# 6

We evaluate our position among global leaders in engineering research and education through a comprehensive series of metrics that include the quality of applicants to our programs and the awards and honours earned by our faculty members. International rankings are another measure of excellence, capturing our performance in terms of research influence, learning environment, knowledge transfer and other factors.

U of T Engineering has consistently ranked as the top engineering school in Canada across four organizations that have been producing world university rankings specific to engineering for 10 years or more: the Quacquarelli Symonds World University Rankings (QS), the Times Higher Education World University Rankings (THE), Academic Ranking of World Universities (ARWU) 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 and is the only Canadian university to appear within the top 50 in the three rankings for which metrics specific to engineering are published.

While each organization's assessments are unique and often distinct from the others, our high standing across all major rankings is one of the factors that enables us to attract top students, faculty and industry collaborators. We are focused on maintaining and enhancing our global reputation in the years to come.

## **Comprehensive University Rankings**

QS World University Rankings for Engineering and Information Technology

#### Figure 6.1a QS Top 50 World Universities, 2018

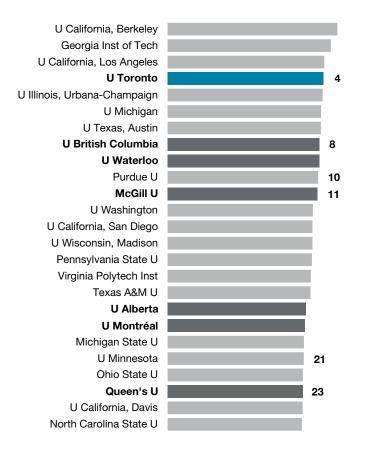
Massachusetts Inst of Tech Stanford U U Cambridge Swiss Fed Inst of Tech (ETH), Zürich Nanyang Tech U Imperial College London National U Singapore U Tokyo U Oxford Tsinghua U U California, Berkeley École Polytech Féd, Lausanne Harvard U Tokyo Inst of Tech Korea Adv Inst Sci & Tech (KAIST) Seoul National U Politecnico di Milano Hong Kong U of Sci and Tech National Taiwan U Peking U Kyoto U Delft U of Tech Universiti Malaya Georgia Inst of Tech Tech U Munich California Inst of Tech **U** Melbourne U New South Wales Shanghai Jiao Tong U U Hong Kong Carnegie Mellon U RWTH Aachen U National Tsing Hua U Politecnico di Torino U California, Los Angeles Monash U Zhejiang U Princeton U Tech U Berlin U Sydney KTH Royal Inst of Tech Chinese U Hong Kong **U** Toronto 43 Osaka U Pohang U of Sci And Tech Australian National U U Illinois, Urbana-Champaign Korea U National Chiao Tung U Tohoku U

U of T Engineering ranked 43rd in the most recent QS World University Rankings for Engineering and Information Technology. As in past years, ours was the only Canadian university to make the QS top 50. Shown in Figure 6.1b, our standing among North American public universities, our closest peers, remained in fourth place.

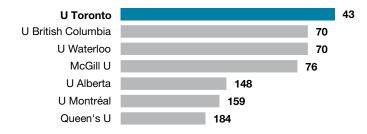
We continue to rank as the top Canadian engineering school in four of the seven engineering and information technology subjects (Chemical Engineering, Civil & Structural Engineering, Computer Science & Information Systems, Electrical & Electronic Engineering) and second in two of the others (Materials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

Data in this chapter include rankings published between August 2017 and July 2018.

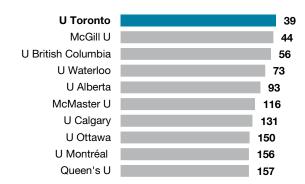
#### Figure 6.1b QS Top North American Public Universities, 2018



#### Figure 6.1c Canadian U15 Universities in QS Top 200, 2018

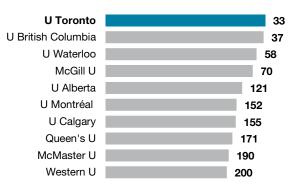


### Figure 6.1d Canadian Universities in QS by Subject, 2018

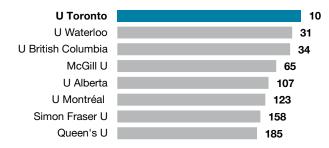


#### **Chemical Engineering**

#### **Civil & Structural Engineering**



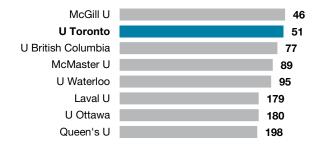
#### **Computer Science & Information Systems**



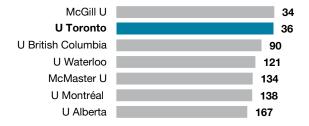
#### **Electrical & Electronic Engineering**

U Toronto		24
U British Columbia		47
U Waterloo		51
McGill U		70
U Alberta		99
U Montréal	16	67
U Calgary	17	3
Concordia U	17	4
McMaster U	17	8

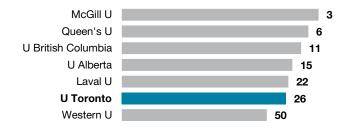
#### **Materials Sciences**



#### 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, 2017

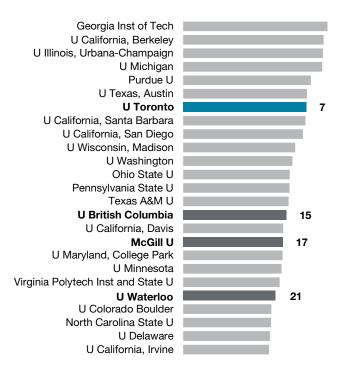
Stanford U	
California Inst of Tech	
U Oxford	
Massachusetts Inst of Tech	
U Cambridge	
Princeton U	
Peking U	
National U Singapore	
Swiss Federal Inst of Tech (ETH), Zurich	
Imperial College London	
Georgia Inst of Tech	
Carnegie Mellon U	
U California, Berkeley	
U Illinois, Urbana-Champaign	
École Polytech Fédérale de Lausanne	
Nanyang Tech U	
U Michigan	
Hong Kong U of Sci and Tech	
Delft U Tech	
Tech U Munich	
Cornell U	
Tsinghua U	
Northwestern U	
RWTH Aachen U	
Purdue U	
Columbia U	
Korea Adv Inst of Sci and Tech (KAIST)	
U Texas, Austin	
U Toronto	29
U Hong Kong	
U California, Santa Barbara	
Seoul National U	
U California, San Diego	
Johns Hopkins U	
U Tokyo	
U College London	
KU Leuven	
KTH Royal Inst of Tech	
U Science and Tech of China	
U Wisconsin, Madison	
Shanghai Jiao Tong U	
Kyoto U Tech U Berlin	
U Washington	
U Edinburgh	
U Manchester	
Sungkyunkwan U (SKKU)	
Fudan U	
Rice U	
Zhejiang U	

In the 12 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 seventh.

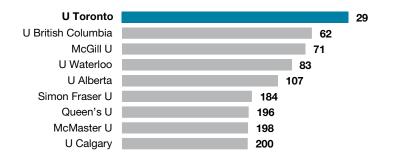
THE is the second-longest-running survey of its kind after ARWU. What sets it apart as an influential assessment of global, research-intensive universities is the breadth of its evaluation, which aims to measure institutions across all their core missions: teaching, research, knowledge transfer and international outlook. The THE ranking 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, 2017



#### Figure 6.2c Canadian U15 Universities in THE Top 200, 2017



#### Academic Ranking of World Universities (ARWU) for Engineering Subjects

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

ARWU has provided university-level rankings since 2003 and 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). In the most recent data, ARWU discontinued the fieldlevel rankings that have formed the basis of our previous reporting in favour of an expanded set of subject-level rankings. These included 22 engineering-related fields, of which we have chosen to report the nine most relevant to our programs (See list at right). In the final ARWU field-level rankings for engineering (2016) we remained Canada's top school and ranked 50th worldwide.

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

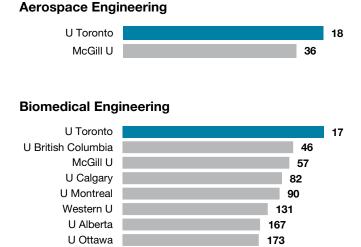
- **PUB** The number of papers authored by an institution in an academic subject during 2011-2015, as indexed in Clarivate's InCites report.
- **CNCI** Category Normalized Citation Impact: The ratio of citation of papers published by an institution in an academic subject during the period of 2011-2015 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:

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

Metallurgical Engineering

### Figure 6.3 Top 200 Canadian Universities in the Academic Ranking of World Universities (ARWU) by Subject, 2017



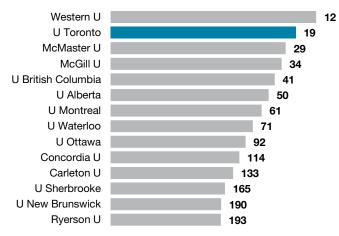
189

#### **Chemical Engineering**

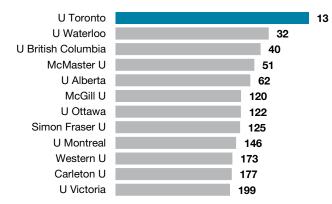
Queen's U

U Alberta	38
U Waterloo	59
U British Columbia	84
Western U	119
U Ottawa	125
U Calgary	129
U Toronto	157
Laval U	177
McGill U	178
McMaster U	190

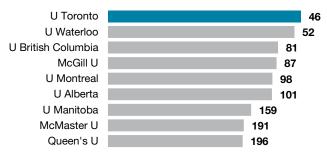
#### **Civil & Structural Engineering**



#### **Computer Science & Engineering**



#### **Electrical Engineering**



#### **Materials Science & Engineering**

U Toronto			70
U Waterloo		136	
U British Columbia		141	
Dalhousie U	17	8	
McGill U	19	1	

#### **Mechanical Engineering**



#### **Mineral Engineering**



## National Taiwan University (NTU) Performance Ranking of Engineering Papers

U of T Engineering ranked first in Canada, ninth among top-tier North American public universities, and 50th in the National Taiwan University (NTU) Performance Ranking of Engineering Papers.

The NTU ranking differs from the others in this section in that it is 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 (2006–16) [10%]
- Total number of articles published in the most recent year reported (2016) [15%]

#### **Research Impact**

- Total number of citations in the past 11 years (2006–16) [15%]
- Total number of citations in the past two years (2015–16) [10%]
- Average annual number of citations over the past 11 years (2006–16) [10%]

#### **Research Excellence**

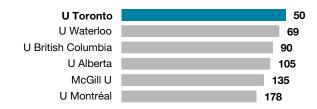
- H-index (measures productivity and impact of published work) of the past two years (2015–16) [10%]
- Number of highly cited papers in the past 11 years (2006–16) [15%]
- Number of papers published in high-impact journals in the current year (2016) [15%]

#### Tsinghua U Nanyang Tech U Harbin Inst of Tech Massachusetts Inst of Tech Zhejiang U Shanghai Jiao Tong U National U Singapore U California, Berkeley Georgia Inst of Tech Huazhong U of Sci & Tech U Chinese Academy of Sciences Stanford U U Sci and Tech of China Xian Jiaotong U Figure 6.4b NTU Top North American Public Tianjin U **Universities**, 2017 Peking U City U Hong Kong South China U of Tech Imperial College London U California, Berkeley Swiss Fed Inst of Tech, Lausanne Georgia Inst of Tech U Cambridge U Texas, Austin Seoul National U U Michigan, Ann Arbor U Texas. Austin U Illinois, Urbana-Champaign Harvard U U California, Los Angeles Southeast U Pennsylvania State U, Univ Park U Michigan, Ann Arbor U Washington, Seattle Swiss Fed Inst of Tech, Zurich U Toronto 9 Dalian U of Tech Purdue U, West Lafayette U Illinois, Urbana-Champaign Texas A&M U, College Station Hong Kong Polytech U U California, San Diego Fudan U U Waterloo 13 Beihang U U Maryland, College Park Northwestern U Korea Adv Inst of Sci and Tech U California, Santa Barbara U Wisconsin, Madison Delft U of Tech U California, Los Angeles North Carolina State U Pennsylvania State U, Univ Park U British Columbia 18 Central South U U Minnesota, Twin Cities King Abdulaziz U Ohio State U, Columbus U New South Wales U Alberta 21 Tongji U U Florida Nanjing U Arizona State U Tech U Denmark Virginia Polytech Inst **U** Chicago U California, Davis Wuhan U U Colorado, Boulder Jilin U U Tennessee, Knoxville National Taiwan U McGill U 28 Soochow U U California, Riverside U Washington, Seattle Iowa State U **U** Toronto 50

#### Figure 6.4a NTU Top 50 World Universities, 2017

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

#### Figure 6.4c Canadian U15 Universities in NTU Top 200, 2017



#### Figure 6.4d Canadian Universities in NTU by Subject, 2017

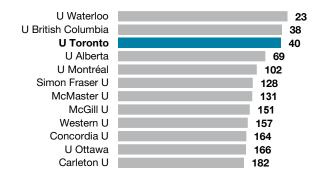
#### **Chemical Engineering**



#### **Civil Engineering**



#### **Computer Science**



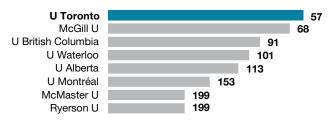
#### **Materials Science**

U Toronto	74
U Waterloo	109
McGill U	155
U Alberta	184

#### **Electrical Engineering**

<b>U Toronto</b> U Waterloo U British Columbia U Alberta	26 32 38 42
McGill U U Montréal Ryerson U Concordia U Carleton U Western U U Ottawa	112 137 148 158 162 177 186
McMaster U	195

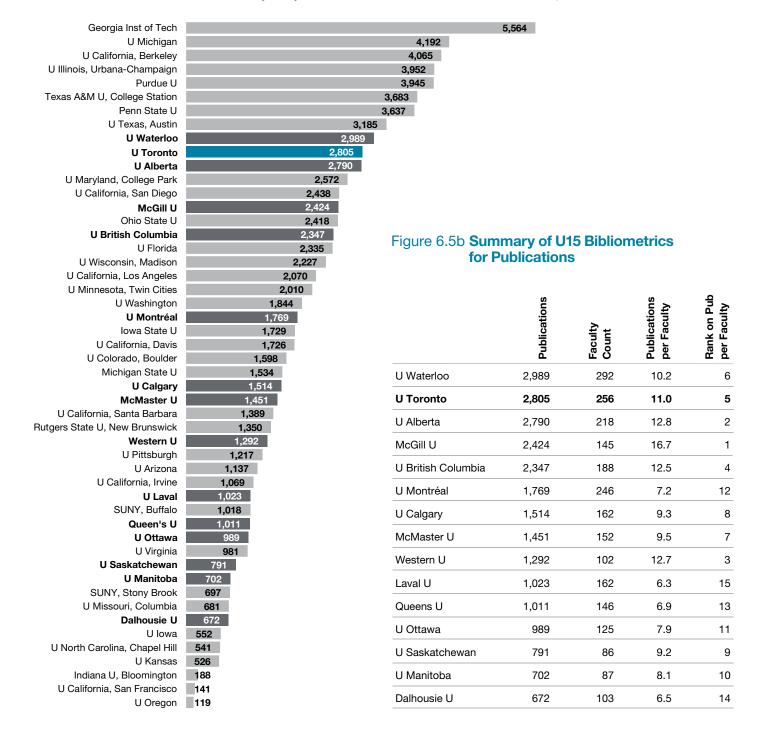
#### **Mechanical Engineering**



# **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 2,805 papers between 2012 and 2016.

#### Figure 6.5a Number of Engineering Publications Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2012 to 2016



Note 6.5 and 6.6: Faculty counts are based on data from the Engineers Canada Resources Report (2016) Publication and citation data from Thomson Reuters InCites™, updated April 20, 2018.

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.

As in the past three years we ranked third in Canada for citations per faculty after McGill University and Western 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, 2012-2016

Georgia Inst of Tech			75,708					
U California, Berkeley		66,49	1	-				
U Michigan		52.727						
U Illinois, Urbana-Champaign		50,820						
U Texas, Austin		46,073						
Penn State U	39,500							
U California, Los Angeles	37,286							
Purdue U	36,520							
U Toronto	34,927							
U Waterloo	33,567							
U California, San Diego	33,250							
Texas A&M U, College Station	32,207							
U Maryland, College Park	30,198							
U Washington	29,800	Figure 6.6b Sun	nmary o	f U15	Biblior	netrics	S	
U California, Santa Barbara	29,744	for	Citation	s				
U Alberta	26,390			-				
U Wisconsin, Madison	25,385					s		s
Ohio State U	25,193					Rank on Citations per Faculty		Rank on Citations per Publication
U Florida	25,193					ati	۲	tio
U Minnesota, Twin Cities	22,720				≧	ē≩	ă 5	ca. Ci
McGill U	22,128		sue	>	su	c n	ati	n la
U British Columbia	21,987		atic	발 분	Fa	Ăв	lic Iti	хд
U Colorado, Boulder	20,124		Citations	Faculty Count	Citations per Faculty	Rank on Cii per Faculty	Citations per Publication	Rank on Citatio per Publication
U Montréal	18,989		0	щU	0 4	шо	ОЦ	ш о
U California, Davis	16,425	U Toronto	34,927	256	136.5	3	12.5	1
lowa State U	15,852		~~ ~~~					
Michigan State U	15,704	U Waterloo	33,567	292	115.0	6	11.2	2
Rutgers State U, New Brunswick	15,695	U Alberta	26,390	218	121.3	4	9.5	6
U Pittsburgh	15,293		20,000	210	121.0		0.0	
Western U	14,058	McGill U	22,198	145	153.1	1	9.2	10
McMaster U	12,250							
U Calgary	12,198	U British Columbia	21,987	188	117.2	5	9.4	8
SUNY, Buffalo	10,498	LI Montréal	10.000	246	77.2	9	10.7	4
U California, Irvine	10,327	U Montréal	18,989	240	11.2	9	10.7	4
U Arizona	9,848	Western U	14,058	102	138.5	2	10.9	3
U Virginia	9,699		•					
Queen's U	9,548	McMaster U	12,250	152	80.5	8	8.4	13
U Ottawa	9,081		10,100	100	75.0	10	0.1	
U Laval	8,978	U Calgary	12,198	162	75.3	10	8.1	14
U North Carolina, Chapel Hill	8,790	Queens U	9,548	146	65.4	12	9.4	7
SUNY, Stony Brook	8,218		0,010				••••	•
U Saskatchewan	7,630	U Ottawa	9,081	125	72.6	11	9.2	9
Dalhousie U	5,966							
U Missouri, Columbia	5,513	Laval U	8,978	162	55.4	15	8.8	12
U Manitoba	5,379	U Saskatchewan	7,630	86	89.1	7	9.6	5
U Iowa	4,979	Counteriowall	7,000		00.1		0.0	
U Kansas	4,688	Dalhousie U	5,966	103	58.0	14	8.9	11
Indiana U, Bloomington	2,272							
	-	U Manitoba	5,379	87	61.8	13	7.7	15
U Oregon	1,791	OMAINODA	0,010		01.0	10	1.1	10

# **Summary of Ranking Results**

In the most recent results available, U of T Engineering remained the top Canadian university across all rankings, and the only Canadian institution within the global top 50. Among North American public universities, we ranked in the top 10 in three of the four ranking systems. 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 2018	1	4	43
QS World University Rankings by Subject	February 2018			
Chemical Engineering		1	9	39
Civil & Structural Engineering		1	7	33
Electrical & Electronic Engineering		1	5	24
Materials Science		2	11	51
Mechanical, Aeronautical & Manufacturing Engineering		2	7	36
Mineral & Mining Engineering		6	9	25
Computer Science & Information Systems		1	2	10
Times Higher Education (THE) – Elsevier World University Ranking for Engineering & Technology	October 2017	1	7	29
Academic Ranking of World Universities (ARWU) for Engineering Subjects	August 2017			
Aerospace Engineering		1	9	18
Biomedical Engineering		1	5	17
Chemical Engineering		7	28	157
Civil Engineering		2	9	19
Computer Science and Engineering		1	3	13
Electrical & Electronic Engineering		1	15	46
Mechanical Engineering		2	18	64
Materials Science & Engineering		1	13	70
Environmental Science & Engineering		1	1	9
National Taiwan University (NTU) Performance Ranking of Scientific Papers for World Universities by Subject	October 2017	1	9	50
NTU Performance Ranking by Subject	October 2017			
Chemical Engineering		4	20	136
Civil Engineering		2	12	48
Electrical Engineering		1	6	26
Materials Science		1	11	74
Mechanical Engineering		1	12	57
Computer Science		3	9	40