



**Group of Canadian  
Research Universities**

Regroupement des  
universités de recherche  
du Canada

# University Profiles 2020

University of Alberta  
The University of British Columbia  
University of Calgary  
University of Dalhousie  
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



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Note:

As a result of differences in how institutions count enrolment, the sum of undergraduate and graduate enrolment may not equal total enrolment.

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The number of Canada Research Chairs (CRCs) refers to the institutional allocation by the Tri-agency Institutional Programs Secretariat as per <http://canada150.chairs-chaieres.gc.ca/chairholders-titulaires/index-eng.aspx> as of June 2019.

# TABLE OF CONTENT

Message from the Chair/Executive Director ..... 1

U15 Universities ..... 2

University of Alberta ..... 4

The University of British Columbia..... 6

University of Calgary ..... 8

Dalhousie University ..... 10

Université Laval ..... 12

University of Manitoba ..... 14

McGill University..... 16

McMaster University..... 18

Université de Montréal ..... 20

University of Ottawa ..... 22

Queen’s University ..... 24

University of Saskatchewan ..... 26

University of Toronto ..... 28

University of Waterloo ..... 30

Western University..... 32







## MESSAGE FROM THE CHAIR AND THE EXECUTIVE DIRECTOR



We are pleased to share with you the third edition of The U15 Universities Profiles. The U15 Group of Canadian Research Universities brings together leading research-intensive universities in the country. Together, these institutions account for close to 80% of the peer-reviewed research funding in Canada, and are home to more than 70% of Canada research chairs (i.e., Canada Research Chairs, Canada Excellence Research Chairs and the Canada 150 Research Chairs). The profiles offer a snapshot of the research strengths of our universities, along with some important institutional statistics.

As you go through each university profile, you will discover and appreciate the breadth and impact of the research activities conducted by our students, postdoctoral fellows, research associates and faculty members. Every day, U15 researchers devote their time and effort to address some of the most pressing and challenging issues facing humanity – saving lives through organ and tissue transplant, designing crops for global food security, preserving Indigenous languages, unravelling the causes of rare diseases, and assessing the future implications of climate change.

Driven by their unwavering commitment to advancing knowledge and preparing tomorrow's leaders, U15 researchers are also training the next generation of researchers and innovators that Canada needs if we are to maintain and enhance the quality of life that we enjoy today. Every year, 125,000 graduate students work with world-class researchers using state-of-the-art research facilities in U15 universities and their affiliated research hospitals and institutes. These students come from across Canada and from all corners of the world because of the exceptional learning and training environment provided by these exceptional institutions.

We invite you to discover for yourselves the impressive array of talent and strength showcased by the U15 Group of Canadian Research Universities.

Meric Gertler  
Chair, U15 and  
President, University of Toronto

Gilles Patry  
Executive Director, U15



## Group of Canadian Research Universities

Regroupement des universités de recherche du Canada

# U15 UNIVERSITIES

The U15 Group of Canadian Research Universities is a collective of some of Canada’s most research-intensive universities. Although each institution advances its own research and education mandate, The U15 Directorate works for the collective interest of all our members. We foster the development and delivery of long-term, sustainable higher education and research policy, in Canada and around the world.

Our universities generate and mobilize world-changing knowledge. They educate and inspire leaders, from our Nobel Prize winners to our astronauts and prime ministers. They attract exceptional researchers, scholars and students, whose stellar accomplishments form the foundation of our nation’s research and development capacity.

From quantum computing to oncology, and oceanography to the humanities, the U15’s research strengths are as broad as its aims are high. U15 universities foster world class scholarship that shapes and realizes our national and global public policy goals, enables strong industry partnerships, fosters social, cultural, economic and environmental innovation and advances Canada’s international influence and effectiveness.

U15 institutions share a global orientation and seek out international partnerships with other top institutions. The organization belongs to the Global Network of Research Intensive Universities and is a signatory to the Hefei Statement on the Ten Characteristics of Contemporary Research Universities.

*“ As leaders in research and advanced education, U15 universities are driving Canada’s current and future prosperity. Our scholars make breakthrough discoveries and enhance our understanding of the world around us. Our teaching programs produce talent of the highest quality. Our collaboration with other great universities around the world enables Canada to play a leading role in tackling grand global challenges. And our partnerships with industry and with local communities drive innovation and broader social wellbeing.”*

Meric Gertler, U15 Chair

## HISTORY OF THE U15

1985

Five Ontario research universities (McMaster, Queen’s, Toronto, Waterloo and Western) begin meeting informally.

1989

The Ontario group expands to include three other universities (McGill, Montréal and UBC).

1991

The group expands with the addition of the universities of Alberta and Laval. The group is referred to as the G10.

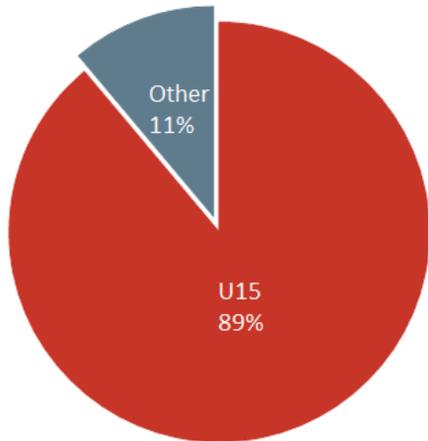
2006

The G10 becomes the G13 with the addition of the universities of Dalhousie, Calgary and Ottawa.

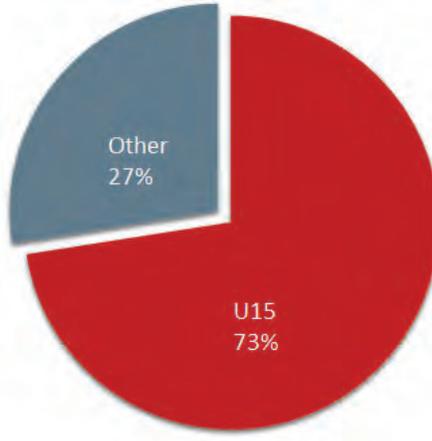
2011

The universities of Manitoba and Saskatchewan join and the group is renamed The U15.

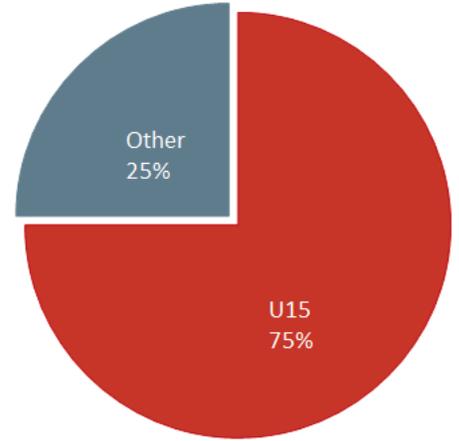
**Canada Excellence Research Chairs (18)**



**Canada Research Chairs (2285)**

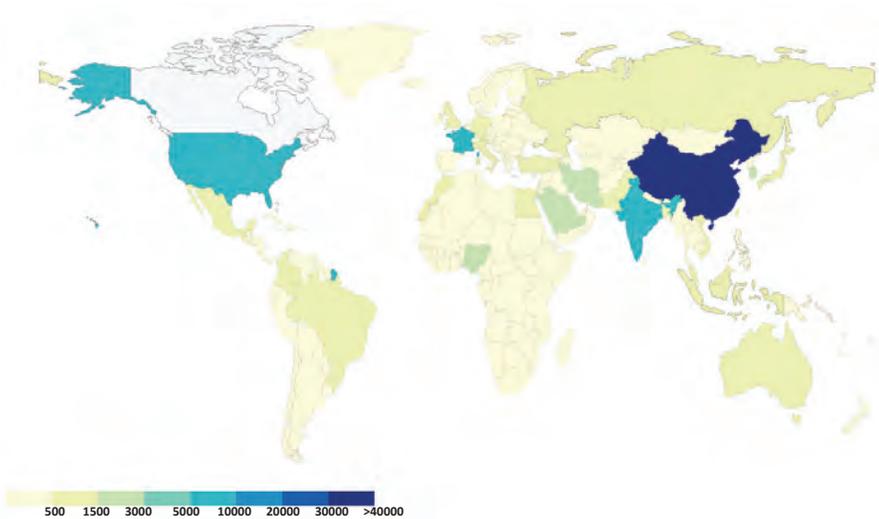


**Canada 150 Research Chairs (24)**



Source: Tri-agency Institutional Programs Secretariat

**Attract students from around the world**



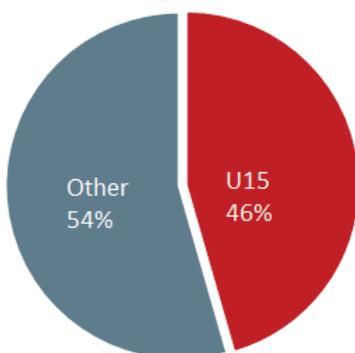
**Facts:**

- Home to more than 618,000 students and post-doctoral fellows
- Conducts more than \$11B of research per year
- Employs more than 100,000 people
- Located in communities where 60% of Canadians live
- Programs delivered in English, French and in both English and French
- Residence to world-class research facilities

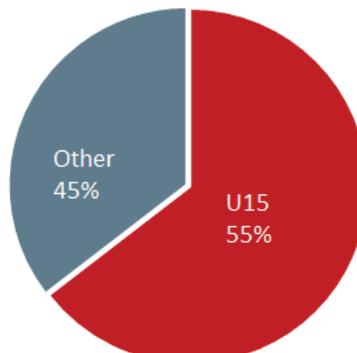
Source: U15

**Full-time enrolment at Canadian Universities**

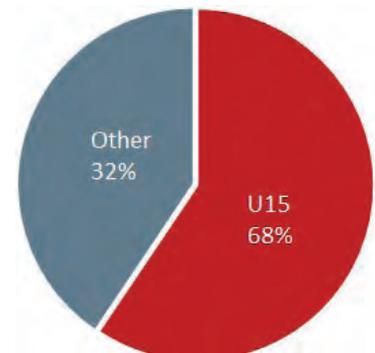
**Undergraduates**



**Masters**



**PhDs**



Source: Statistics Canada (2017)



## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chair (CERC) | 1       |
| Canada 150 Research Chair               | 1       |
| Canada Research Chairs (CRC)            | 118     |
| Research Income                         | \$513 M |
| Undergraduate Enrolment                 | 30,855  |
| Graduate Enrolment                      | 7,460   |
| International Students                  | 7,865   |
| Total Enrolment                         | 38,310  |

## Research Strengths

- Agriculture and agri-food
- Artificial intelligence
- Energy
- Environment and climate
- Health
- Science and technology
- Society and culture

## UNIVERSITY PROFILE

The University of Alberta is one of the world’s top 100, and one of Canada’s top five research-intensive universities with a reputation for excellence in translational and discovery research, scholarship and creative activities across diverse areas of impact. One of Canada’s leading centres of expertise in Artificial Intelligence, the university is also home to world-renowned institutes and centres including the Nanotechnology Initiative, the Alberta Transplant Institute and the Alberta Diabetes Institute. Our researchers’ full spectrum of inquiry and the university’s strong innovation, commercialization and technology transfer record positions the university to make comprehensive contributions towards scientific, social and cultural innovations.

## Research and Learning Environment

The University of Alberta advances cutting-edge knowledge that translates into tangible societal benefits, while providing a dynamic learning and research environment for our diverse campus community of students, faculty and researchers. The university leads the country with the most 3M national teaching fellowships and offers class sizes, tuition and fees that are among the smallest for a major Canadian university, while graduates enjoy the highest employment rate in Canada according to QS Graduate Employability Rankings.



## International Engagement

The University of Alberta continually strives to enhance the international dimensions of its teaching, research, service, outreach and administration. One of Canada’s most international universities, the U of A is involved in more than 800 formal teaching, research and student mobility agreements with governments, organizations and institutions in over 80 countries. The university is also part of the Worldwide Universities Network, a consortium of 23 top universities established to facilitate global research and teaching collaborations.

## RESEARCH EXCELLENCE



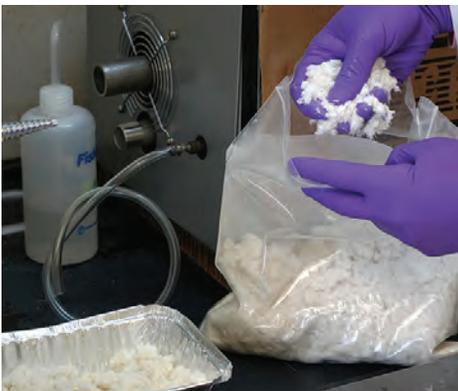
### Saving lives by saving donor organs

Technology developed by medical researchers and transplant surgeons Darren Freed and Jayan Nagendran may solve two significant organ transplant problems: the number of healthy organs available and the window of time to get a donated organ to a patient. The Ex-Vivo Organ Support System (EVOSS™) is a portable organ perfusion device allowing more time for assessment, repairs and transportation—potentially tripling the number of available donor organs worldwide. Dr. Freed and Dr. Nagendran are the founders of U of A spinoff company Tevosol Inc. and researchers at the Alberta Transplant Institute—led by Dr. Lori West.



### Developing autonomous systems

Dr. Tony Qiu, Scientific Director of the Centre for Autonomous Systems and Canada Research Chair in Cooperative Transportation Systems, leads a team of researchers in the investigation and development of automated systems technologies. This includes technology at the heart of self-driving cars and smart transportation networks that improves the safety and movement of people and goods. Following the completion of Canada's only operational Connected Vehicle testbed network in Edmonton, Dr. Qui and his team are expanding the project to better support Connected Vehicle application development and testing, fundamental and applied research, and industry product testing.



### Decontaminate your water with...feathers

University of Alberta researchers are using an innovative solution to address water contamination from energy production: poultry feathers. After being broken down and treated with modifying agents, the feathers can stick to a variety of particles due to their high keratin protein content. As a waste product from an existing industry, this low-cost alternative is readily customized for multiple types of contamination, including heavy metals like arsenic and mercury. The team, led by Tariq Siddique and Aman Ullah, is part of Future Energy Systems, a research program funded by the Canada First Research Excellence Fund.



### Predicting forest fires with AI

Using artificial intelligence, wildfire scientist Mike Flannigan co-created a new early-warning system for predicting the most destructive forest fires. The tool uses five decades' worth of weather data in combination with real-time information on atmospheric conditions to predict where the most extreme fire weather is likely to occur. Sifting through high volumes of information, the tool can identify patterns that humans might not see, making this a critically valuable tool for emergency responders and policymakers.



## Quick Facts

|   |                |
|---|----------------|
| Canada Excellence Research Chairs (CERCs) | <b>3</b>       |
| Canada 150 Research Chairs                | <b>4</b>       |
| Canada Research Chairs (CRC)              | <b>205</b>     |
| Research Income                           | <b>\$658 M</b> |
| Undergraduate Enrolment                   | <b>52,710</b>  |
| Graduate Enrolment                        | <b>10,840</b>  |
| International Students                    | <b>16,190</b>  |
| Total Enrolment                           | <b>65,010</b>  |

## Research Strengths

- Advanced materials
- Brain health
- Cancer
- Culture and diversity
- Digital technologies
- Economics and business
- Environment
- Genomics
- Heart and lung
- HIV and AIDS



## UNIVERSITY PROFILE

The University of British Columbia (UBC) is a global centre for teaching, learning and research, consistently ranked among the top 20 public universities in the world and recently recognized as North America’s most international university. Since 1915, our motto, Tuum Est (It is Yours), has been a declaration of our commitment to attracting and supporting those who have the drive to shape a better world. UBC students, faculty and staff embrace innovation and challenge the status quo, placing us at the forefront of discovery, learning and engagement. UBC encourages bold thinking, curiosity and initiative, so you can realize your greatest potential.

## Research and Learning Environment

As one of the world’s top research universities, UBC attracts the highest calibre research faculty and students and approximately \$600 million in research funding annually.

In partnership with universities, industries, government and communities worldwide, our research is advancing new knowledge and has led to countless new products, treatments and services.

Our two campuses and affiliated teaching hospitals attract, nurture and transform more than 60,000 students from Canada and more than 140 countries around the world.



## International Engagement

UBC is committed to international engagement that fosters global citizenship and contributes to a better world. Ranked third worldwide in THE’s 2019 University Impact Rankings, and as North America’s most international university, UBC partners deeply and networks widely to engage on collaborative, multidisciplinary solutions to complex and pressing global challenges. Our diverse campus community from 150+ countries is making an impact globally and locally through experiential learning programs, research collaborations, and capacity-building activities.

## RESEARCH EXCELLENCE



### At the forefront of an advanced materials revolution

UBC researchers are emerging as global leaders in the hunt for quantum materials that could trigger a technical revolution to rival the Industrial Revolution.

Quantum materials are set to transform industries such as computing, nanoelectronics, medicine and sustainable energy. UBC's Stewart Blusson Quantum Matter Institute, supported by the CFREF program and led by Scientific Director Dr. Andrea Damascelli, is at the forefront.

Advances in the fundamental understanding of quantum matter include the work of Marcel Franz, part of an international collaboration that discovered that graphene flakes could create a quantum hologram that mirrors black hole characteristics.



### Forest bioproducts

UBC is one of the world's leading academic centres for bioeconomy research. The Bio-Products Institute network at UBC represents deep knowledge from the seeds of the trees to cutting edge bio-refining technologies and novel bio-based products. The network is actively engaged in research projects that provide innovative and sustainable solutions to local and global challenges that affect industry and society.

This highly collaborative research group combines knowledge throughout a fully integrated 'seeds to solutions' bio-refining value chain. Scientific director of the institute, Orlando Rojas, is joining UBC as the Canada Excellence Research Chair in Forest Bioproducts.



### Precision cancer medicine for improved care

Building from a rich tradition of discovery science, UBC researchers and partners are utilizing new technologies and exploring new areas of research to advance knowledge and improve care, developing precision treatments to tackle certain types of cancers more effectively.

UBC researchers such as Drs. Samuel Aparicio and Marco Marra are at the leading edge of understanding the complexities of different types of cancers, and setting the stage for new types of treatments. Dr. Sriram Subramaniam joins UBC as the Gobind Khorana Canada Excellence Research Chair in Precision Cancer Drug Design, aiming to accelerate drug discovery through the use of cryo-EM.



### Leading in language sciences

UBC is an epicentre for groundbreaking interdisciplinary research in the language sciences. Dr. Janet F. Werker has fundamentally changed our understanding of language acquisition, showing that the foundations of language begin in early infancy, and that acquiring multiple languages from birth comes as naturally as learning a single mother tongue.

Other researchers include Dr. Bryan Gick, a leading expert on the physical mechanisms of speech production, and Dr. Bonnie Norton, research lead for Storybooks Canada, an educational website that translates children's stories into multiple languages to help children to learn one of Canada's official languages while maintaining their mother tongue.



# UNIVERSITY OF CALGARY

## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chair (CERC) | 1       |
| Canada Research Chairs (CRC)            | 79      |
| Research Income                         | \$419 M |
| Undergraduate Enrolment                 | 24,625  |
| Graduate Enrolment                      | 5,895   |
| International Students                  | 3,505   |
| Total Enrolment                         | 30,520  |

## Research Strengths

- Brain and mental health
- Child health and wellness
- Clinical, health services, and population health
- Energy Innovations for Today and Tomorrow
- Engineering solutions for health: biomedical engineering
- Human dynamics in a changing world
- Infections, inflammation and chronic diseases
- New earth-space technologies
- One health



## UNIVERSITY PROFILE

The University of Calgary is a global intellectual hub located in Canada’s most enterprising city. Together, our 14 faculties spread across five campuses are making tremendous progress on our journey to become a top five Canadian research institution, where research and innovative teaching go hand-in-hand, and where we fully engage the communities we both serve and lead. Our strategy is called Eyes High, inspired by the university’s Gaelic motto, which translates as “I will lift up my eyes”. UCalgary has been named as one of the top Golden Age universities in North America and ranks sixth among Canadian universities for research income.

## Research and Learning Environment

UCalgary’s academic and research plans drive innovation and are connected through mutual values of student experience and impact. To achieve these goals, we have identified six research themes and two cross-cutting themes, enabling us to focus on research and scholarship in areas of strength while demonstrating leadership in globally relevant issues. We are committed to engaging our students in learning guided by processes of discovery, creativity, and innovation, and strive to provide hands-on, entrepreneurial experiences.



## International Engagement

As an award-winning leader in internationalization, we aim to produce graduates with global knowledge and forge strategic alliances. UCalgary operates a campus in Qatar focused on nursing, offers an international energy lawyer program with the University of Houston and delivers the world’s most holistic energy-management program. The new knowledge we create through cutting-edge research results in societal impact and positive change in local, national, and international communities. Development projects are ongoing in Africa and Asia.

## RESEARCH EXCELLENCE



### Leading the way to a low carbon future

The Global Research Initiative in Sustainable Low Carbon Unconventional Resources (GRI) is a major vehicle to translate lab-based technology innovations into full-scale solutions, transforming energy research for a sustainable, clean energy future. UCalgary secured four major sites as part of GRI, including Western Canada, China, Mexico, and the Middle East to tackle three major themes: heavy oil and bitumen, tight oil and gas, and CO<sub>2</sub> conversion. The university's leadership has resulted in 131 inventions, seven start-ups, more than 80 CFREF supported publications, and 64 awards. GRI is part of the implementation of the Energy Innovations for Today and Tomorrow research theme.



### Helping youth 'SHRed' the burden of concussion

In 2018, the university was the only Canadian institution selected by the National Football League's scientific advisory board to lead a pan-Canadian research program on concussions. SHRed Concussions (short for Surveillance in High Schools to Reduce Concussions and Consequences of Concussions in Youth), provides a national platform for concussion surveillance in high schools to evaluate solutions for concussion prevention that will have a significant impact on reducing concussions and their consequences in youth sport at a national level. SHRed is part of the implementation of the Brain and Mental Health research theme, led by the Hotchkiss Brain Institute.



### One Health: understanding the interdependence between humans, animals and the environment

One Health is founded on understanding the interdependence between human, animal, and environmental health, including economic and social dynamics. With growing support from agencies worldwide to develop team-based approaches to resolve emerging health issues at the interface of animals, humans, and their shared environment, the One Health approach can improve sustainability of impact, increase cost effectiveness, and enhance ability to mitigate unintended consequences. Announced in 2019, UCalgary's One Health team will leverage excellence in established strengths, including the International Microbiome Centre, Advancing Canadian Wastewater Assets, the O'Brien Institute for Public Health and W.A. Ranches to contribute interdisciplinary solutions to complex global issues.



### Child Health and Wellness: creating the foundation for lifelong health and societal success

Led by an interdisciplinary team of researchers, Child Health and Wellness is an initiative that builds engaging partnerships and connections between researchers, children and their families, healthcare providers, community organizations, policymakers, and industry to create the foundation for lifelong individual health and societal success. By encompassing a comprehensive view of child health and well-being, including physical, cognitive, emotional, social and spiritual domains, the initiative aims to develop and implement a transformative partnership and framework that will empower research teams to address child health challenges at all scales.

## Quick Facts

|                              |                |
|------------------------------|----------------|
| Canada Research Chairs (CRC) | <b>56</b>      |
| Research Income              | <b>\$168 M</b> |
| Undergraduate Enrolment      | <b>14,700</b>  |
| Graduate Enrolment           | <b>3,960</b>   |
| International Students       | <b>4,190</b>   |
| Total Enrolment              | <b>19,150</b>  |

## Research Strengths

- Big data
- Clean tech, energy, the environment
- Culture, society, community development
- Food security
- Healthy people, healthy communities, healthy populations
- Innovation and entrepreneurship
- Sustainable ocean



## UNIVERSITY PROFILE

Dalhousie University is Atlantic Canada’s leading research-intensive university. Located in the heart of Halifax, NS, with an Agricultural Campus in Truro/Bible Hill, Dalhousie is a truly national and international university, with more than half of our 19,000-plus students coming from outside the province. Our 6,000 faculty and staff foster a diverse, purpose-driven community, one that spans 13 faculties and conducts more than \$165 million in research annually. Part of a cluster identified as one of the world’s top international centres in ocean research, Dalhousie proudly celebrated its 200th anniversary in 2018.

## Research and Learning Environment

Dalhousie is a vibrant hub with regional, national and global impact, recognized for the outstanding quality of its research and innovation. With more than 200 undergraduate and graduate programs across 13 faculties, Dalhousie provides a unique, interactive and collaborative environment for creating and sharing knowledge. Our signature research clusters are grounded in the United Nations’ 2030 Sustainable Development Goals, focusing our research enterprise on tackling some of our planet’s most pressing issues.



## International Engagement

Recognized in world rankings for its high level of internationalization, Dalhousie’s global connections enhance the quality and impact of education and research at local, national and international levels. The university has over 300 partnership agreements with universities from 67 countries, and our researchers collaborate with colleagues in over 100 countries across the globe. Dalhousie currently welcomes more than 4,000 international visiting and degree-seeking students each year, from more than 120 countries.

## RESEARCH EXCELLENCE



### A world leader in ocean research

Dalhousie University is a powerhouse in ocean expertise and education. An international hub for exploration and discovery, the university is the host institution for the Ocean Tracking Network, the Marine Environmental Observation Prediction and Response Network and the Ocean Frontier Institute — a more than \$220-million partnership that brings together experts from both sides of the North Atlantic to explore the vast potential of the North Atlantic Ocean.



### Discovering new ways to defend ourselves against disease

Dr. Jean Marshall has been internationally recognized for her research on the role of mast cells — immune cells that regulate inflammatory responses in defence of cancer, infection and chronic inflammatory diseases. Mast cells had for a long time been seen as useless in the therapeutic sense, but Dr. Marshall's research has helped show that they can be used strategically to manipulate immunity to fight cancer or prevent allergic diseases.



### Healthy stores, healthy communities

As Canada Research Chair in Promoting Health Populations, Dr. Catherine Mah is studying what determines where, how and why we buy food. With an aim of helping to design solutions to support healthy livelihoods in the food sector and healthy diets for populations, Dr. Mah and her team are gathering inspiration and evidence from the practical and Indigenous ways in which local residents, businesses, public health practitioners and civic leaders address food access issues.



### Sustainable power from Lithium-ion batteries

Dr. Jeff Dahn is recognized as one of the pioneering developers of the lithium-ion battery now used worldwide in laptop computers and cell phones. As the NSERC/Tesla Canada Industrial Research Chair, his lab hosts Tesla Motors' first ever university partnership, helping create lithium-ion cells with a longer lifetime (by decades) and higher energy density at lower cost. Dr. Dahn's energy leadership has been recognized with NSERC's Herzberg Gold Medal and the Governor General's Award for Innovation.



UNIVERSITÉ  
LAVAL

## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chairs (CERCs) | 4       |
| Canada Research Chairs (CRC)              | 94      |
| Research Income                           | \$357 M |
| Undergraduate Enrolment                   | 29,470  |
| Graduate Enrolment                        | 13,240  |
| International Students                    | 5,665   |
| Total Enrolment                           | 42,710  |

## Research Strengths

- Children's social development and academic success
- Data science, artificial intelligence and industry 4.0
- Ethics, law and governance
- Human and non-human genomics
- Neurophotonics
- Northern research
- Optics and photonics
- Sustainable development
- Sustainable health
- The microbiome and metabolic health



## UNIVERSITY PROFILE

Driven by innovation and excellence, Université Laval is the eighth largest research university in Canada with \$357M in research funding in 2018. Located in Quebec City, a world heritage city, it is the oldest French-language university in North America, and it has educated more than 300,000 people who participate in the progress of society. The University has 3,825 professors and other teaching and research staff members who share their knowledge with some 43,000 students, 25% of whom are enrolled at the graduate level. Moreover, its carbon neutral campus is ranked second in Canada and eighth in the world in terms of sustainable development according to STARS.

## Research and Learning Environment

Université Laval has impressive technological and scientific platforms, such as optics-photonics, metabolic health, Northern, Arctic and climate change sciences and neurosciences. Its learning and research framework provides advanced education supervised by experienced professors in an environment of excellence who are engaged in major multidisciplinary and unifying projects. Its varied and innovative research programs contribute to the progress of society and the well-being of communities.



## International Engagement

Université Laval has built a solid international reputation in many leading-edge areas. Nearly 2,500 students benefit from its international mobility programs and nearly one out of every two doctoral candidates come from abroad. The University welcomes nearly 7,000 international students from 120 countries. Committed to humanitarian aid and international development, it has entered into over 900 partnership agreements with some 600 higher education institutions around the world.

## RESEARCH EXCELLENCE



### At the origin of a genetic revolution - Sylvain Moineau

An exceptional microbiologist, Sylvain Moineau created the CRISPR-Cas9 genome editing tool, a veritable revolution now used by many scientists. He was named one of the most cited researchers in the world for the 5th consecutive year and won the prestigious NSERC John-C. Polanyi Award. The International Committee on Taxonomy of Viruses even named the *Moineauvirus* genus after him. As the Canada Research Chair on Bacteriophages, he is working on developing a new phage therapy that could revolutionize the medical field by providing an alternative to antibiotics.



### Clarification of the link between stress and depression - Caroline Ménard

Caroline Ménard has discovered the link between stress and depression. By studying mice submitted to daily stress, she observed that the inflammatory process that was triggered altered the permeability of the blood-brain barrier that separates the brain and peripheral blood circulation. The results published in *Nature Neuroscience* show that increased permeability of the blood-brain barrier is synonymous with depression symptoms in both mice and humans. This breakthrough could have significant clinical implications, allowing a better diagnosis of depression, improved follow-up of people with the disease, and the development of new antidepressants.



### Dedicated to genomics research - Jacques Simard et François Rousseau

Jacques Simard (left) and François Rousseau (right), researchers at the CHU de Québec—Université Laval research centre, are sharing a \$27M grant from Genome Canada for genomics research. While Jacques Simard is working on developing a personalized breast cancer screening protocol, François Rousseau is focusing on a new method of screening for genetic anomalies in the fetus. The researchers are contributing to making healthcare more accessible by assessing the possibility of making new screening tools available more easily for the greatest number of people.



### Enhancing the value of forestry biomass - Évelyne Thiffault

A pioneer in forestry biomass research, Évelyne Thiffault considers the forest as a means of reducing greenhouse gases. She is testing various forest management measures that take into account both forest longevity and economic needs, among other things. In partnership with various organizations, she is engaging communities to support sustainable development and encouraging the Quebec forest industry to be the leaders in sustainable development for the fight against climate change. In addition, her research generates jobs in the forestry industry.



## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chair (CERC) | 1       |
| Canada 150 Research Chair               | 1       |
| Canada Research Chairs (CRC)            | 52      |
| Research Income                         | \$212 M |
| Undergraduate Enrolment                 | 25,135  |
| Graduate Enrolment                      | 3,755   |
| International Students                  | 5,590   |
| Total Enrolment                         | 29,620  |

## Research Strengths

- Arctic system science & climate change
- Culture and creative works
- Fundamental research
- High performance materials, structures & processes
- Human rights & social justice
- Immunity, inflammation & infectious disease
- Integrative research in health & well-being
- Population & global health
- Sustainable systems for resilient communities
- Sustainable water management systems

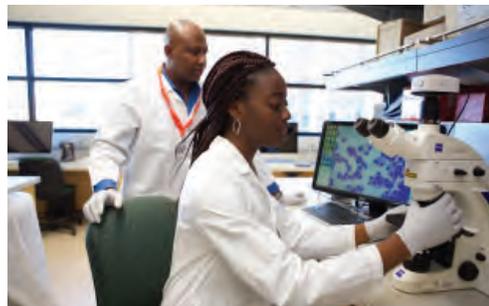


## UNIVERSITY PROFILE

For more than 140 years, the University of Manitoba has been recognized as Manitoba’s premier university – shaping our leaders, enhancing our community, and conducting world-class research. Our home is Manitoba but our impact is global. The University has a tradition of excellence in research, scholarly work and creative activities. Our connection to the agricultural and natural landscapes of the Canadian Prairie, to the Arctic, to local and Indigenous communities has shaped our research focus. We have made pioneering contributions in many fields and developed life-changing solutions to problems being faced by peoples in Manitoba, Canada and the world.

## Research and Learning Environment

The University of Manitoba is the province’s research university: research informs our teaching and teaching informs our research. We provide high-quality liberal arts, science and professional programs that are consistent with our mission and size. Our university equips our undergraduate and graduate students to be locally and globally engaged citizens who understand the importance and contributions of Indigenous peoples in Manitoba and Canada. We are committed to ensuring our students have an outstanding educational experience.



## International Engagement

Through projects and collaborative activities around the world, University of Manitoba faculty, staff and students bring international perspectives to learning and research and enrich the overall university experience. They become crucial agents of change in our local and global community. The University engages on two continents through the Partners for Health Development in Africa and the Karnataka Health Promotion Trust in India. Our International Centre offers exchange opportunities with partner universities in dozens of countries.

## RESEARCH EXCELLENCE



### Preventing HIV epidemics

Approximately two million new cases of HIV are reported each year. Dr. Marissa Becker, Associate Professor at the Centre for Global Public Health, is conducting research designed to understand how this global epidemic continues to spread – and how to slow it down. Instead of focusing on individual cases, her team studies the larger pattern of outbreaks in countries bordering on areas of regional conflict. They have demonstrated that when people are forced to flee their homes, some turn to the sex trade to survive, resulting in high-risk sexual activity. By using conflict as a predictor, Dr. Becker’s discoveries are enabling local healthcare workers to prevent outbreaks before they occur.



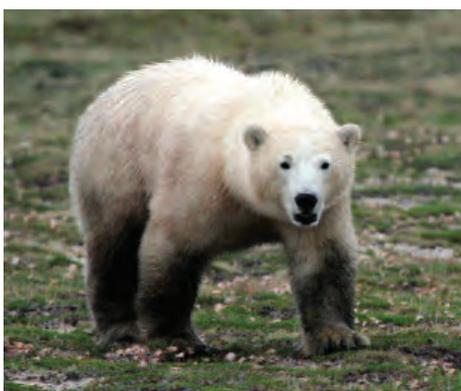
### Preserving Indigenous languages

Recent studies predict most Indigenous languages—with the exception of Cree, Anishinaabe and Inuktitut—will last only another few generations. This crisis is what fuels Dr. Frank Deer, Canada Research Chair in Indigenous Education. The importance of Indigenous languages to the ethno-cultural identity of Indigenous peoples is the focus of Deer’s research. By exploring and sharing the successes that some have experienced in sustaining of their respective languages, Indigenous peoples and communities can all benefit and achieve a stronger connection to their own indigeneity.



### Working together on clean water and sanitation

According to the United Nations (UN), three out of 10 people lack access to safely managed drinking water services. The U of M was recently selected by the UN to host the SDG Hub for Goal 6 – Clean Water and Sanitation on the basis of our research, innovation and scholarship in the field. One example of our research in this area is led by soil scientist Dr. Annemieke Farenhorst, NSERC Chair for Women in Science & Engineering, and the CREATE H2O program for First Nations water and sanitation security. The program addresses research science and training gaps that are preventing effective, culturally appropriate investments in water and sanitation security in First Nations communities.



### Solving an environmental mystery

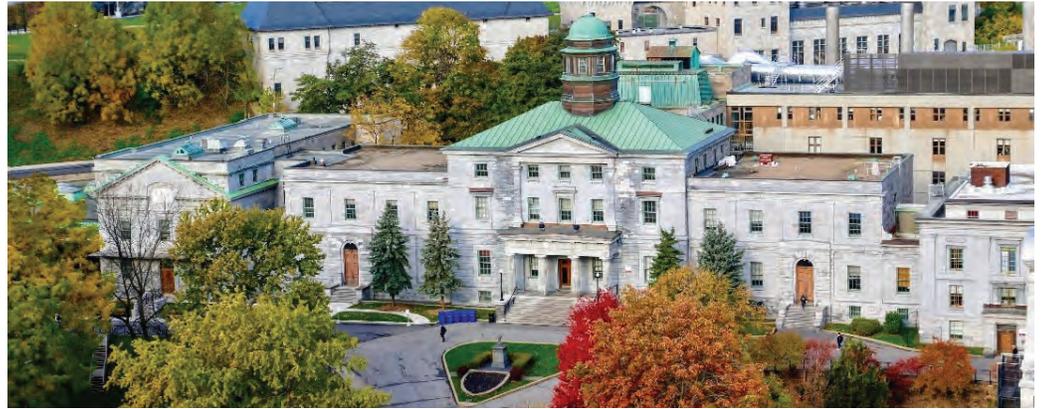
Dr. Feiyue Wang, Canada Research Chair in Arctic Environmental Chemistry, focuses on understanding the release and effects of contaminants in the Arctic in a changing climate. He and his team recently solved a long-standing puzzle of why marine animals in the western Canadian Arctic have higher mercury levels than those in the east: higher methylmercury concentrations below the ocean surface. Ecosystem recovery from mercury contamination will depend on environmental and climatic processes that convert inorganic mercury to methylmercury, and will lag behind mercury emission controls. This requires policy-makers and Indigenous peoples to take actions to balance the benefits and risks of marine country food consumption.

## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chairs (CERCs) | 2       |
| Canada 150 Research Chairs                | 2       |
| Canada Research Chairs (CRC)              | 185     |
| Research Income                           | \$515 M |
| Undergraduate Enrolment                   | 27,600  |
| Graduate Enrolment                        | 10,145  |
| International Students                    | 12,535  |
| Total Enrolment                           | 40,035  |

## Research Strengths

- Biomedical and health sciences
- Humanity, identity and expression
- Public policy and social transformation
- Sustainable materials, technologies, landscapes and communities
- Technology in the digital age
- The earth's biological and physical systems and the universe
- The human brain and nervous system



## UNIVERSITY PROFILE

Founded in 1821, McGill University attracts people inspired by challenge and committed to shaping a better future. McGill researchers are not only recognized for their scientific and technological breakthroughs – the world's first blood test for cancer and first Internet search engine among them – but also for examining the social, environmental, ethical and policy impacts of business practices, technology, science and medicine. The diverse composition of McGill's community, with 50% of students from Quebec, 20% from the rest of Canada and 30% international, plus professors drawn from across the world, fosters an entrepreneurial and creative environment.

## Research and Learning Environment

McGill is a research-intensive, student-centred university with an enduring sense of public purpose. Our researchers ask important questions, contributing across disciplines to address the most pressing and complex challenges facing humanity and the natural environment. Our core commitments to ideas, innovation, sustainability, collaboration and partnership and to social engagement in research, guide our work. The result is an environment that nurtures research excellence, where faculty and students co-create solutions with partners on a global scale.



## International Engagement

McGill is proudly one of the most international universities in the world. Our faculty members hail from over 70 countries and drive research that has global impact. McGill has institutional-level research partnerships with leading institutions in the United Kingdom, Japan, Brazil, France and Israel, among others, and has exchange agreements with more than 160 institutions across the world. Thirty percent of our students are international, the highest proportion of any research-intensive university in Canada.

## RESEARCH EXCELLENCE



### A bold, big-data approach to brain health

The Healthy Brains for Healthy Lives (HBHL) program has received \$84 million through the Canada First Research Excellence Fund. Led by Alan C. Evans, HBHL builds on McGill's leading position and partnerships in neuroscience to create a global hub for brain research. The program is deepening understanding of individual variations in brain health and susceptibility to illness by studying the most complex and costly conditions facing our society: autism, chronic pain, suicide, Alzheimer's, MS, Parkinson's and ALS. HBHL applies a big-data approach and integrated expertise with the goal of providing new tools and personalized treatments for patients.



### Beyond sustainability

Informed by systems thinking, McGill researchers respond to the challenges of sustaining the life support systems of the planet now and for future generations by advancing renewable materials, energy, landscape, agricultural, and transportation systems. McGill's leading researchers include Tomislav Friščić, Associate Professor of Chemistry and winner of the 2018 Steacie Prize; Andrew Gonzalez, Canada Research Chair in Biodiversity Science, and Elena Bennett, a specialist in ecosystem services. The holistic view of environmental sustainability includes an emphasis on environmental policy through the new Max Bell School of Public Policy.



### Blazing trails in space

Instrumentation developed at McGill is allowing us to interpret the moments after the Big Bang and explore our cosmos. Our collaboration with international observatories is providing measurements that may unlock the mystery of dark energy powering the accelerated expansion of the Universe. We can now also detect an unprecedented number of fast radio bursts, a new and unexpected phenomenon. These advances made at McGill have wide applications in communications and earth observation, and also in understanding of our place in the Universe. Victoria Kaspi, who was the first woman to win the Gerhard Herzberg Canada Gold Medal for Science and Engineering, leads the McGill Space Institute.



### Harnessing artificial intelligence and computational power

Machine learning—a branch of AI studying algorithms that can learn from data and experience—is a growing focus. McGill's researchers develop reinforcement learning systems, which can interact with and learn from an environment. Applications span diverse areas of scientific, social and commercial interest, including robotics, the life sciences, medical imaging and clinical monitoring. Our leading researchers include Joëlle Pineau, co-director of McGill's Reasoning and Learning Lab and head of the Facebook AI Research lab, and Doina Precup, Associate Professor in Computer Science, Senior Fellow of the Canadian Institute for Advanced Research and head of DeepMind Montreal.

## Quick Facts

|                                 |                |
|---------------------------------|----------------|
| Canada 150<br>Research Chair    | <b>1</b>       |
| Canada Research<br>Chairs (CRC) | <b>88</b>      |
| Research<br>Income              | <b>\$380 M</b> |
| Undergraduate<br>Enrolment      | <b>27,280</b>  |
| Graduate<br>Enrolment           | <b>4,560</b>   |
| International<br>Students       | <b>3,525</b>   |
| Total<br>Enrolment              | <b>31,845</b>  |

## Research Strengths

- Aging across the lifespan
- Chronic disease
- Data, artificial intelligence and the digital society
- Environment and energy
- Equitable, prosperous and sustainable societies
- Health and social determinants
- Indigenous knowledge, research and inquiry
- Materials, manufacturing and the built society
- Sustainability for global equity & prosperity
- Understanding and responding to infectious disease



## UNIVERSITY PROFILE

McMaster is Canada's most research-intensive and impactful university (second in the world), and consistently ranked among the top 100 universities globally. From becoming one of the first universities in the world to house a nuclear reactor to our radical notion of problem-based learning and evidence-based medicine that revolutionized the way health professionals learn and practice, McMaster's outstanding researchers have had extraordinary success in achieving outcomes that have far-reaching impact on health, prosperity, and the future of our planet. A leader in corporate-sponsored research income, we're home to more than 70 research centres and institutes.

## Research and Learning Environment

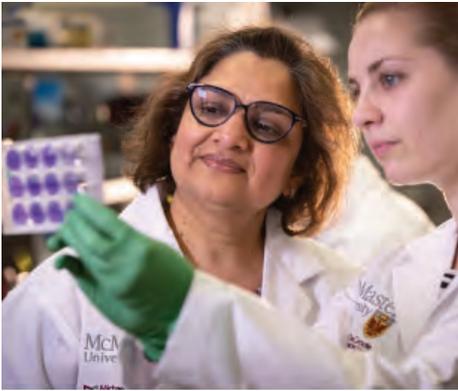
Our research-focused, student-centred approach means we inspire critical thinking and personal growth and push the boundaries of knowledge to prepare students to be tomorrow's leaders and innovators. We were the first Canadian university to give Indigenous students from across the country an early taste of graduate student life, in our labs, libraries, and in the field. The Indigenous Undergraduate Summer Research Scholars program pairs students with research supervisors from a variety of disciplines, while incorporating Indigenous studies and cultural activities.



## International Engagement

McMaster engages in hundreds of international partnerships around the world, including student exchange agreements with top-tier universities, and major research collaborations with countries in every hemisphere. Our Population Health Research Institute has more than 200,000 participants enrolled worldwide in more than 70 research studies and has over 1,500 centres in 86 countries on all inhabited continents. We are North America's only institution to host a United Nations University: The Institute for Water, Environment and Health (UNU-INWEH).

## RESEARCH EXCELLENCE



### Antimicrobial resistance and infectious disease research

Scientists in the Michael G. DeGroot Institute for Infectious Disease Research (IIDR) at McMaster University are bridging the divide between basic research and the clinic to develop life-altering drugs, vaccines and prevention strategies. IIDR researchers – an extraordinary and diverse group of world-leading experts including Gerry Wright – are conducting groundbreaking research in antibiotic resistance mechanisms, new drug discovery, and innovations in therapeutic alternatives to antibiotics. Their work has already resulted in more than 200 filed patents and the launch of three new start-up companies. In 2019, the university launched the David Braley Centre for Antibiotic Discovery.



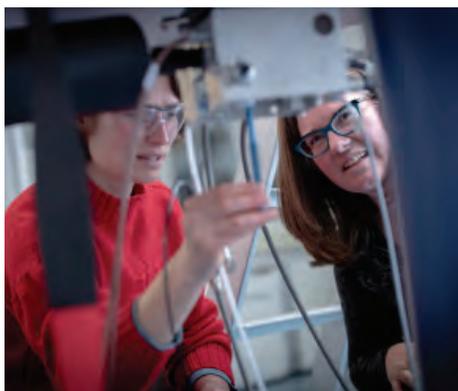
### Aging across the lifespan

At McMaster, more than 100 faculty members and postgraduate students from disciplines as diverse as gerontology, biology, psychology, rehabilitation science, business, and sociology are examining the phenomenon and science of aging from every angle. McMaster is also the headquarters of the Canadian Longitudinal Study on Aging. By blending scientific expertise and medical advances with social insights, engineering acumen, and appropriate management, McMaster researchers are designing innovative solutions to support healthy living for longer. They are even designing smart cars for older drivers and smart homes that can alert health professionals to the first signs of Alzheimer's or diabetes.



### Cross-discipline big data and cohort studies

McMaster researchers are working with enormous sets of data to improve research outcomes within and across every discipline. They're scrutinizing individual genomes to revolutionize patient care with tailored treatments. They're creating smart energy meters for homes, mapping changes in our brains, and studying the properties of stars. They're conducting population-level studies that provide definitive proof of health outcomes. Our world-leading cohort studies are central to our understanding of the onset, progression and outcome of chronic diseases. Cohorts such as the Canadian Longitudinal Study on Aging, Prospective Urban and Rural Epidemiological Study, and the Canadian Healthy Infant Longitudinal Development birth cohort provide priceless data to maximize prevention, treatment and management.



### Materials & manufacturing research

From the study of new steel alloys to neutrons and silicon chips, from the safety and efficacy of our roads to the strength of our bridges, from advanced robotics to smart cars, our ability to understand the behaviour of materials and how they are produced is fundamental to the modern world. We're creating new materials and devising innovative applications for them. Home to the McMaster Manufacturing Research Institute, the Canadian Centre for Electron Microscopy, and the McMaster Small Angle Neutron Scattering beamline, the university is focused on finding solutions to the challenges faced by today's manufacturing industry and nanostructured materials.

## Quick Facts

|  |                |
|--|----------------|
| Canada Excellence<br>Research Chair (CERC) | <b>1</b>       |
| Canada 150<br>Research Chair               | <b>1</b>       |
| Canada Research<br>Chairs (CRC)            | <b>149</b>     |
| Research<br>Income                         | <b>\$536 M</b> |
| Undergraduate<br>Enrolment                 | <b>49,535</b>  |
| Graduate<br>Enrolment                      | <b>18,235</b>  |
| International<br>Students                  | <b>9,500</b>   |
| Total<br>Enrolment                         | <b>67,770</b>  |

## Research Strengths

- Artificial intelligence and operational research
- Astrophysics
- Ethics, responsibility and the digital transition
- Neurosciences, development and aging
- Public Health
- Research-creation
- Sustainable development
- Therapeutic innovation and precision care



## UNIVERSITY PROFILE

Deeply rooted in Montreal and dedicated to its international mission, Université de Montréal is a leading research university. It ranks among the top 100 universities worldwide and among the best French-language universities. The Times Higher Education ranks UdeM 7th among institutions committed to achieving the UN's sustainable development goals. With its affiliated schools, Polytechnique Montréal and HEC Montréal, UdeM attracts over \$500 million in research funding every year, making it one of the top three university research hubs in Canada. UdeM has more than 67,000 students, 2,400 professors and researchers, and an active global network of 400,000 alumni.

## Research and Learning Environment

With its 14 faculties and its affiliated schools, Université de Montréal is home to 465 research units, active in every field of knowledge. It is the only university in Canada to offer the full range of disciplines in life sciences, including medicine, public health, pharmacy, nursing, dentistry, optometry and veterinary medicine. Its network of 27 hospitals and affiliate healthcare centers is one of the strongest clinical divisions in the country.



## International Engagement

The Université de Montréal has partnership agreements with institutions in 65 different countries involving 550 institutions worldwide, and more than half its academic's publications are co-authored with one or several international colleagues. The Montreal Declaration for a Responsible Development of Artificial Intelligence stands as an example of UdeM's leadership in cross-disciplinary work, international outreach and social impact.

## RESEARCH EXCELLENCE



### **Mila - Quebec Artificial Intelligence Institute**

Founded by UdeM Professor Yoshua Bengio, co-recipient of the 2018 Turing Award, Mila rallies researchers in Montreal specializing in the field of deep learning. Recognized globally for its significant contributions, Mila has distinguished itself in the areas of language modelling, machine translation, object recognition and generative models. With its new premises in the Mile-Ex neighbourhood, Mila creates a unique space for innovation in artificial intelligence and technology transfer that will make use of interactions with industry and spark the emergence of start-ups while integrating the social impacts of technology in its projects.



### **Canada 150 Research Chair in Bacterial Cell Biology**

Under the direction of Professor Yves Brun, the Chair investigates the growing and alarming phenomenon of bacterial resistance to antibiotics, which the World Health Organization calls one of the most serious threats to global health. Bacteria are evolving and becoming resistant to antibiotics. To counteract this evolution, the Chair is pursuing two specific strands of research: bacterial cell wall synthesis and the adhesion of bacteria to surfaces and biofilms. This is done in collaboration with chemists, biophysicists, bioengineers and public health experts.



### **Health Hub: politics, Organizations and law**

The Health Hub's activities are based on the expectation that tomorrow's successful health systems will rely heavily on innovations in the areas of health policy, organizations, and law. It works on key issues that mark the evolution of contemporary health systems, such as digital innovation and the renewal of medical professionalism. Health hub's co-directors are Jean-Louis Denis, Canada Research Chair in Health System Design and Adaptation, and Catherine Régis, Canada Research Chair in Collaborative Culture in Health Law and Policy.



### **Canada Research Chair in Quantum Information Processing**

Gilles Brassard is the co-recipient of the 2018 Wolf Prize in Physics for his contribution to the creation and development of quantum cryptography and quantum teleportation. Brassard, who is the first Canadian to receive this prize, is considered by many to be the father of quantum computing. He continues his groundbreaking work to apply the "spooky action" of quantum mechanics to information processing. His research explores the potential to create quantum computers-capable of performing some calculations faster than a classical computer the size of the universe, at least in theory.



uOttawa

## Quick Facts

|                                 |                |
|---------------------------------|----------------|
| Canada 150<br>Research Chair    | <b>1</b>       |
| Canada Research<br>Chairs (CRC) | <b>89</b>      |
| Research<br>Income              | <b>\$313 M</b> |
| Undergraduate<br>Enrolment      | <b>35,515</b>  |
| Graduate<br>Enrolment           | <b>6,740</b>   |
| International<br>Students       | <b>7,150</b>   |
| Total<br>Enrolment              | <b>42,255</b>  |

## Research Strengths

- Brain and mental health
- Catalysis and green chemistry
- Digital health and digital humanities
- Emerging materials and nanotechnology
- Francophonie and bilingualism
- Law and social justice
- Public policy
- Quantum and photonics technology
- Regenerative medicine
- Vascular and cardiovascular science



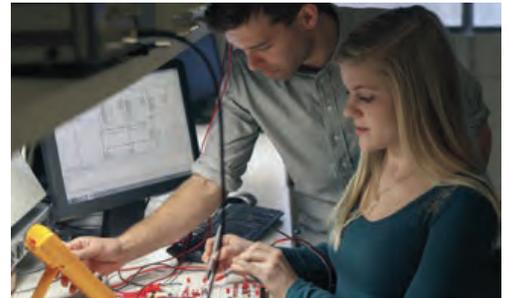
## UNIVERSITY PROFILE

Founded in 1848, the University of Ottawa is located in the heart of the nation's capital, with ready access to national institutions. As the world's largest bilingual (French-English) university, we're committed to academic and research excellence and value cultural diversity, equity and inclusion.

The University of Ottawa, together with its affiliated hospital research institutes, are acclaimed innovators. Our researchers are world leaders in photonics, vascular and cardiovascular health, brain and mental health, Francophonie, public policy and social justice. With over 24 research centres and institutes cutting across faculties and disciplines, uOttawa promotes dynamic research collaboration and leverages Ottawa's government laboratories, industry and policymakers.

## Research and Learning Environment

The University promotes active and experiential learning and boasts one of the top five co-op programs in Canada. Students are also encouraged to develop their international experience through the recently launched uOGlobal program. Experiential learning is at the heart of the new STEM Complex, designed to encourage inclusion and innovation among disciplines: the arts, humanities, science and engineering. It will also help boost research on campus and foster greater collaboration with industry, as will the University's new satellite office in Kanata North. The University's strategic areas of development in research focus on four pillars: Creating a Sustainable Environment, Advancing Just Societies, Shaping the Digital World and Enabling Lifelong Health and Wellness.



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## International Engagement

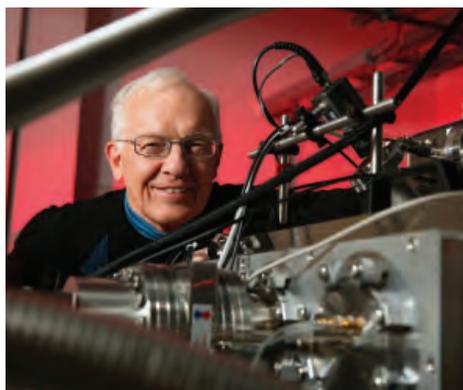
With students and faculty from over 100 countries, the University of Ottawa offers opportunities to build research collaborations with the best institutions in the world, such as Germany's Max Planck Institutes and the Chinese Academy of Sciences. The establishment of the Max Planck-uOttawa Centre for Extreme and Quantum Photonics as well as the joint satellite office of France's Université de Lyon and the Centre national de la recherche scientifique — located on uOttawa's campus — are examples of the international level of our engagements.

## RESEARCH EXCELLENCE



### A model for dealing with diversity

Lori Beaman, Canada Research Chair in Religious Diversity and Social Change, was the principal investigator of the Religion and Diversity Project, which involved 37 researchers and 24 universities around the world over seven years. The project changed the academic discourse on religious diversity, and has since greatly influenced public awareness and public policy in Canada and elsewhere. Its approach is highly innovative: religious diversity is seen as an opportunity, not a problem. Professor Beaman developed a concept she calls “deep equality,” which focuses on positive practices founded on mutual respect, caring and reciprocity to negotiate diversity. Her research has attracted worldwide attention.



### The power of light

Physicist Paul Corkum helped launch the growing field of attosecond science (an attosecond lasts one billionth of a billionth of a second). A Distinguished Professor at uOttawa and the National Research Council-Canada Research Chair in Attosecond Photonics, he is known worldwide for producing flashes of light so short and powerful they allow scientists to capture the movement of subatomic particles and observe molecular reactions as they occur. His ultimate goal is to direct the movement of electrons, which could lead to transformative advances in computing, engineering and medicine. Professor Corkum has received many prestigious international awards for his research, including the 2018 Isaac Newton Medal and Prize from the United Kingdom’s Institute of Physics.



### Unravelling the causes of rare childhood diseases

Clinical geneticist Kym Boycott leads a Canadian consortium of clinicians and scientists dedicated to identifying genes linked to hundreds of rare pediatric diseases. So far, they have discovered 150 new disease genes and provided a diagnosis to thousands of patients. A professor in uOttawa’s Faculty of Medicine and a senior scientist at the CHEO Research Institute, Dr. Boycott uses genomic sequencing approaches to read the genetic code and uncover the causes of these diseases. She aims to incorporate genomic sequencing into routine diagnostics and patient care. To leverage these discoveries, she co-leads the Canadian Rare Diseases: Models and Mechanisms Network and serves on the steering committee of the Global Alliance for Genomics and Health.



### Trustworthy AI

When should we trust the use of artificial intelligence (AI)? That question is at the heart of research conducted by Jason Millar, Canada Research Chair in the Ethical Engineering of Robotics and Artificial Intelligence in the Faculty of Engineering. The uOttawa researcher is leading international discussions on the responsible use of AI from an interdisciplinary perspective. His research informs international policymakers, including from the G7, on accountability and trust in AI. Professor Millar specializes in the ethical engineering of AI and robotics, applied ethics and technology policy.



## Quick Facts

|   |         |
|---|---------|
| Canada Excellence Research Chair (CERC) | 1       |
| Canada 150 Research Chair               | 1       |
| Canada Research Chairs (CRC)            | 51      |
| Research Income                         | \$207 M |
| Undergraduate Enrolment                 | 19,665  |
| Graduate Enrolment                      | 4,985   |
| International Students                  | 3,405   |
| Total Enrolment                         | 26,650  |

## Research Strengths

- Applied AI and analytics
- Art conservation
- Chemistry
- Clean technology
- Engineering
- Environment
- Health - cancer trials
- Indigenous research
- Mental health
- Particle astrophysics
- Prison, justice, and surveillance



## UNIVERSITY PROFILE

Queen's University is one of Canada's leading research institutions, with a history of discovery and innovation. For more than 175 years, Queen's has shaped knowledge and helped address some of the world's most pressing questions. Queen's researchers lead the way in numerous fields, making notable advances recently in particle astrophysics, cancer research, ecological history and environmental change, as well as clean energy technology. The university ranks fourth among medical-doctoral universities in Canada and is home to many faculty-based research centres that provide dynamic, collaborative settings for scholars. Students are an integral part of the vibrant research community, and Queen's research-intensive environment and interdisciplinary program offerings provide students with the comprehensive and nimble skills required in today's competitive and evolving workforce.

## Research and Learning Environment

Bolstered by the outstanding reputations of its scholars and researchers, including 2015 Nobel Prize winner Arthur B. McDonald, Queen's provides students with unparalleled access to careers and personal development opportunities around the world. Queen's boasts leading graduation rates for both undergraduate and graduate students, as well as diverse learning opportunities, and a tight-knit global network of 159,000 alumni in 153 countries. To graduate from Queen's University is to join an international community of lifelong learners and accomplished leaders.



## International Engagement

With more than 220 international exchange partners, and as a member of the Matariki Network of Universities, Queen's provides rich international opportunities for learning and research collaboration. This includes InteLab-Yangtze, a joint project with China's Tongji University that aims to create the world's foremost research centre on the ecology of the Yangtze River basin. Significant boosts in international research funding, as well as prestigious international faculty awards, reinforce Queen's research excellence.

## RESEARCH EXCELLENCE



### Arthur B. McDonald Canadian Astroparticle Physics Research Institute

Named after Canada's famed 2015 Nobel Laureate in Physics, the Arthur B. McDonald Canadian Astroparticle Physics Research Institute was established in 2016 with the awarding of \$63.7M from the Canada First Excellence Fund. The institute's mission is to coordinate, expand and strengthen Canada's efforts in experimental astroparticle physics, cosmology, detector development, and low-background techniques. Astroparticle physics at Queen's relies on the state-of-the-art, multi-institutionally managed and internationally collaborative SNOLAB facilities. <https://mcdonaldinstitute.ca/>



### Beaty Water Research Centre

Water-related issues are a driving force for economic growth, social well-being and a healthy population in Canada and around the world. The interdisciplinary Beaty Water Research Centre, led by Dr. Pascale Champagne, Canada Research Chair in Bioresources Engineering, is committed to fostering an environment that encourages collaborative research spanning both traditional water-related disciplines, as well as non-traditional and emerging disciplines.

Four leading Canadian researchers affiliated with Beaty, including Dr. Champagne, were awarded the 2019 NSERC Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering for their work in enhancing the value and sustainability of our natural renewable resources through collaboration. <https://waterresearchcentre.ca/>



### The Canadian Cancer Trials Group (CCTG)

Cancer research has a rich history of discovery, accomplishment and leadership at Queen's. The CCTG, led by Dr. Janet Dancey, is an international leader in the design and execution of national and international clinical trials. More than 500 trials in 40 countries have aimed at improving survival rates and quality of life for people with cancer. CCTG is home to more than 100 staff members who coordinate the activities of approximately 2,000 investigators, including oncologists, hematologists, radiologists, surgeons, and nurses. <https://www.ctg.queensu.ca/>



### ePower

From the space station to renewable power, research at Queen's is transforming industry with energy-efficient power conversion electronics. ePOWER brings together academic and industrial researchers to develop a broad range of applications and expertise, from power consumption, to power application-specific integrated circuits. Under the leadership of Dr. Praveen Jain, Canada Research Chair in Power Electronics, ePOWER has more than 125 patents issued or pending.

## Quick Facts

|   |                |
|---|----------------|
| Canada Excellence Research Chair (CERC) | <b>1</b>       |
| Canada 150 Research Chair               | <b>1</b>       |
| Canada Research Chairs (CRC)            | <b>34</b>      |
| Research Income                         | <b>\$176 M</b> |
| Undergraduate Enrolment                 | <b>20,010</b>  |
| Graduate Enrolment                      | <b>4,335</b>   |
| International Students                  | <b>3,405</b>   |
| Total Enrolment                         | <b>25,705</b>  |

## Research Strengths

- Agriculture: food and bioproducts for a sustainable future
- Energy and mineral resources: technology and public policy for a sustainable environment
- Indigenous Peoples: engagement and scholarship
- One health: solutions at the animal-human-environment interface
- Synchrotron sciences: innovation in health, environment and advanced technologies
- Water security: stewardship of the world's freshwater resources

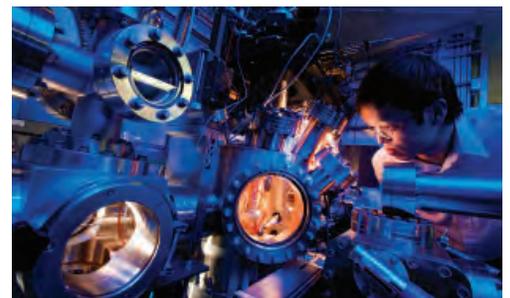


## UNIVERSITY PROFILE

Over more than a century, the University of Saskatchewan has led far-sighted research and innovation, developing, for example, the cobalt-60 cancer therapy technology and more than 400 commercial crop varieties. Offering more than 140 graduate programs in 14 colleges and three graduate schools, the university is renowned for its cluster of world-class science facilities that include Canada's only synchrotron—the Canadian Light Source—and a unique vaccine and infectious disease research centre. The university is a powerhouse for food and water security research, with Canada First Research Excellence Fund (CFREF) programs in both areas—the only university with two CFREF awards.

## Research and Learning Environment

The university has a strong focus on collaborative, interdisciplinary research aimed at solving pressing global issues such as food, water and energy security. USask is a leader in community-engaged scholarship, connecting research, teaching and learning with the needs and interests of local and global communities. Undergraduate research and experiential learning are priorities. With one of the highest populations of Indigenous students among Canadian post-secondary institutions, the university particularly fosters Indigenous student success.



## International Engagement

Global engagement in teaching, learning, and research is an institutional priority at USask. Embracing a diverse student body, the university welcomes over 3,000 students from more than 130 countries around the world, and offers opportunities to learn and engage in all regions of the globe. Strengthening global impact through research networks worldwide, the university currently has 139 international MOUs and over \$15 million in international research funding with 121 partner institutions in 47 countries.

## RESEARCH EXCELLENCE



### Predicting and preparing for water threats in a changing global climate

USask's \$176.8-M Global Water Futures network—the largest university-led water research program worldwide—is led by the USask Global Institute for Water Security and three key university partners. With core federal CFREF funding of \$77.8 million, GWF is transforming the way communities, governments and industries in Canada and other cold regions of the world prepare for and manage increasing water-related threats in the face of global climate change. The GWF network involves more than 335 stakeholders/users, 162 faculty researchers from 15 Canadian universities, and almost 500 research personnel (students, postdoctoral fellows, and technicians) associated with 39 pan-Canada projects. [www.globalwaterfutures.ca](http://www.globalwaterfutures.ca)



### Designing crops for global food security

Funded with a \$37.2-M CFREF award, USask's Plant Phenotyping and Imaging Research Centre (P2IRC) is becoming a unique global resource for plant breeders to develop new targeted crop varieties and boost crop yields. The digital agriculture research centre—managed by the Global Institute for Food Security—combines plant genomics with crop phenotyping (identification of useful traits), high-performance computing, and digital imaging technology, along with social science research on societal impacts. P2IRC researchers have played a key role in international consortia that have recently decoded the genomes for both bread wheat and durum wheat, discoveries that will benefit farmers globally.



### Probing matter with the brightest light in Canada

The Canadian Light Source is a national research facility of the University of Saskatchewan and the only synchrotron in Canada, producing the brightest light in the country—millions of times brighter than even the sun. More than 1,000 academic, government and industry scientists from around the world use the CLS for innovative health, agriculture, environment, and advanced materials research. Eight USask Canada Research Chair holders and their teams use CLS imaging for world-leading research programs—such as cutting-edge investigations into multiple sclerosis, cystic fibrosis, heart repair, bone loss, superconductors, bioenergy, drought tolerance in wheat, and metal bioavailability in the environment.



### Developing vaccines for devastating diseases

USask's Vaccine and Infectious Disease Organization-International Vaccine Centre (VIDO-InterVac) is a global leader in infectious disease research and vaccine development, combating dangerous pathogens in both animals and humans. Using the new containment Level 3 facility, researchers are developing vaccines for new and re-emerging diseases such as Zika, respiratory infection MERS-CoV, and tuberculosis, as well as diseases in cattle, pigs and poultry such as John's disease, bovine tuberculosis, lung plaque (Mycoplasma), African swine fever, and the devastating pig virus PEDV. VIDO-InterVac has developed eight commercialized animal vaccines (six world firsts), and will launch a manufacturing facility for rapid vaccine production by 2020.



## Quick Facts

|                                 |                |
|---------------------------------|----------------|
| Canada 150<br>Research Chairs   | <b>3</b>       |
| Canada Research<br>Chairs (CRC) | <b>315</b>     |
| Research<br>Income              | <b>\$1.3 B</b> |
| Undergraduate<br>Enrolment      | <b>71,525</b>  |
| Graduate<br>Enrolment           | <b>18,555</b>  |
| International<br>Students       | <b>19,190</b>  |
| Total<br>Enrolment              | <b>90,075</b>  |

## Research Strengths

- Advanced materials and manufacturing
- Artificial intelligence and machine learning
- Business and Management Science
- Children’s health and development
- Cleantech and renewable energy
- Genomics
- Legal studies
- Medieval studies and philosophy
- Regenerative medicine
- Urban studies



## UNIVERSITY PROFILE

Founded in 1827, the University of Toronto is Canada’s leading institution of learning, discovery and knowledge creation. We’re proud to be among the world’s top research-intensive universities, driven to invent and innovate. With over 980 programs on three campuses to choose from, our undergraduate and graduate students learn from and work with professors recognized as global thought leaders in areas such as artificial intelligence, human rights, global security, ethics, autism, cancer, robotics and nanotechnology. U of T encourages collaboration across disciplines, with community and international partners, to spark the ideas, cutting-edge discoveries and inventions that will build a better world for tomorrow.

## Research and Learning Environment

U of T ranks among the top five universities in the world that excel across virtually every subject of inquiry, and we’re Canada’s most innovative university. With an annual research budget of \$1.3 billion, the university and its nine partner hospitals are a vital research engine for Toronto, Canada, and the world. Our researchers’ papers are so influential they’re ranked second only to Harvard in citations. The university has more than a thousand research labs, access to state-of-the-art equipment and advanced computing. We recently launched an online portal to easily connect undergraduates to research positions. In 2017-18, our nine entrepreneurship hubs worked with over 300 student-led start-up teams, attracting \$150M in investment and generating \$10M in sales.



## International Engagement

U of T welcomes 19,000 international students each year, has more than 552,000 alumni in 150 countries, and collaborates with other leading universities, research institutes and industry partners around the world. Our international partners include University College London, Centre National de la Recherche Scientifique, Tel Aviv University, and the University of Hong Kong, among many others. More than half of all papers published by U of T researchers are joint efforts with researchers at institutions outside Canada.

## RESEARCH EXCELLENCE



### Medicine by Design

Medicine by Design harnesses U of T's exceptional expertise at the convergence of the physical and life sciences, engineering, mathematics, and medicine, accelerating breakthroughs in regenerative medicine and cell therapy. Supported by a \$114-million grant from the government of Canada it builds on our rich legacy in stem cell research by uniting more than 130 researchers in collaborative teams to improve treatments for diseases such as cancer, heart disease, and diabetes. Working at the frontier of biological design, Medicine by Design powers Toronto's vibrant biomedical ecosystem and strengthens Canada as a global centre for regenerative medicine.



### Institute for Sustainable Energy

Contributing to U of T's research excellence in cleantech, the Institute for Sustainable Energy is a multidisciplinary centre that brings together researchers and students from across the university, along with partners from industry and government, to advance solutions in technologies such as wind turbines, solar power, fuel cells, and hydroelectricity. The goal of their work is to increase energy efficiency and reduce the environmental impact of energy use and conversion. U of T's leading-edge research in this area is also helping companies make better use of resources and enabling access to new technologies for a cleaner, greener, and more sustainable future.



### Schwartz Reisman Institute for Technology and Society

The Schwartz Reisman Institute for Technology and Society brings together leading scholars to better understand the benefits and challenges that AI, biotechnology, and other technological advances present for our economy, our society and our day-to-day lives. Established through a generous gift from Gerald Schwartz and Heather Reisman in 2019, the Institute facilitates cross-disciplinary research and collaboration and draws on U of T's signature strengths in the sciences, humanities and social sciences to address areas such as fairness and inclusivity, security and privacy, and values and ethics.



### School of Cities

The School of Cities brings together researchers from across various disciplines to address the challenges facing the world's urban areas, where more than half of all people live. The School convenes urban-focused researchers, educators, students, practitioners, and the general public to explore and address complex urban challenges, with the aim of making cities and urban regions more sustainable, prosperous, inclusive, and just. U of T's deep urban expertise across all fields is tackling the future of cities. The School of Cities is where educators, institutions, practitioners and the public will engage in research, education and outreach to drive forward new city solutions—and a shared prosperity for all citizens.

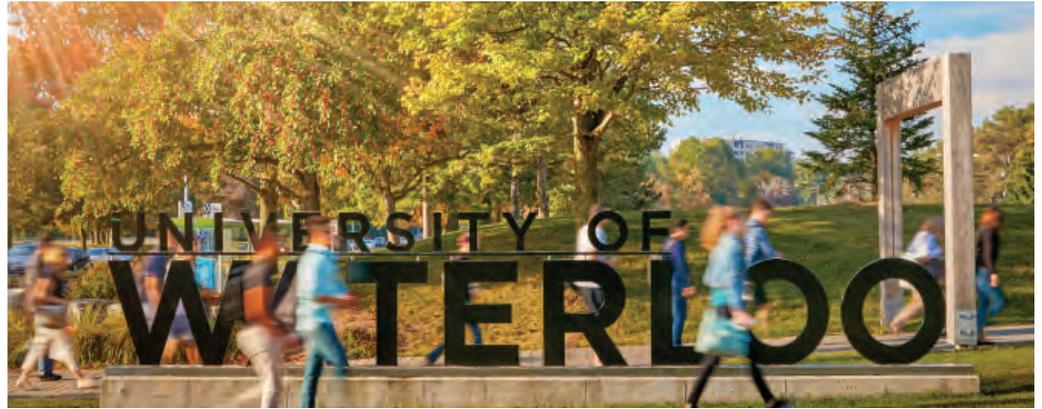


## Quick Facts

|   |                |
|---|----------------|
| Canada Excellence Research Chair (CERC) | <b>1</b>       |
| Canada 150 Research Chairs              | <b>2</b>       |
| Canada Research Chairs (CRC)            | <b>74</b>      |
| Research Income                         | <b>\$224 M</b> |
| Undergraduate Enrolment                 | <b>34,000</b>  |
| Graduate Enrolment                      | <b>6,000</b>   |
| International Students                  | <b>9,000</b>   |
| Total Enrolment                         | <b>40,000</b>  |

## Research Strengths

- Computer science
- Environmental sustainability and climate change
- Healthy aging
- Information and computing technology
- Pure mathematics
- Quantum information and nanotechnology
- Society, culture and governance
- Vision and ocular
- Water



## UNIVERSITY PROFILE

The University of Waterloo is at the forefront of innovation with impact. We are home to transformational research and inspired learning through our world leading cooperative education program and entrepreneurial ecosystem.

Consistently ranked Canada’s most innovative university, Waterloo champions a culture of curiosity, exploration, risk-taking, entrepreneurship, global stewardship and leadership. We bring bold ideas and brilliant minds together with world-class research institutes in quantum computing, water, health, artificial intelligence, cybersecurity and transportation. Waterloo is a leader in the unique collaboration across sectors and disciplines to shape our future by operating at the forefront of discovery, learning and impact.

## Research and Learning Environment

Waterloo’s success is grounded in teaching excellence and curiosity-driven research and discovery, residing in each of our six faculties: Applied Health Sciences, Arts, Engineering, Environment, Mathematics and Science. Early exposure to research, experience-rich work terms and a wealth of entrepreneurial opportunities create a unique learning environment. Our dedication to education begins with equity-focused initiatives that open doors to education for all learners, and extend around the world.



## International Engagement

Waterloo encourages research that ventures beyond conventional boundaries, convening global coalitions of researchers and institutions to tackle the most pressing challenges facing our society. We are working to become the most internationalized university in Canada by playing to our strengths in cooperative education and research, and affiliating with the most innovative universities and organizations in the world. Waterloo co-op students find work with companies in more than 60 countries, while alumni are making their mark in 152 countries.

## RESEARCH EXCELLENCE



### Making laser technology ubiquitous

Millions of people undergo what has become routine laser eye surgery. Laser technology is now so common, but that wasn't the case in 1985 when Donna Strickland, a professor in the Faculty of Science, was working on her Nobel Prize-winning research. Strickland co-developed chirped pulse amplification which enabled the most intense laser pulses ever created. The technique greatly expanded the uses for lasers and is applied today in laser eye surgery. Strickland continues to research laser technology and leads the ultrafast laser group developing high-intensity laser systems for nonlinear optics investigations.



### Artificial intelligence helps doctors diagnose cancer

A new imaging device that uses artificial intelligence (AI) and deep-tissue scans of our bodies can detect skin cancer earlier – without doing biopsies. Alexander Wong, a professor in the Faculty of Engineering, and his research team are sharing the technology through their start-up company, Elucid Labs. At the heart of Wong's research is "deep learning AI," a type of powerful machine learning that can take a wealth of data and then learn how to do a task on its own. When combined with deep-tissue scanning technology, it provides state-of-the-art cancer screening to assist clinicians.



### A "second heart" to strengthen our golden years

Each year, millions of older adults fall resulting in injuries that lead to hospitalization and severe functional decline. Richard Hughson, a professor in Applied Health Sciences, has co-developed the Second Heart device to tackle the root cause of many falls—poor blood pressure regulation. Hughson's team at the Research Institute for Aging has uncovered that up to a third of older adults' blood pressure does not recover quick enough when they stand-up. The Second Heart wraps around a person's calf muscle and after each heartbeat, the device compresses to help drive blood into the brain.



### Diversity is good for business

At a time when global migration is at a record high, Bessma Momani, a professor in the Faculty of Arts, is examining the impact of immigration on the bottom lines of Canadian businesses. Her research shows that across all sectors in Canada, a one-percent increase in workforce diversity corresponds to an average increase of 2.4 percent increase in revenue and a 0.5 percent increase in productivity. Momani explores how Canada is uniquely positioned to harness the benefits of immigration, a benefit that she has named Canada's diversity dividend.

## Quick Facts

|                              |                |
|------------------------------|----------------|
| Canada Research Chairs (CRC) | <b>75</b>      |
| Research Income              | <b>\$257 M</b> |
| Undergraduate Enrolment      | <b>24,587</b>  |
| Graduate Enrolment           | <b>5,935</b>   |
| International Students       | <b>3,835</b>   |
| Total Enrolment              | <b>30,520</b>  |

## Research Strengths

- Child & youth
- Environmental sustainability & green energy
- Global health equity & social innovation
- Imaging
- Materials & biomaterials
- Musculoskeletal health
- Neuroscience/brain & mind
- Philosophy of science
- Planetary science & space exploration
- Wind engineering & natural disaster mitigation



## UNIVERSITY PROFILE

Western University ranks as one of Canada’s top research universities. From fundamental to applied knowledge, discoveries at Western benefit economic, social, health, policy and cultural development in Canada and around the world.

Founded in 1878, the university attracts students with broad worldviews seeking to study, engage, and lead in international communities. Students from 121 countries share in classroom experiences and engage in study-abroad, research and volunteer opportunities that broaden perspectives and knowledge. Through 12 faculties and schools, and three affiliated university colleges, Western teaches a full complement of disciplines with five subjects ranked in the top 50 globally.

## Research and Learning Environment

Western appeals to students with a broad worldview seeking to study, engage with and lead in the global community. The university excels at moving research out of labs and into people’s lives, including through extensive collaborative networks that allow researchers to inform policy on the global stage. From the operating room to the boardroom, and from the factory floor to spacecraft rocketing beyond Earth’s atmosphere, Western’s research drives discovery and influences the way we live.



## International Engagement

With the goal of supporting excellence on the world stage, and preparing citizens to lead in diverse global communities, Western’s international engagement focuses on fostering unique international learning opportunities; recruiting and supporting international students; and enhancing overall global activity and awareness. Each year, more than 2,200 Western students participate in international learning abroad. Further, more than 80 percent of Western’s publications between 2013 and 2017 were co-authored with international partners.

## RESEARCH EXCELLENCE



### Putting brain misconceptions to rest

Preliminary results from the world's largest sleep study have shown that people who sleep on average between seven and eight hours nightly performed better cognitively than those who slept less – or, surprisingly, more – than this amount.

Researchers at the renowned Brain & Mind Institute indicated approximately half of all participants reported typically sleeping less than 6.3 hours nightly, about an hour less than the study's recommendation. One of the most startling revelations? Most participants who slept four hours or less performed as if they were almost nine years older.

Another surprising discovery was that sleep affected all adults equally.



### Unpacking polymers

Elizabeth Gillies' work with degradable polymers (plastics) may transform everything from a farmer's fertilizer to a doctor's cancer drugs.

The Chemistry and Chemical & Biochemical Engineering professor is developing polymer molecules that respond to specific triggers like light, heat or chemicals, and degrade at specific times and locations. Used as coatings, today's polymers take time to degrade and tend to break down inefficiently, often causing negative side effects.

Gillies has made sure her polymers act like tiny suitcases that don't break down or 'unpack' their contents until they reach their final destinations – often a plant's roots or a cancerous tumour.



### Protecting women and children

In the aftermath of the 1989 Montréal Massacre, where 14 young women engineering students were murdered, the federal government commissioned a panel of experts on violence against women.

In the 30 following years, Western's Centre for Research & Education on Violence Against Women & Children has led national efforts to educate, drive research and practice, and change legislation. Over this time, the Centre has led many groundbreaking policy and legislative changes related to domestic violence, child protection, child custody and labour employment standards. It has also integrated healthy relationship curriculum into thousands of schools in Canada and the United States.



### Tornado project takes a national spin

If a tornado touches down in Canada, Greg Kopp won't be far behind.

As lead researcher for the Northern Tornadoes Project, Kopp hopes to identify every Canadian tornado in 2019. Using the latest radar and satellite technology and high-resolution aerial surveys, he is conducting the country's most comprehensive analysis ever undertaken.

Approximately 60 tornadoes are verified annually in Canada; however, data suggests the actual number is nearly four times that amount. By developing a deeper database, the project should improve early detection, mitigate against damage to people and property and help model future implications of climate change.







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