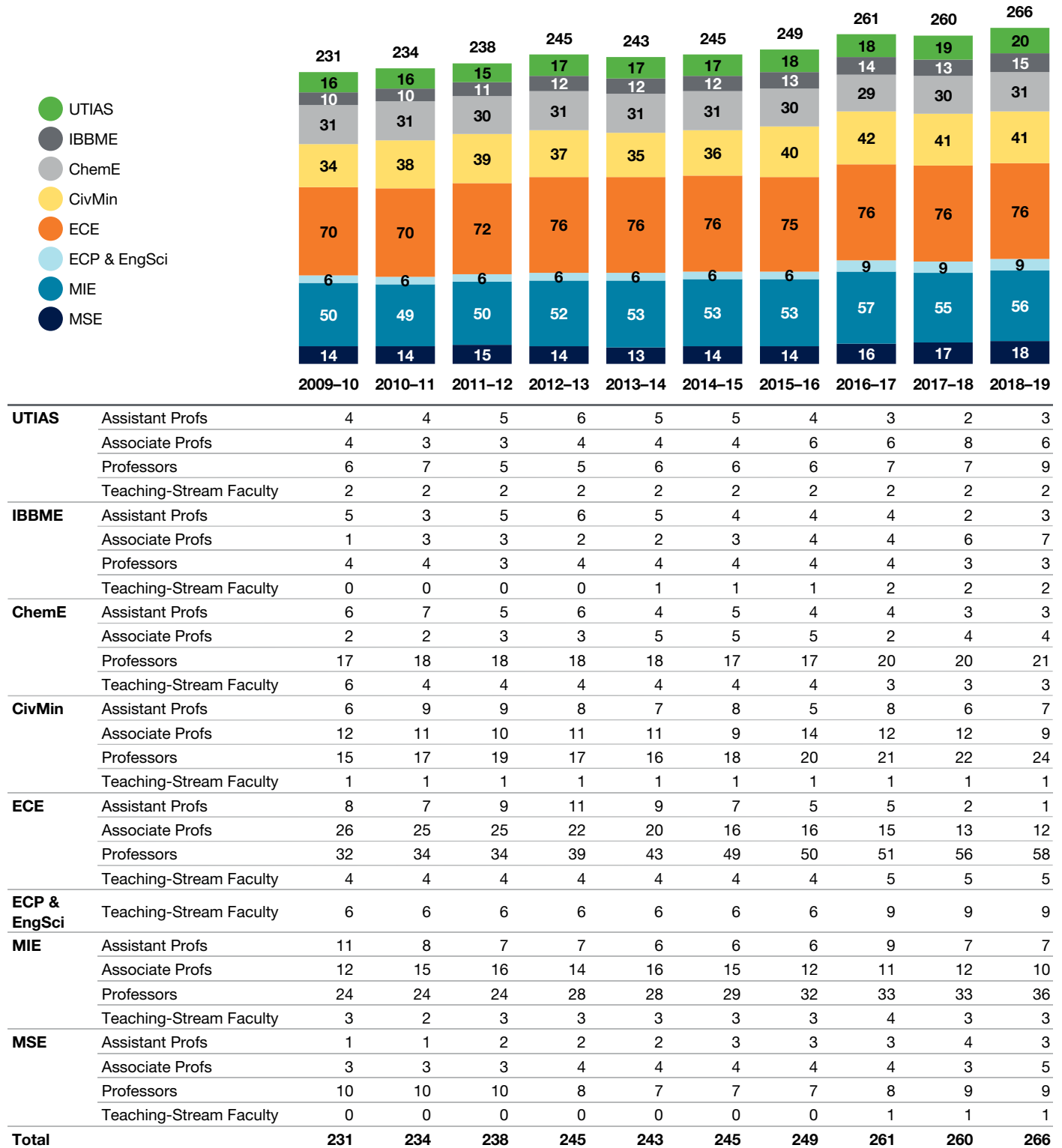


Figure H.1b University of Toronto Faculty of Applied Science & Engineering Total Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019

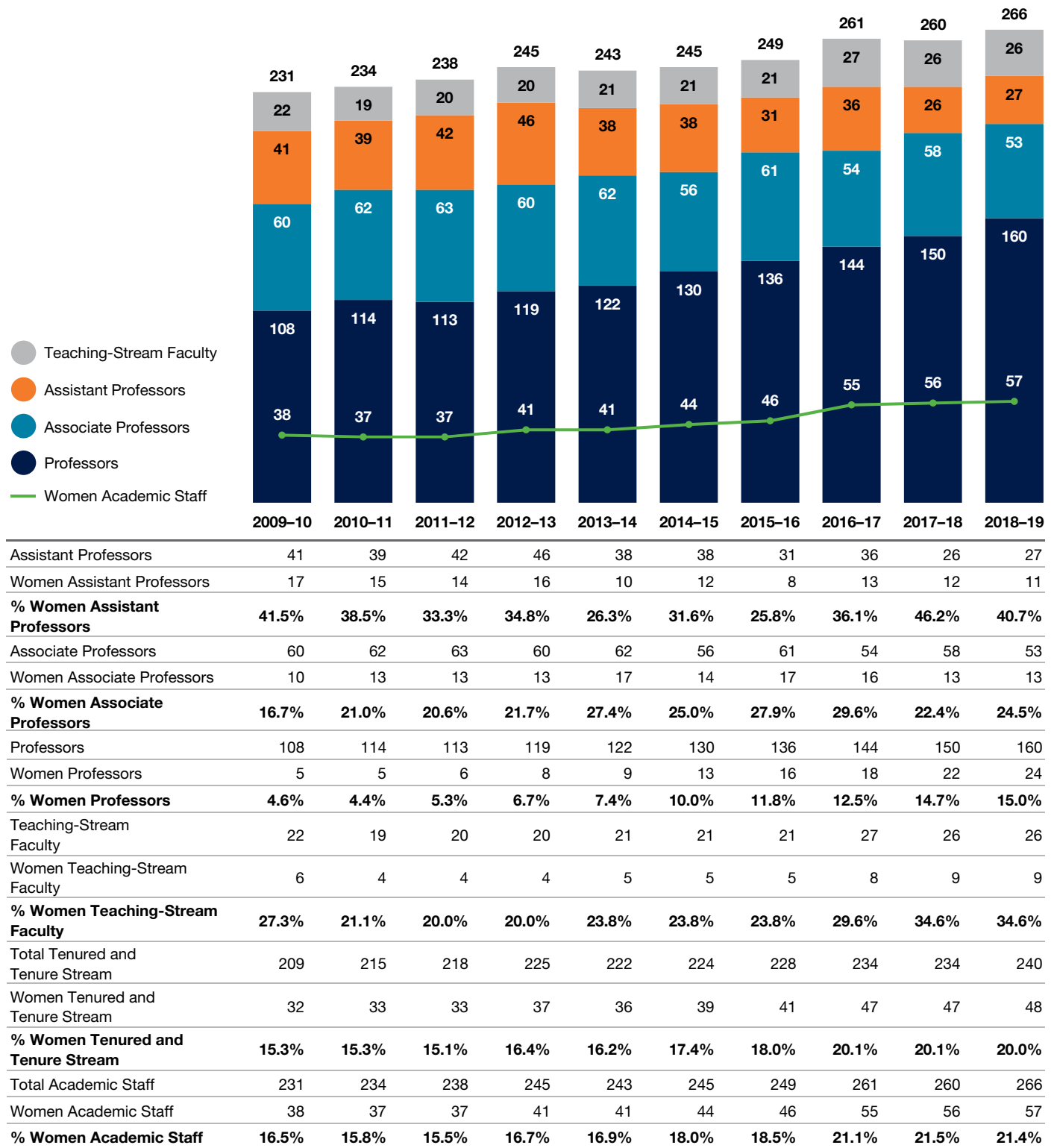


Figure H.2 University of Toronto Institute for Aerospace Studies:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019

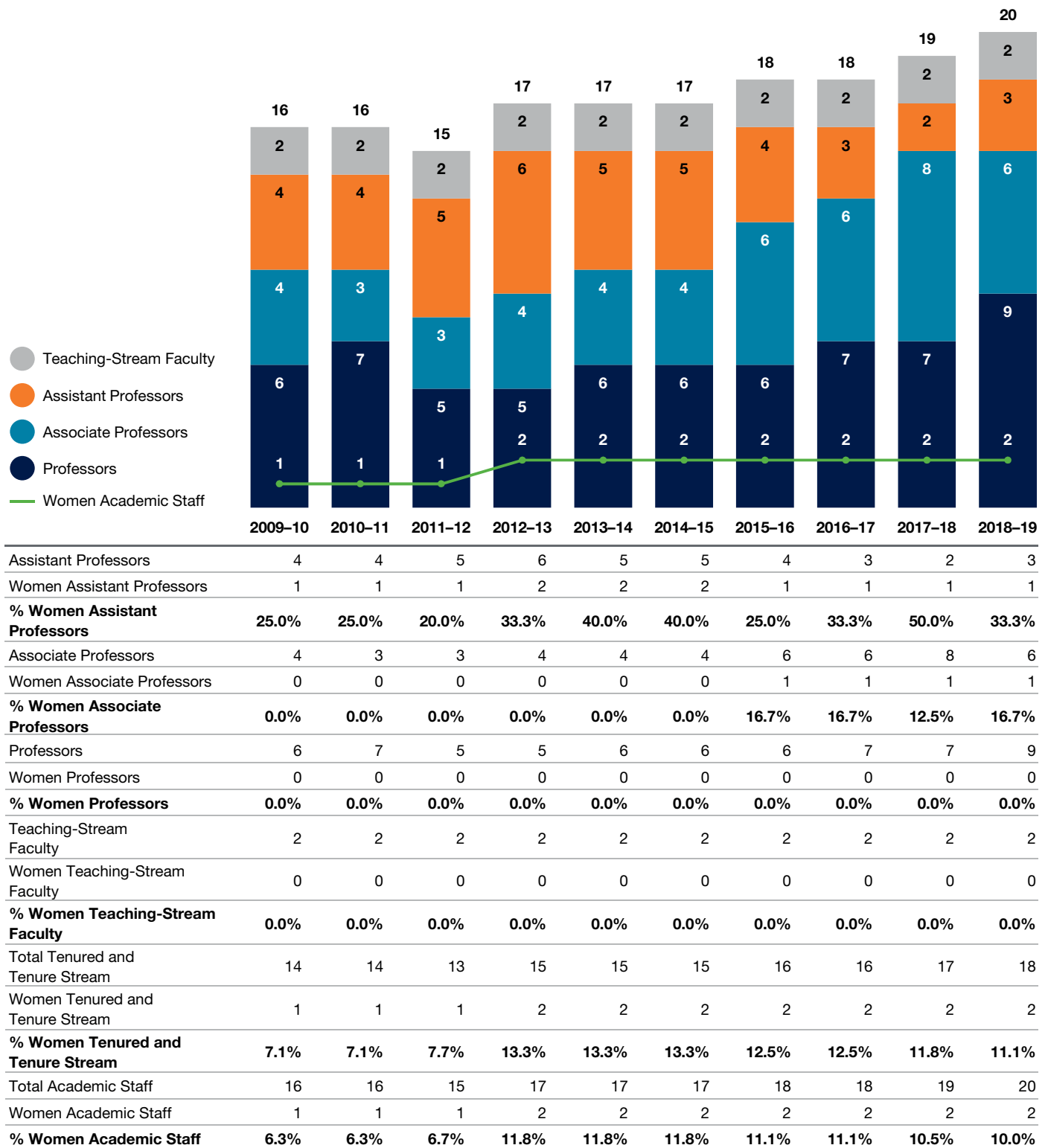


Figure H.3 Institute of Biomaterials & Biomedical Engineering:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019

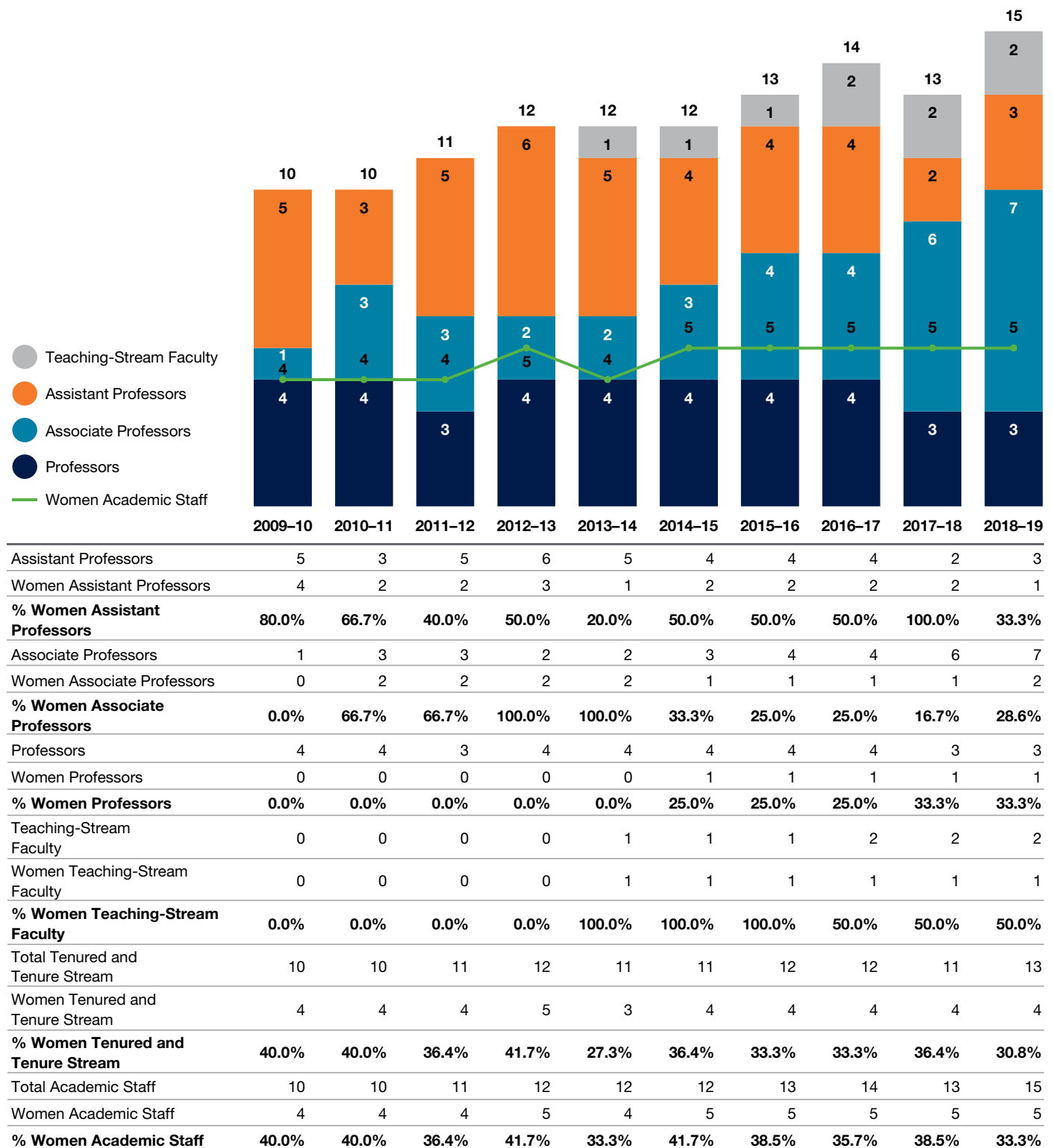


Figure H.4 Department of Chemical Engineering & Applied Chemistry:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019

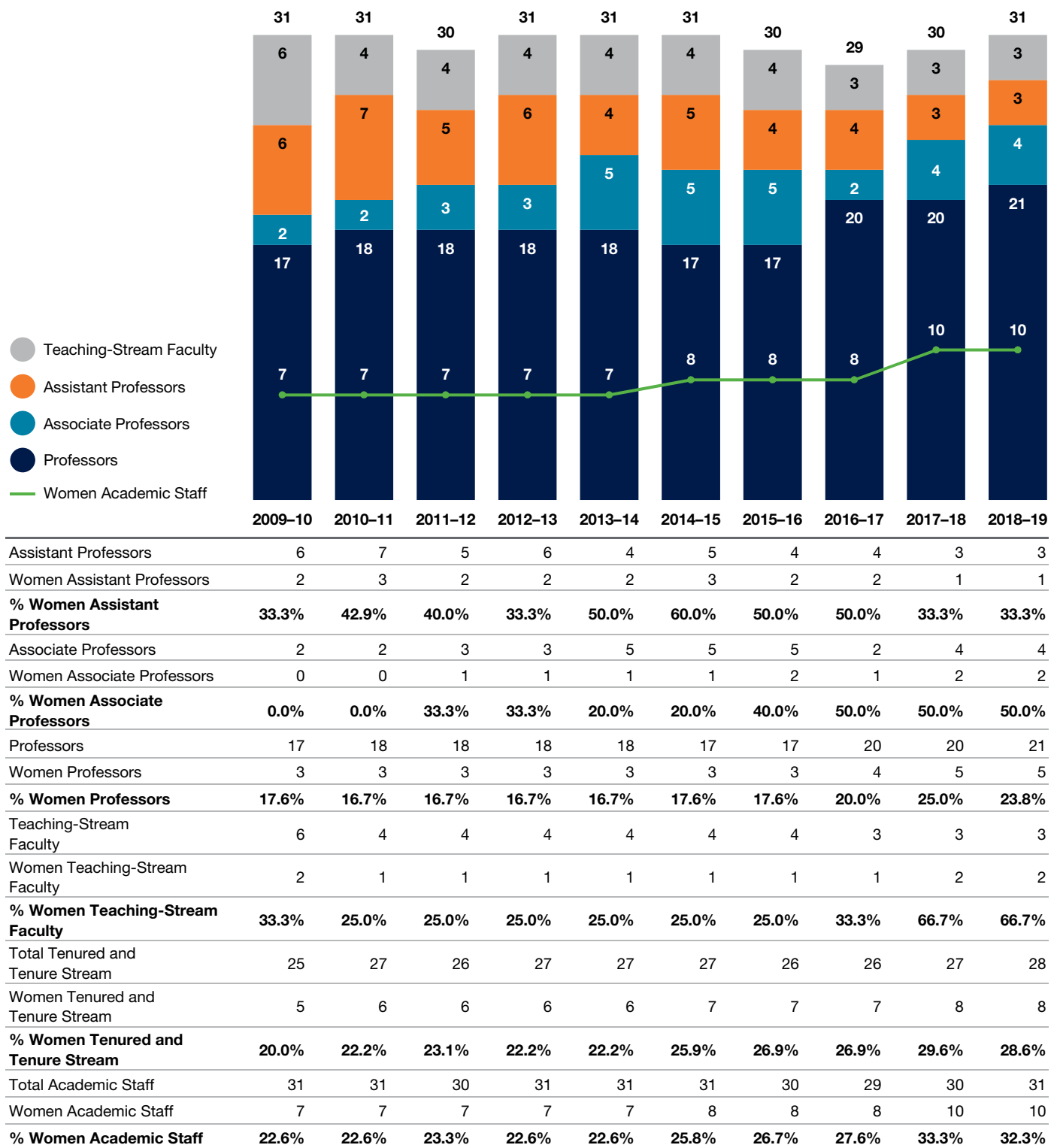
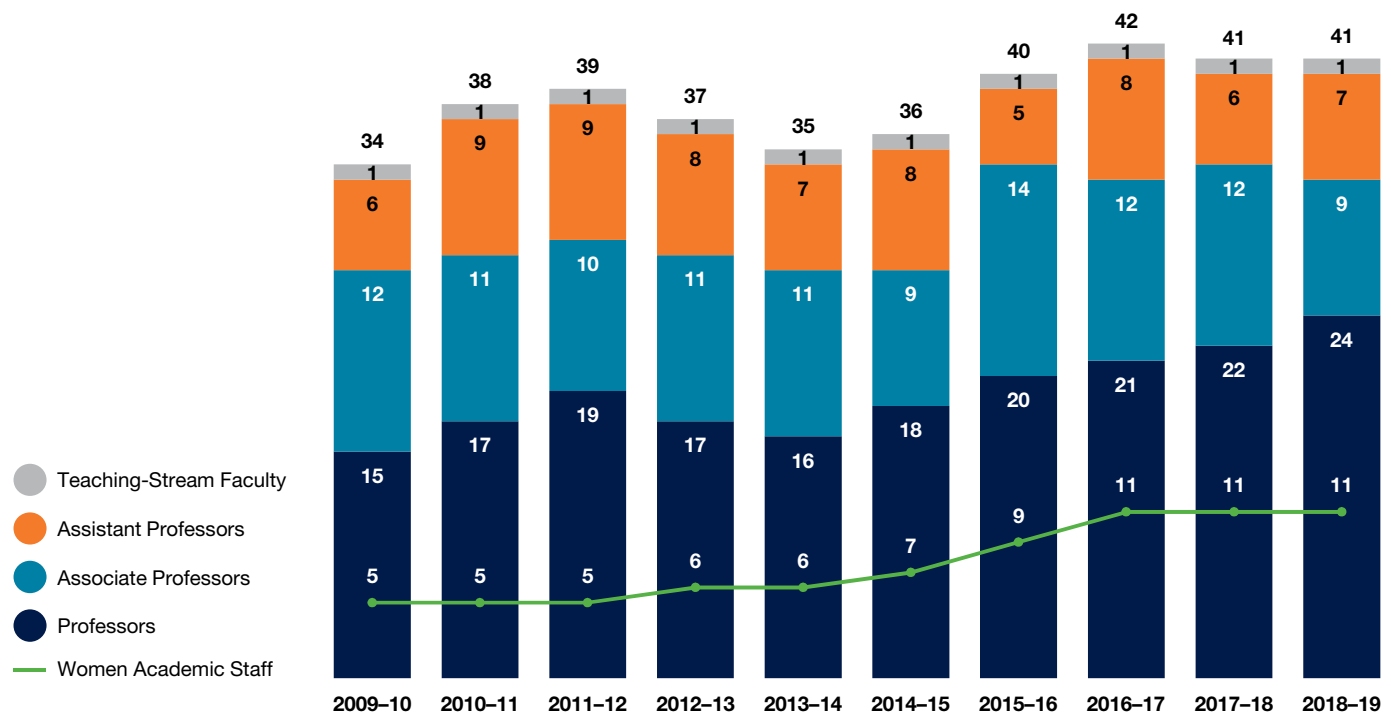
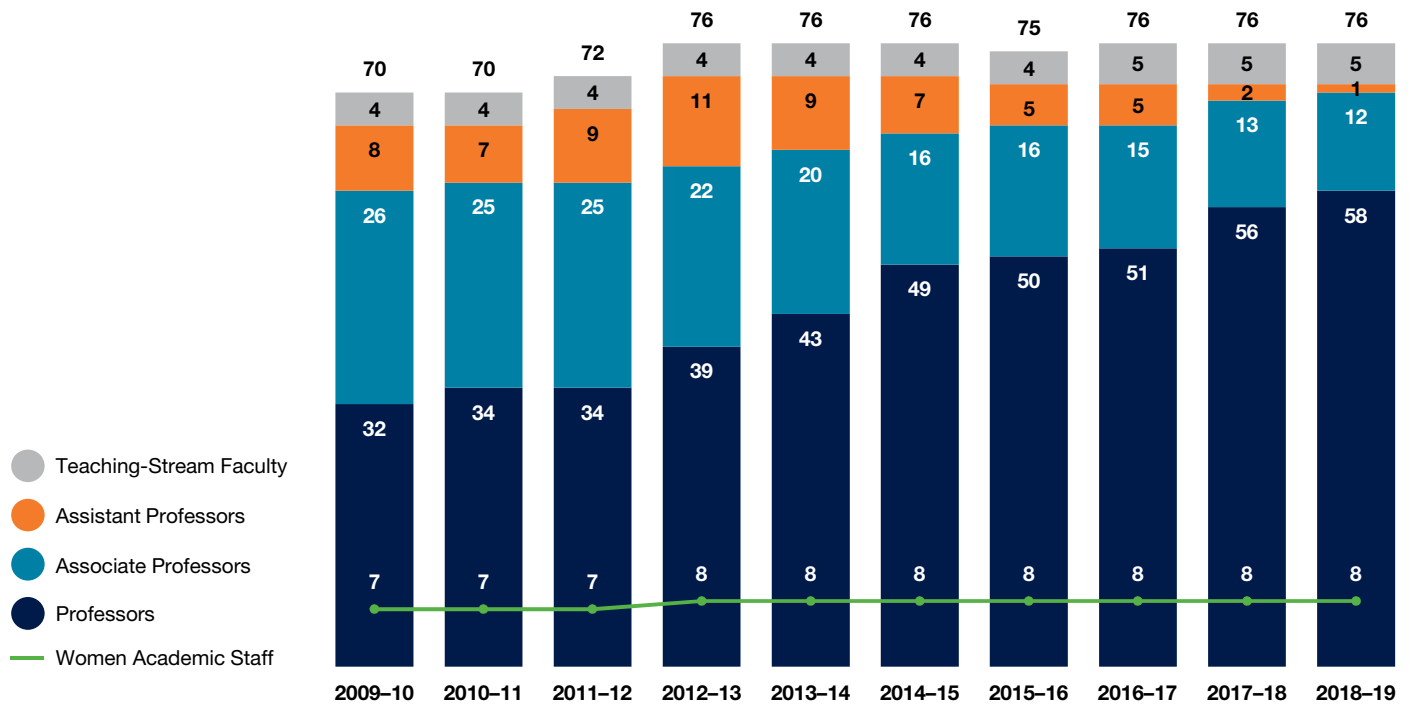


Figure H.5 Department of Civil & Mineral Engineering:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019



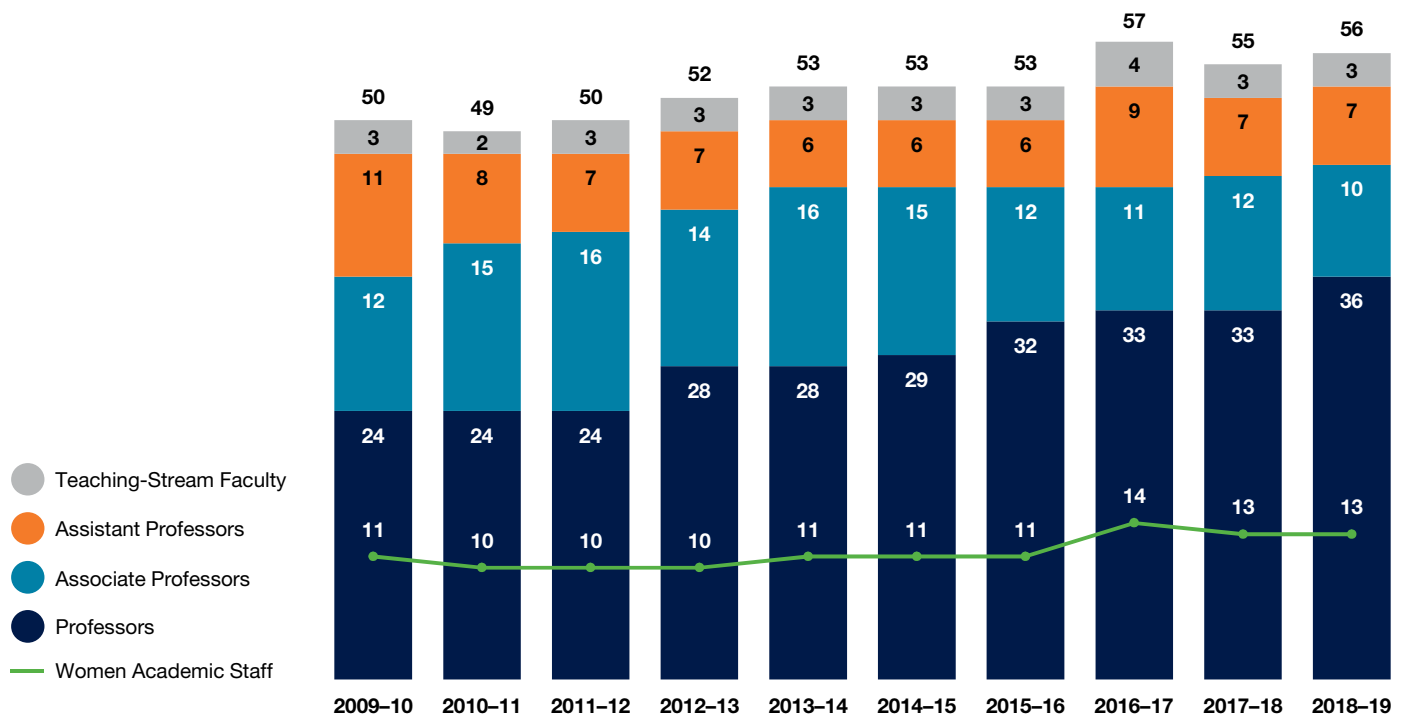
| | 2009–10 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Assistant Professors | 6 | 9 | 9 | 8 | 7 | 8 | 5 | 8 | 6 | 7 |
| Women Assistant Professors | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 4 | 4 | 4 |
| % Women Assistant Professors | 33.3% | 22.2% | 22.2% | 37.5% | 28.6% | 37.5% | 40.0% | 50.0% | 66.7% | 57.1% |
| Associate Professors | 12 | 11 | 10 | 11 | 11 | 9 | 14 | 12 | 12 | 9 |
| Women Associate Professors | 3 | 3 | 2 | 2 | 3 | 2 | 4 | 4 | 3 | 2 |
| % Women Associate Professors | 25.0% | 27.3% | 20.0% | 18.2% | 27.3% | 22.2% | 28.6% | 33.3% | 25.0% | 22.2% |
| Professors | 15 | 17 | 19 | 17 | 16 | 18 | 20 | 21 | 22 | 24 |
| Women Professors | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 |
| % Women Professors | 0.0% | 0.0% | 5.3% | 5.9% | 6.3% | 11.1% | 15.0% | 14.3% | 18.2% | 20.8% |
| Teaching-Stream Faculty | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Women Teaching-Stream Faculty | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Women Teaching-Stream Faculty | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total Tenured and Tenure Stream | 33 | 37 | 38 | 36 | 34 | 35 | 39 | 41 | 40 | 40 |
| Women Tenured and Tenure Stream | 5 | 5 | 5 | 6 | 6 | 7 | 9 | 11 | 11 | 11 |
| % Women Tenured and Tenure Stream | 15.2% | 13.5% | 13.2% | 16.7% | 17.6% | 20.0% | 23.1% | 26.8% | 27.5% | 27.5% |
| Total Academic Staff | 34 | 38 | 39 | 37 | 35 | 36 | 40 | 42 | 41 | 41 |
| Women Academic Staff | 5 | 5 | 5 | 6 | 6 | 7 | 9 | 11 | 11 | 11 |
| % Women Academic Staff | 14.7% | 13.2% | 12.8% | 16.2% | 17.1% | 19.4% | 22.5% | 26.2% | 26.8% | 26.8% |

Figure H.6 The Edward S. Rogers Sr. Department of Electrical & Computer Engineering: Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019



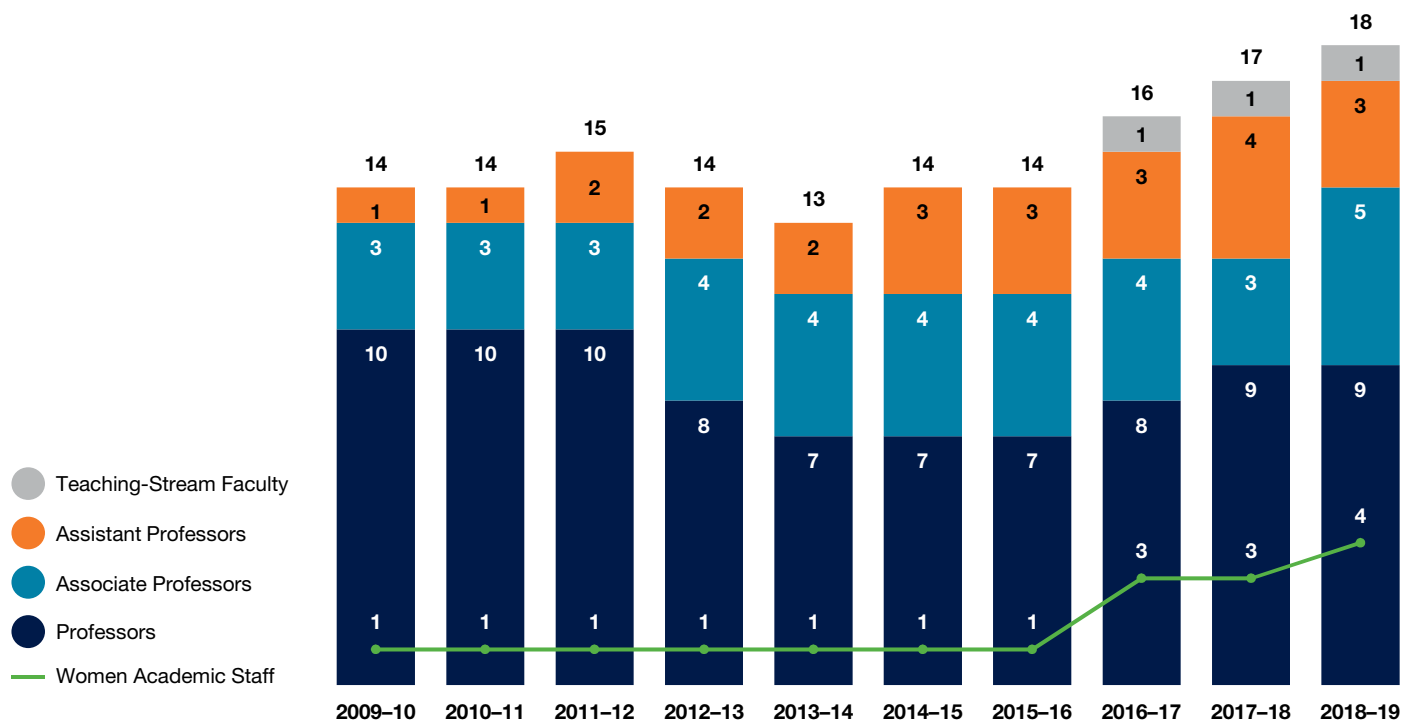
| | | | | | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Assistant Professors | 8 | 7 | 9 | 11 | 9 | 7 | 5 | 5 | 2 | 1 |
| Women Assistant Professors | 2 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| % Women Assistant Professors | 25.0% | 28.6% | 22.2% | 18.2% | 11.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Associate Professors | 26 | 25 | 25 | 22 | 20 | 16 | 16 | 15 | 13 | 12 |
| Women Associate Professors | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 0 | 0 |
| % Women Associate Professors | 15.4% | 16.0% | 16.0% | 18.2% | 20.0% | 25.0% | 18.8% | 20.0% | 0.0% | 0.0% |
| Professors | 32 | 34 | 34 | 39 | 43 | 49 | 50 | 51 | 56 | 58 |
| Women Professors | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 4 | 7 | 7 |
| % Women Professors | 0.0% | 0.0% | 0.0% | 2.6% | 4.7% | 6.1% | 8.0% | 7.8% | 12.5% | 12.1% |
| Teaching-Stream Faculty | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| Women Teaching-Stream Faculty | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % Women Teaching-Stream Faculty | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 20.0% | 20.0% | 20.0% |
| Total Tenured and Tenure Stream | 66 | 66 | 68 | 72 | 72 | 72 | 71 | 71 | 71 | 71 |
| Women Tenured and Tenure Stream | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| % Women Tenured and Tenure Stream | 9.1% | 9.1% | 8.8% | 9.7% | 9.7% | 9.7% | 9.9% | 9.9% | 9.9% | 9.9% |
| Total Academic Staff | 70 | 70 | 72 | 76 | 76 | 76 | 75 | 76 | 76 | 76 |
| Women Academic Staff | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| % Women Academic Staff | 10.0% | 10.0% | 9.7% | 10.5% | 10.5% | 10.5% | 10.7% | 10.5% | 10.5% | 10.5% |

Figure H.7 Department of Mechanical & Industrial Engineering:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019



| | | | | | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Assistant Professors | 11 | 8 | 7 | 7 | 6 | 6 | 6 | 9 | 7 | 7 |
| Women Assistant Professors | 6 | 5 | 5 | 4 | 2 | 2 | 1 | 3 | 3 | 3 |
| % Women Assistant Professors | 54.5% | 62.5% | 71.4% | 57.1% | 33.3% | 33.3% | 16.7% | 33.3% | 42.9% | 42.9% |
| Associate Professors | 12 | 15 | 16 | 14 | 16 | 15 | 12 | 11 | 12 | 10 |
| Women Associate Professors | 2 | 3 | 3 | 3 | 6 | 5 | 5 | 5 | 5 | 4 |
| % Women Associate Professors | 16.7% | 20.0% | 18.8% | 21.4% | 37.5% | 33.3% | 41.7% | 45.5% | 41.7% | 40.0% |
| Professors | 24 | 24 | 24 | 28 | 28 | 29 | 32 | 33 | 33 | 36 |
| Women Professors | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 5 | 4 | 5 |
| % Women Professors | 8.3% | 8.3% | 8.3% | 10.7% | 10.7% | 13.8% | 15.6% | 15.2% | 12.1% | 13.9% |
| Teaching-Stream Faculty | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 |
| Women Teaching-Stream Faculty | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| % Women Teaching-Stream Faculty | 33.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 25.0% | 33.3% | 33.3% |
| Total Tenured and Tenure Stream | 47 | 47 | 47 | 49 | 50 | 50 | 50 | 53 | 52 | 53 |
| Women Tenured and Tenure Stream | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 13 | 12 | 12 |
| % Women Tenured and Tenure Stream | 21.3% | 21.3% | 21.3% | 20.4% | 22.0% | 22.0% | 22.0% | 24.5% | 23.1% | 22.6% |
| Total Academic Staff | 50 | 49 | 50 | 52 | 53 | 53 | 53 | 57 | 55 | 56 |
| Women Academic Staff | 11 | 10 | 10 | 10 | 11 | 11 | 11 | 14 | 13 | 13 |
| % Women Academic Staff | 22.0% | 20.4% | 20.0% | 19.2% | 20.8% | 20.8% | 20.8% | 24.6% | 23.6% | 23.2% |

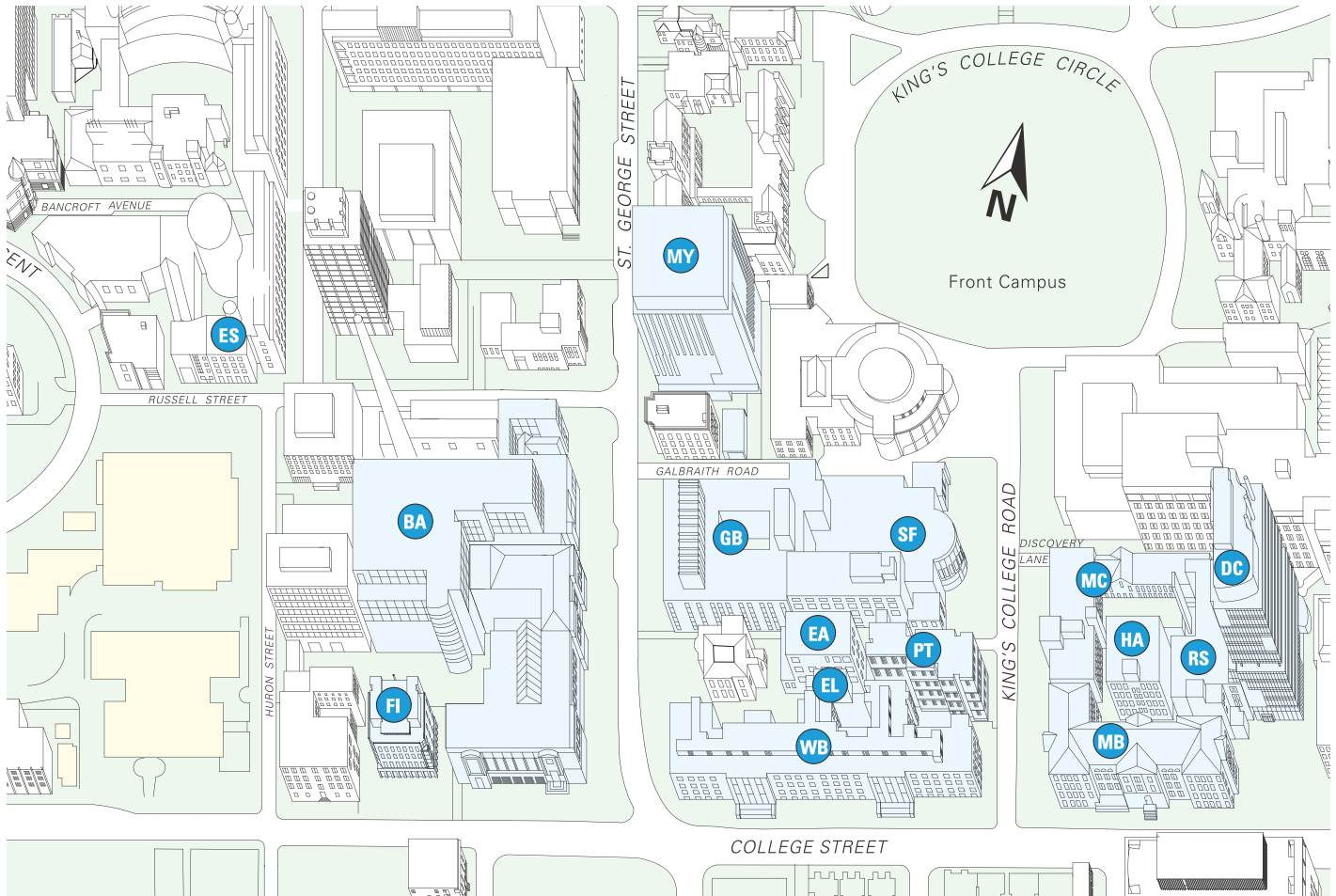
Figure H.8 Department of Materials Science & Engineering:
Academic Staff by Position with Percentage of Women, 2009–2010 to 2018–2019



| | | | | | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Assistant Professors | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 3 |
| Women Assistant Professors | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| % Women Assistant Professors | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 33.3% | 25.0% | 33.3% |
| Associate Professors | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 5 |
| Women Associate Professors | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| % Women Associate Professors | 33.3% | 33.3% | 33.3% | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 33.3% | 40.0% |
| Professors | 10 | 10 | 10 | 8 | 7 | 7 | 7 | 8 | 9 | 9 |
| Women Professors | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| % Women Professors | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 12.5% | 11.1% | 11.1% |
| Teaching-Stream Faculty | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Women Teaching-Stream Faculty | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Women Teaching-Stream Faculty | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total Tenured and Tenure Stream | 14 | 14 | 15 | 14 | 13 | 14 | 14 | 15 | 16 | 17 |
| Women Tenured and Tenure Stream | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 4 |
| % Women Tenured and Tenure Stream | 7.1% | 7.1% | 6.7% | 7.1% | 7.7% | 7.1% | 7.1% | 20.0% | 18.8% | 23.5% |
| Total Academic Staff | 14 | 14 | 15 | 14 | 13 | 14 | 14 | 16 | 17 | 18 |
| Women Academic Staff | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 4 |
| % Women Academic Staff | 7.1% | 7.1% | 6.7% | 7.1% | 7.7% | 7.1% | 7.1% | 18.8% | 17.6% | 22.2% |

Appendix I: The Engineering Precinct

The map below highlights buildings on the St. George campus that form the Engineering Precinct. Most of our buildings reside on the southern-most part of campus. Along with UTIAS in Downsview, our offices at 256 McCaul Street, 704 Spadina Avenue and the West Tower of MaRS Discovery District, these buildings house our students, faculty, staff, research and teaching spaces. For details on the buildings we occupy, please see *Chapter 11: Financial and Physical Resources*.



| | | | |
|-----------|--|-----------|--|
| BA | Bahen Centre for Information Technology | MC | Mechanical Engineering Building |
| DC | Donnelly Centre for Cellular and Biomolecular Research (CCBR) | MY | Myhal Centre for Engineering Innovation & Entrepreneurship |
| EA | Engineering Annex / Electro-Metallurgy Lab Building (South Side) | PT | D.L. Pratt Building |
| EL | Electrometallurgy Lab | RS | Rosebrugh Building |
| ES | Earth Sciences Centre | SF | Sandford Fleming Building |
| FI | Fields Institute | WB | Wallberg Building |
| GB | Galbraith Building | - | 704 Spadina Avenue [not pictured] |
| HA | Haultain Building | - | 256 McCaul Street [not pictured] |
| MB | Lassonde Mining Building | - | MaRS Discover District West Tower [not pictured] |
| | | - | UTIAS (Downsview) [not pictured] |

This section indicates the sources for data and information presented throughout this report. Sources are organized in order of appearance by figure number and title.

Figure Data Source

Faculty Leadership, 2018–2019

Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering. A current organizational chart is also available online at www.engineering.utoronto.ca/about/office-of-the-dean/#academiclead

Comparison of U of T Engineering with Ontario and Canada, 2017–2018

Enrolment, degrees granted and faculty data are based on the 2017 calendar year and come from the National Council of Deans of Engineering and Applied Science (NCDEAS) 2017 Resources Report, prepared by Engineers Canada and circulated to Canadian engineering deans in July 2018. An updated version of this report was not yet available at the time this Report went to print. Undergraduate enrolment figures exclude non-degree students and those doing a Professional Experience Year Co-op (PEY Co-op). Full-time equivalent (FTE) enrolment statistics represent averages that take into account all three terms of the year (winter, summer and fall). Undergraduate FTE shows the three-term total divided by two; Graduate FTE shows the three-term total divided by three. Research funding data comes from the Natural Sciences and Engineering Research Council (NSERC) search engine (www.nserc-crsng.gc.ca/ase-oro/index_eng.asp) with the following parameters: Selection Committees = Discovery Grants + Research Partnerships (excl CRCs & NCEs); Research Subjects = all engineering-related categories; Universities only; Fiscal Year = 2017–2018 (April to March). Major awards data comes from the Director, Awards and Honours, Faculty of Applied Science & Engineering, based on press releases and websites of individual awards for the 2017–2018 grant year (April to March).

Comparison of U of T Engineering with St. George Campus and University of Toronto, 2018–2019

All student enrolment statistics are based on headcount for Fall 2018 from the U of T Enrolment Reporting Cube (St. George and U of T statistics do not include Toronto School of Theology). All degrees awarded statistics come from ROSI and reflect September 2018 to June 2019 dates (St. George and U of T statistics do not include Toronto School of Theology). All sponsored-research funding statistics come from the U of T Research Reporting Cube, based on the 2017–2018 grant year, and exclude partner hospitals; includes all program types; data is current as of May 2019. Engineering academic staff statistics provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering (based on HRIS and published lists of faculty members). Engineering administrative and technical staff statistic from the Manager, Finance and Budget, Faculty of Applied Science & Engineering. U of T academic and administrative staff statistics come from U of T Facts and Figures 2018. Engineering total revenue provided by the Chief Financial Officer, Faculty of Applied Science & Engineering. U of T total revenue provided by the Office of the Vice-Provost, Planning & Budget. Engineering space statistic from U of T Office of Space Management data, March 2019. U of T and St. George space statistics from U of T Facts and Figures 2018, which is available online at: data.utoronto.ca/wp-content/uploads/2019/06/Facts-Figures-2018_final.pdf

Chapter 1: Undergraduate Studies

1.1a Applications, Offers, Registrations, Selectivity and Yield of First-Year Undergraduates, 2009 to 2018

All years' data for applications and offers are based on annual Admissions Committee reports to Engineering Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2009–2018, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Measure = Headcount.

1.1b Applications, Offers, Registrations, Selectivity and Yield of Domestic First-Year Undergraduates, 2009 to 2018

All years' data for applications and offers are based on annual Admissions Committee reports to Engineering Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2009–2018, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Domestic / International (DOM_INTL) = Domestic; Measure = Headcount.

1.1c Applications, Offers, Registrations, Selectivity and Yield of International First-Year Undergraduates, 2009 to 2018

All years data for applications and offers are based on annual Admissions Committee reports to Engineering Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2009–2018, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Domestic / International (DOM_INTL) = International; Measure = Headcount.

-
- 1.2 Ontario Secondary School Averages of Incoming First-Year Undergraduates and Retention Rate Between First and Second Year, 2009 to 2018**
Averages of incoming first-year students from Admissions Committee Report to Engineering Faculty Council (November). Retention rate is the proportion of students who successfully move on to second year in the fall semester following their first year.
-
- 1.3 Incoming First-Year Undergraduates with Percentage of Women and International Students, 2009 to 2018**
Headcount from the U of T Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018; Degree Type = Undergraduate; New Intake (NEWINTK) = Yes; Measure = Headcount; [Gender] and [DOM_INTL] parameters used to calculate percentages of women and international students, respectively. See footnote to Fig. 1.3 for more information about changes in the reporting of gender beginning in 2018.
-
- 1.4 Incoming First-Year Domestic and International Undergraduates, 2009 to 2018**
Headcount from the U of T Enrolment Master Files, source of the Enrolment Reporting Cube. Includes new and returning students. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018; Stage of Study (SESLEV) = Year 1; New Intake (NEWINTK) = Yes; Degree Type = Undergraduate; Measure = Headcount
-
- 1.5a Undergraduate Enrolment with Percentage of Women and International Students, 2009–2010 to 2018–2019**
Headcount from the U of T Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018; Degree Type = Undergraduate; Measure = Headcount; [Gender] and [DOM_INTL] parameters used to calculate percentages of women and international students, respectively. See footnote to Fig. 1.5a for more information about changes in the reporting of gender beginning in 2018.
-
- 1.5b Percentage of Women by Undergraduate Program, 2009–2010 to 2018–2019**
Headcount from the U of T Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Fall Terms for 2009–2018; Degree Type = Undergraduate; Gender = Female; Programs of study based on [Program] field
-
- 1.6 Undergraduates by Program, Year of Study and Professional Experience Year Co-op, 2018–2019**
Headcount from the U of T Enrolment Reporting Cube. Includes full-time students, part-time students and students on PEY Co-op. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Stage of Study (SESLEV) = Years 1–4; Fall 2018; Programs of study based on [Program] field; Degree Type = Undergraduate.
-
- 1.7 Undergraduates by Program, 2009–2010 to 2018–2019**
Headcount from the U of T Enrolment Reporting Cube. Includes full-time students, part-time students and students on PEY Co-op. Excludes students with special status. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018; Stage of Study (SESLEV) = Years 1–4; Degree Type = Undergraduate; Measure = Headcount; Programs of study based on [Program] field.
-
- 1.8a Number of Awards Received by Cohort with Total Number of Undergraduate Need-Based Award Recipients, 2009–2010 to 2018–2019**
Award data from the U of T Student Accounts Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Income / Awards – Undergraduate; Needs-based Awards; Level of Instruction = Undergraduate; Enrolment Status = All (e.g. FINCA, CANC, etc.); Stage of Study (SESLEV) = Years 1–4 (exclude any N/A); Sessions include most recent (current) academic year except for the Summer semester; Measure = Dollar amount
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- 1.8b Total Value of Undergraduate Financial Assistance and Percentage Distributed by Year of Study, 2009–2010 to 2018–2019**
Award data from the U of T Student Accounts Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Income / Awards – Undergraduate; Needs-based Awards; Level of Instruction = Undergraduate; Enrolment Status = All (e.g. incl. FINCA, CANC, etc.); Stage of Study (SESLEV) = Years 1–4 (exclude any N/A); Sessions include most recent (current) academic year except for the Summer semester; Measure = Distinct student count
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- 1.9a Undergraduate Degrees Awarded by Program, 2009–2010 to 2018–2019**
All data from ROSI download: 5EA (Graduated Students); Faculty = APSC (Applied Science & Engineering). Includes Fall (Nov), Spring (March) and Summer (June) convocations.
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1.9b Undergraduate Degrees Awarded by Gender, 2009–2010 to 2018–2019

All data from ROSI download: 5EA (Graduated Students); Faculty = APSC (Applied Science & Engineering). Includes Fall (Nov), Spring (March) and Summer (June) convocations.

1.9c U of T Engineering Degrees Awarded by Academic Area Compared with Canadian, and North American Degree Totals, 2017

U of T and Canadian statistics are based on the 2017 calendar year and come from Engineers Canada Report of Enrolment & Degrees Granted (*Canadian Engineers for Tomorrow, Trends in Engineering Enrolment and Degrees Awarded 2013–2017*), released November 2018, and available online at: <https://engineerscanada.ca/publications/canadian-engineers-for-tomorrow-2017>. American statistics used to calculate North American percentages are based on the 2017–2018 academic year and come from the 2018 American Society of Engineering Educators (ASEE) Report, available online at: www.asee.org/papers-and-publications/publications/college-profiles

1.10a Undergraduate Full-Time Equivalent Student-to-Faculty Ratios by Academic Area, 2018–2019

Number of undergraduates from the U of T Enrolment Reporting Cube. Excludes students on PEY Co-op and students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Fall 2018, Degree Type = Undergraduate; Associated Org = blank (to exclude PEY Co-op); Measure = Headcount. Faculty Total does not include teaching done for Engineering by extra-divisional units (especially Arts & Science departments). Results are not adjusted for departmental contributions to shared first-year curriculum, Engineering Science or Engineering minors. Faculty counts are provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering and used on a slip-year basis: totals from July 2018 are used to compare with 2018–2019 student counts. Calculation includes tenured, tenure-stream and teaching-stream faculty.

1.10b Undergraduate Full-Time Equivalent Student-to-Faculty Ratios, 2018–2019

Number of undergraduates from the U of T Enrolment Reporting Cube. Excludes students on PEY Co-op and students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Fall 2018, Degree Type = Undergraduate; Associated Org = blank (to exclude PEY Co-op); Measure = Headcount. Does not include teaching done for Engineering by extra-divisional units (especially Arts & Science departments). Faculty counts are provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering and used on a slip-year basis: totals from July 2018 are used to compare with 2018–2019 student counts. Calculation includes tenured, tenure-stream and teaching-stream faculty.

1.11a Number of Students and Percentage of Class Graduating with Honours, 2010 to 2019

Data provided by the Office of the Faculty Registrar, Faculty of Applied Science & Engineering.

1.11b Number of Students on the Dean's Honour List by Term and Academic Area, Fall 2014 to Winter 2019

Data provided by the Office of the Faculty Registrar, Faculty of Applied Science & Engineering. Based on ROSI 4FF download; Academic Standing Code = H*

Chapter 2: Graduate Studies

2.1a International and Domestic Graduate Students by Degree Type, with Percentage of International Students, 2009–2010 to 2018–2019

Enrolment counts are from the U of T Enrolment Reporting Cube and exclude special status students. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018, Measure = Headcount. [DOM_INTL] parameter used to calculate percentage of international students.

2.1b Graduate Students by Degree Type and Gender with Percentage of Women, 2009–2010 to 2018–2019

Enrolment counts are from the U of T Enrolment Reporting Cube and exclude special status students. Cube Parameters: Faculty = Applied Science & Engineering; All Fall Terms for 2009–2018; Measure = Headcount. [Gender] parameter used to calculate percentage of women. See footnote to Fig. 2.1b for more information about changes in the reporting of gender beginning in 2018.

2.1c Graduate Student Enrolment by Full-Time Equivalent (FTE) and Headcount (HC) by Academic Area, 2009–2010 to 2018–2019

Enrolment counts are from the U of T Enrolment Reporting Cube and exclude special status students. Cube Parameters: Faculty = Applied Science & Engineering; Measure = Headcount or Total FTE (UAR). Headcounts are reported for all fall terms from 2009–2018. FTEs are counted by academic year as reported in the cube (May to April).

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- 2.2a Undergraduate and Graduate Full-Time Equivalent Student-to-Faculty Ratios, 2009–2010 to 2018–2019**
Number of FTE undergraduates is from the U of T Enrolment Reporting Cube, excluding students on PEY Co-op and students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Fall terms 2009–2018; Associated Org = blank (to exclude PEY Co-op); Degree Type = Undergraduate; Measure = Headcount. To calculate Undergraduate FTEs, part-time students are counted as 0.3 FTE. Number of FTE graduate students is from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Applied Science & Engineering; Fall terms 2009–2018; Measure = Total FTE (UAR); excludes students with special status. Number of faculty included in the calculation is provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering and used on a slip-year basis: totals from July 2018 are used to compare with 2018–2019 student counts. Graduate ratios include only tenured and tenure-stream faculty. Undergraduate ratios also include teaching stream faculty.
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- 2.2b Ratio of Undergraduate to Graduate Full-Time Equivalent Students, 2009–2010 to 2018–2019**
Number of FTE undergraduates is from the U of T Enrolment Reporting Cube, excluding students on PEY Co-op and students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Fall terms 2009–2018; Associated Org = blank (to exclude PEY Co-op); Degree Type = Undergraduate; Measure = Headcount. To calculate undergraduate FTEs, part-time students are counted as 0.3 FTE. Number of FTE graduate students is from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Applied Science & Engineering; Fall terms 2009–2018; Measure = Total FTE (UAR); Includes all degree types but excludes students with special status.
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- 2.2c FTE Graduate Student-to-Faculty Ratios by Academic Area and Degree Type, 2018–2019**
Number of FTE graduate students is from the U of T Enrolment Reporting Cube. Cube Parameters: Faculty = Applied Science & Engineering; Fall 2018; Measure = Total FTE (UAR). Includes all degree types but excludes students with special status. The number of graduate students per department is adjusted as per the budget calculation for inter-departmental graduate student supervision. Faculty counts are provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and are used on a slip-year basis: totals from July 2018 are used to compare with 2018–2019 student counts. Includes tenured and tenure-stream faculty only.
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- 2.3 Domestic and International PhD Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019**
All data from ROSI download: 4BEG (Admissions Statistics). Students who have fast-tracked from MASc programs into PhD programs are calculated separately (see Fig. 2.8a) but have been included in this figure as applications, offers and admissions in order to more accurately reflect total PhD student intake.
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- 2.4 Domestic and International MASc Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019**
All data from ROSI download: 4BEG (Admissions Statistics)
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- 2.5 Domestic and International MEng and MHSc Students: Applications, Offers, Registrations, Selectivity and Yield, 2009–2010 to 2018–2019**
All data from ROSI download: 4BEG (Admissions Statistics).
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- 2.6a Graduate Student Funding by Category, 2008–2009 to 2017–2018**
Data from 2009–2010 onward was obtained from the U of T Student Accounts Reporting Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Awards – Grad, Stipend, UT Employment; excludes Awards – Undergraduate, Waiver. Data for 2008–2009 was obtained from the U of T Graduate Student Income Reporting Cube. Includes funding from all sources except work-study employment income. Student funding reported by academic year (September to August).
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- 2.6b Graduate Student Funding by Category and Academic Area, 2017–2018**
Data obtained from the U of T Student Accounts Reporting Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Awards – Grad, Stipend, UT Employment; excludes Awards – Undergraduate, Waiver. Includes funding from all sources except work-study employment income. Student funding reported by academic year (September to August).
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- 2.7a Total External Graduate Student Scholarships by Source, 2008–2009 to 2017–2018**
Data from 2009–2010 onward was obtained from the U of T Student Accounts Reporting Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Income / Awards – Grad; Award Income Source = External. Data for 2008–2009 was obtained from the U of T Graduate Student Income Reporting Cube. Parameters: Award Income only. Student funding reported by academic year (September to August).
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2.7b Number of NSERC Graduate Student Award Recipients by Academic Area, 2008–2009 to 2017–2018

Data from 2009–2010 onward was obtained from the U of T Student Accounts Reporting Cube. Parameters: Faculty = Applied Science & Engineering; Transaction Type = Income / Awards – Grad; Award Income Source = Federal – Natural Sciences and Engineering Research Council. Data for 2008–2009 was obtained from the U of T Graduate Student Income Reporting Cube. Parameters: Award Income only. Source = Federal – Natural Sciences and Engineering Research Council. Measure = Distinct Student Count. Student funding reported by academic year (September to August).

2.8a Number of Students Fast-Tracked from MASc to PhD by Academic Area, 2009–2010 to 2018–2019

All data from ROSI download: 4FF (Student Registrations). Fast-tracked students are identified by POST codes that end in 'PHD U' and are counted when prior session POST code was a Masters degree (MASc or MEng). To reflect fast-tracking practice, an academic year is defined as Summer-Fall-Winter (May to April).

2.8b Number of Direct-Entry PhD Students by Academic Area, 2009–2010 to 2018–2019

All data from ROSI download: 4FF (Student Registrations). Include all PhD students where prior session POST code was blank or AE NDEGP (recently-completed UGrad). Reported by academic year defined as Summer-Fall-Winter (May to April).

2.9 Time to Completion for PhD, MASc, MEng and MHSc Students, 2009–2010 to 2018–2019

All data from ROSI download: 4BEA (Years to Graduate), originally created for Ontario Council of Graduate Studies (OCGS) reporting purposes. The data reflects median values based on the total number of terms in which a student is registered. Leaves, lapses and (in most cases) the term in which the convocation occurs are excluded. Where a student is fast-tracked from the MASc into a PhD, the total time for both programs is counted. Full-time, extended full-time and part-time MEng students are distinguished for greater clarity and accuracy.

2.10 Graduate Degrees Awarded by Degree Type and Gender, 2009–2010 to 2018–2019

All data from ROSI download: 5EA (Graduated Students); Faculty = APSC (Applied Science & Engineering).

2.11 ELITE Emphases Awarded, 2009–2010 to 2018–2019

ELITE eligibility based on year of graduation and successful completion of a minimum of 4 ELITE-designated courses. Data provided by the Vice-Dean Graduate Studies, Faculty of Applied Science & Engineering.

Chapter 3: Research

3.1a Research Infrastructure Funding and Research Operating Funding, 2008–2009 to 2017–2018

Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Infrastructure Funding includes the following programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program.

3.1b Research Operating Funding by Year, Source and Funding per Faculty Member, 2008–2009 to 2017–2018

Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program. Faculty data is provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and here includes tenured and tenure-stream faculty only, as reported each July. Faculty counts are used on a slip-year basis: e.g. those reported in July 2017 (for academic year 2016–2017) are linked to Grant Year 2018 (Apr 2017 to Mar 2018).

3.1c Tri-Agency and NCE Support: CIHR, NSERC and NCE Funding, 2008–2009 to 2017–2018

Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018).

3.2a NSERC Funding, 2017–2018

Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Sponsor = Natural Sciences & Engineering. Grant Year = 2018.

3.2b NSERC Industrial Partnership Funding by Program, 2008–2009 to 2017–2018

Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Sponsor = Natural Sciences & Engineering / Research Partnerships Programs

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- 3.2c Industrial Partnerships as a Percentage of Total NSERC Funding, 2008–2009 to 2017–2018**
Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Sponsor = Natural Sciences & Engineering.
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- 3.2d NSERC Research Grant Funding by Program, 2008–2009 to 2017–2018**
Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Sponsor = Natural Sciences & Engineering.
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- 3.3a Canadian Peer Universities vs. University of Toronto Share of NSERC Funding for Engineering Cumulative Five-Year Share, 2013–2014 to 2017–2018**
All data from NSERC Award Search Engine: www.nserc-crsng.gc.ca/ase-oro/index_eng.asp. Based on Selection Committees for Discovery and Partnership Programs, but not Scholarships and Fellowships. Excludes Canada Research Chairs and Networks of Centres of Excellence and does not include indirect costs of research. Research Subjects = all engineering and technology-related fields. Organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018).
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- 3.3b U of T Annual Share of NSERC Funding in Engineering, 2008–2009 to 2017–2018**
All data from NSERC Award Search Engine: www.nserc-crsng.gc.ca/ase-oro/index_eng.asp. Based on Selection Committees for Discovery and Partnership Programs, but not Scholarships and Fellowships. Excludes Canada Research Chairs and Networks of Centres of Excellence and does not include indirect costs of research. Research Subjects = all engineering and technology-related fields. Organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018).
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- 3.4 Distribution of Research Operating Funding by Academic Area, 2008–2009 to 2017–2018**
Data from the U of T Research Information System (RIS) is current as of May 2019 and adjusted to reflect each PI's department of budgetary appointment. Organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program.
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- 3.5a Industry Research Funding by Academic Area, 2008–2009 to 2017–2018**
Data from the U of T Research Information System (RIS) is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Industry = Corporate.
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- 3.5b Industry Research Funding Sources, 2018**
Data from the U of T Research Information System (RIS) and the Corporate & Foundation Partnerships Office, Faculty of Applied Science and Engineering. RIS data is current as of May 2019 and organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Industry = Corporate.
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- 3.5c Industry Partners, 2018–2019**
Data from the U of T Research Information System (RIS) is current as of May 2019. Industry = Corporate. Additional information gathered from selected websites (e.g. those of Industrial Research Chairs and major research consortia) and provided by individual departments within the Faculty of Applied Science & Engineering.
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- 3.6a Engineering Invention Disclosures by Academic Area, 2014–2015 to 2018–2019**
Data from the Report of U of T Commercialization Indicators, Annual Supplement for FY2019, provided by the Office of the Vice President, Research. Data current as of May 1, 2019.
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- 3.6b U of T Invention Disclosures by Faculty, 2018–2019**
Data from the Report of U of T Commercialization Indicators, Annual Supplement for FY2019, provided by the Office of the Vice President, Research. Data current as of May 1, 2019.
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- 3.6c U of T Patent Applications by Faculty, 2018–2019**
Data from the Report of U of T Commercialization Indicators, Annual Supplement for FY2019, provided by the Office of the Vice President, Research. Data current as of May 1, 2019.
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Chapter 4: Cross-Faculty Education and Experiential Learning

- 4.1a Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2009–2010 to 2018–2019**
Information provided by the Cross-Disciplinary Programs Office, Faculty of Applied Science & Engineering
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- 4.1b Students Graduating with an Engineering Business Minor or Certificate, 2011–2012 to 2018–2019**
Information provided by the Cross-Disciplinary Programs Office, Faculty of Applied Science & Engineering.
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- 4.2a Undergraduate Participation in Summer Research Opportunities, 2010 to 2019**
Information regarding Canadian placements provided by the Registrar's Office, Faculty of Applied Science & Engineering. International placement statistics provided by the U of T Centre for International Experience.
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- 4.2b Undergraduate Participation in Summer Research Opportunities by Academic Area, 2019**
Information regarding Canadian placements provided by the Registrar's Office, Faculty of Applied Science & Engineering. International placement statistics provided by the U of T Centre for International Experience.
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- 4.3a Engineering Undergraduate Students Participating in PEY Co-op with Percentage Participation, 2009–2010 to 2018–2019**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.
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- 4.3b Canadian and International PEY Co-op Positions, 2009–2010 to 2018–2019**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.
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- 4.3c PEY Co-op Employers, 2009–2010 to 2018–2019**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.

Chapter 5: Awards and Honours

- 5.1 Summary of Major International, National and Provincial Awards and Honours, 2009 to 2018**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
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- 5.2a Number of Major National and International Awards Received by U of T Engineering Compared to Other Canadian Engineering Faculties, 2018**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
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- 5.2b Percentage of Total Canadian Engineering Faculty Members and Percentage of Major Awards Received by Canadian Engineering Faculties, 2018**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering. Faculty FTEs are based on the National Council of Deans of Engineering and Applied Science (NCDEAS) 2017 Resources Report prepared by Engineers Canada and circulated to Canadian engineering deans in July 2018.
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- 5.3 Number of Awards Received by U of T Engineering Faculty Compared to Other Canadian Engineering Faculties, 2014 to 2018**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
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- Text Selected Awards Received by Faculty**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
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- Text Selected Awards Received by Staff, April 2018 to April 2019**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
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Text **U of T Engineering Staff and Faculty Awards, 2015–2016 to 2018–2019**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.

Text **Engineering Alumni Network Awards, 2015–2016 to 2018–2019**
Information provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

Chapter 6: World Recognition by Rankings

QS World University Rankings for Engineering and Technology

6.1a **QS Top 50 World Universities, 2019**
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/university-subject-rankings/2019/engineering-technology

6.1b **QS Top North American Public Universities, 2019**
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/university-subject-rankings/2019/engineering-technology

6.1c **Canadian U15 Universities in QS Top 200, 2019**
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/university-subject-rankings/2019/engineering-technology

6.1d **Canadian Universities in QS Top 200 by Subject, 2019**
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/university-subject-rankings/2019/engineering-technology

Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Technology

6.2a **THE Top 50 World Universities, 2019**
Data from THE World University Ranking website: www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/engineering-and-IT

6.2b **THE Top North American Public Universities, 2019**
Data from THE World University Ranking website: www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/engineering-and-IT

6.2c **Canadian U15 Universities in THE Top 200, 2019**
Data from THE World University Ranking website: www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/engineering-and-IT

Academic Ranking of World Universities (ARWU) for Engineering Subjects

6.3 **Canadian Universities in ARWU Top 200 by Subject, 2018**
Data from ARWU website: www.shanghairanking.com/Shanghairanking-Subject-Rankings-2018/index.html

National Taiwan University (NTU) Performance Ranking of Engineering Papers

6.4a **NTU Top 60 World Universities, 2018**
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities website: nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2018. Data compiled from Thomson Reuters' science citation indexes.

6.4b **NTU Top North American Public Universities, 2018**
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities website: nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2018. Data compiled from Thomson Reuters' science citation indexes.

6.4c Canadian U15 Universities in NTU Top 200, 2018

Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities website: nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2018. Data compiled from Thomson Reuters' science citation indexes.

6.4d Canadian Universities in NTU Top 200 by Subject, 2018

Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities website: nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2018. Data compiled from Thomson Reuters' science citation indexes.

Rankings Based on Publications and Citations / Summary of Ranking Results

6.5a Number of Engineering Publications Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2013 to 2017

Data from Thomson Reuters InCites™ covering 2013 to 2017. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Schema = Essential Science Indicators (Engineering, Materials Science).

6.5b Summary of U15 Bibliometrics for Publications, 2013 to 2017

Data from Thomson Reuters InCites™ covering 2013 to 2017. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Schema = Essential Science Indicators (Engineering, Materials Science). Faculty counts for analysis of U15 citations per faculty member are from the Engineers Canada 2017 Resources Report.

6.6a Number of Engineering Citations Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2013 to 2017

Data from Thomson Reuters InCites™ covering 2013 to 2017. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Schema = Essential Science Indicators (Engineering, Materials Science).

6.6b Summary of U15 Bibliometrics for Citations, 2013 to 2017

Data from Thomson Reuters InCites™ covering 2013 to 2017. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Schema = Essential Science Indicators (Engineering, Materials Science). Faculty counts for analysis of U15 citations per faculty member are from the Engineers Canada 2017 Resources Report.

6.7 Summary of University of Toronto Engineering Performance in World Rankings

Compiled from other figures in this chapter.

Chapter 7: Advancement

7.1a Philanthropic Support, 2018–2019

Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

7.1b Philanthropic Support, 2009–2010 to 2018–2019

Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

7.2 Gift Designation, 2017–2018

Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

Chapter 8: Communications

8.1a Proportion of U of T Engineering Media Stories by Outlet Location, 2018–2019

Information collected via Cormex Research (May 1, 2018 to April 30, 2019)

8.1b Proportion of U of T Engineering Impressions by Strategic Priority Area, 2018–2019

Information collected via Cormex Research (May 1, 2018 to April 30, 2019)

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- 8.1c Proportion of U of T Engineering Impressions by Academic Area, 2018–2019**
Information collected via Cormex Research (May 1, 2018 to April 30, 2019)
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- 8.2a Audience Engagement on Twitter from May 1, 2018 to April 30, 2019**
Data collected via Sprout Social (May 1, 2018 to April 30, 2019)
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- 8.2b Audience Engagement on Facebook from May 1, 2018 to April 30, 2019**
Data collected via Sprout Social (May 1, 2018 to April 30, 2019))
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- 8.2c Audience Engagement on Instagram from May 1, 2018 to April 30, 2019**
Data collected via Sprout Social (May 1, 2018 to April 30, 2019))
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- 8.3 Summary of Analytics for U of T Engineering Faculty site and U of T Engineering News site, 2018–2019**
Websites: engineering.utoronto.ca and news.engineering.utoronto.ca. Information provided by Engineering Strategic Communications, Faculty of Applied Science & Engineering. Website statistics sourced from Google Analytics (May 1, 2018 to April 30, 2019)
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- 8.4 Social Media Referrals for U of T Engineering News, 2018–2019**
Information provided by Engineering Strategic Communications, Faculty of Applied Science & Engineering. Website statistics sourced from Google Analytics (May 1, 2018 to April 30, 2019)
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- 8.5 Top Stories on the Engineering News and U of T News Websites, 2018–2019**
Information provided by Engineering Strategic Communications, Faculty of Applied Science & Engineering and University of Toronto Strategic Communications. Website statistics sourced from Google Analytics (May 1, 2018 to April 30, 2019)
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- 8.6 Summary of Analytics for Discover Engineering, You Belong Here and Engineering Graduate Studies sites, 2018–2019**
Websites: discover.engineering.utoronto.ca, admit.engineering.utoronto.ca and gradstudies.engineering.utoronto.ca. Website statistics sourced from Google Analytics (May 1, 2018 to April 30, 2019)

Chapter 9: International Initiatives

- Text International Students and Exchanges**
Information provided by the Centre for International Experience.
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- Text Selected International Education and Research Partnerships**
Information provided by the Centre for International Experience.

Chapter 10: Diversity

- 10.1 Continent of Origin: Undergraduate and Graduate Students, Fall 2018**
Student counts from the U of T Enrolment Reporting Cube, excluding students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Year = Fall 2018; Degree Type = Undergraduate or one of 3 Graduate programs; Measure = Headcount; Calculations based on Continent/Country of Citizenship [CUNCIT] parameter.
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- 10.2 Percentage of Women Students, 2009–2010 to 2018–2019**
Student counts from the U of T Enrolment Reporting Cube, excluding students with special status. Cube Parameters: Faculty = Applied Science & Engineering; Year = Fall 2018; Degree Type = Undergraduate or one of 3 Graduate programs; Measure = Headcount; Calculations based on [Gender] category.
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- 10.3 Total Number of Faculty with Percentage of Women Overall and by Academic Rank, 2005–2006 to 2018–2019**
Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering.
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10.4 Percentage of Women Faculty at U of T Engineering compared with Women Faculty in Ontario and Canadian Engineering Faculties, 2017–2018

Information from the 2017 Resources Survey prepared by Engineers Canada for the National Council of Deans of Engineering and Applied Science (NCDEAS) and circulated to Canadian engineering deans in July 2018. Data represents faculty counts as of November 15, 2017. An updated version of this report was not yet available at the time this Report went to print.

10.5 Canada Research Chairs with Number and Percentage of Women Chairholders, 2005 to 2019

Information provided by the Divisional Reporting and Information Analyst, Faculty of Applied Science & Engineering. Includes data sourced from the Office of the Vice-President, Research & Innovation and from the Canada Research Chairs Program website: www.chairs-chaieres.gc.ca/home-accueil-eng.aspx

Chapter 11: Financial and Physical Resources

11.1 Total Revenue, 2009–2010 to 2018–2019

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.2 Total Central Costs, 2009–2010 to 2018–2019

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.3 Budget Data, 2009–2010 to 2018–2019

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.4 Revenue Sources, 2018–2019

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.5 Revenue Distribution, 2018–2019

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.6 Total Operating Budget: Breakdown by Expense, 2018–2019 (net of central university costs)

Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.

11.7 Summary of Buildings and Areas Occupied by the Faculty of Applied Science & Engineering, 2018–2019

Data provided by Director, Facilities & Infrastructure Planning, Faculty of Applied Science & Engineering.

Text Current Projects

Information provided by the Director, Facilities & Infrastructure Planning, Faculty of Applied Science & Engineering.

Appendices

A Outreach Programs

Information provided by Engineering Student Outreach Office, Faculty of Applied Science & Engineering.

B Time to Completion for Graduate Students

All data from ROSI 4BEA downloads (Years to Graduate), originally created for Ontario Council of Graduate Studies (OCGS) reporting purposes. The data reflects median values based on the total number of terms in which a student is registered. Leaves, lapses and (in most cases) the term in which the convocation occurs are excluded. Where a student is fast-tracked from the MASc into a PhD, the total time for both programs is counted. Full-time, extended full-time and part-time MEng students are distinguished for greater clarity and accuracy.

C Chairs and Professorships

Chairholders are reported as of the HR turnover date at the end of the reporting cycle, in this case, July 1, 2019, except in cases where new allocations (e.g. CRCs) have not yet been made public. List compiled from the following sources:

- Canada Research Chairs website: www.chairs-chaire.gc.ca/home-accueil-eng.aspx
- Industrial Research Chairs website: www.nserc-crsng.gc.ca/Professors-Professeurs/CFS-PCP/IRC-PCI_eng.asp
- Office of Advancement, Faculty of Applied Science & Engineering
- Office of the Vice-Dean, Research, Faculty of Applied Science & Engineering
- Assistant Dean, Administration, Faculty of Applied Science & Engineering
- Distinguished Professors and University Professors from the Office of the Vice-President & Provost websites: www.provost.utoronto.ca/distinguished-professors/ and www.provost.utoronto.ca/awards-funding/university-professors/

D Student Clubs and Teams

Information from the Engineering Society: www.skule.ca.

E Research Funding by Academic Area

Data from the U of T Research Information System (RIS) is current as of May 2019 and adjusted to reflect each PI's department of budgetary appointment. Organized by grant year (e.g., 2017–2018 = April 2017 to March 2018 = Grant Year 2018). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program. Faculty data is provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and here includes tenured and tenure-stream faculty only, as reported each July. Faculty counts are used on a slip-year basis: e.g. those reported in July 2017 (for academic year 2016-14) are linked to Grant Year 2018 (Apr 2017 - Mar 2018).

F Spinoff Companies

Information provided by the Office of the Vice President, Research & Innovation (OVPRI).

G Descriptions of Major Awards

Information from the Director, Awards and Honours, Faculty of Applied Science & Engineering.

H Academic Staff by Academic Area

Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering. Women academic staff include all ranks of professors in both the tenure and teaching streams.

I The Engineering Precinct

Information from Office of Space Management. Visit map.utoronto.ca for a full campus map.



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