

UNIVERSITY OF ALBERTA  
THE UNIVERSITY OF BRITISH COLUMBIA  
UNIVERSITY OF CALGARY  
DALHOUSIE UNIVERSITY  
UNIVERSITÉ LAVAL  
UNIVERSITY OF MANITOBA  
MCGILL UNIVERSITY  
MCMASTER UNIVERSITY  
UNIVERSITÉ DE MONTRÉAL  
UNIVERSITY OF OTTAWA  
QUEEN'S UNIVERSITY  
UNIVERSITY OF SASKATCHEWAN  
UNIVERSITY OF TORONTO  
UNIVERSITY OF WATERLOO  
WESTERN UNIVERSITY

# U15-Group of Canadian Research Universities University Profiles

2016



Group of Canadian Research Universities

Regroupement des universités de recherche du Canada



**Group of Canadian Research Universities**

Regroupement des universités de recherche du Canada

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Note to reader:

Please note that 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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*What we learn, what our faculty members teach, and what our graduates take into their workplaces, expands our economy, informs our public policy, and influences our social and cultural development.*

## MESSAGE FROM THE CHAIR



Spanning the breadth of our country, the 15 universities whose profiles are contained here conduct research that changes lives and tackles the world's most pressing problems. From fundamental to applied research that responds to the urgent questions facing our society, our institutions and our campuses are home to world-class facilities, faculty and students.

These talented, inquisitive individuals use their curiosity and creativity to make discoveries, both expected and unexpected.

Their work in the sciences and the humanities covers every imaginable field of study. Our institutions draw scholars and teachers from around the world, and participate in international collaborations that are pushing the frontiers of knowledge. Those global partnerships, and the networks, connections and experience our international students share, enrich our campus experience and our academic pursuits.

Much of the innovation that transforms our society begins here. What we learn, what our faculty members teach, and what our graduates take into their workplaces, expands our economy, informs our public policy, and influences our social and cultural development. We perform \$8.5 billion in research every year, create 81 percent of all the patents filed by Canadian universities, and educate 70 percent of all doctoral students in Canada.

U15 universities benefit not only Canadians, but global citizens. The impacts of our research are wide-reaching and long-lasting. We hope these profiles will illustrate the unique strengths and successes of each of our member institutions, which collectively constitute a world-class network of universities in Canada.

Guy Breton  
Rector, Université de Montréal  
U15 Chair

## EXECUTIVE DIRECTOR MESSAGE



In 2012, 15 of Canada's leading research-intensive universities established a Directorate to help The U15 speak with one voice. Since then, we have been working to advance the sound public policy that ensures our country succeeds in this globally competitive environment.

The U15 works collaboratively to ensure the best conditions for world-class university research in Canada. We do so by contributing to public policy debates, advocating for new or enhanced research programs, and building partnerships with the public and private sectors, as well as international researchers and research institutes.

Through publications like this profile book, a multi-lingual website, and international missions, The U15 raises awareness of the world-class teaching and research that occurs at our universities. The U15 is a member of the Global Network of national research-intensive university groups, working with international counterparts to advance research world-wide and to improve the global research environment.

We hope you enjoy the profiles of our member universities, which offer insight into why the majority of all doctoral students, and almost half of all the university students in Canada, choose to attend our institutions.

We look forward to continuing to work together to create an exciting and enriching research enterprise that draws students, researchers and leaders from around the world to our campuses and to our country.

Suzanne Corbeil  
Executive Director, U15



*The U15 is a member of the Global Network of national research-intensive university groups, working with international counterparts to advance research world-wide and to improve the global research environment.*



Group of Canadian Research Universities

Regroupement des universités de recherche du Canada

## U15 UNIVERSITIES

The U15, Canada’s 15 leading research universities, play a unique role in our society. They 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, teachers 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.



*U15 universities push the frontiers of knowledge through the pursuit of research excellence and world-class teaching. By expanding human knowledge, our universities make profound contributions to individuals, economies and societies. It is the goal of The U15 Group of Canadian Research Universities to ensure our institutions are able to make the largest contributions possible in Canada and around the world.*

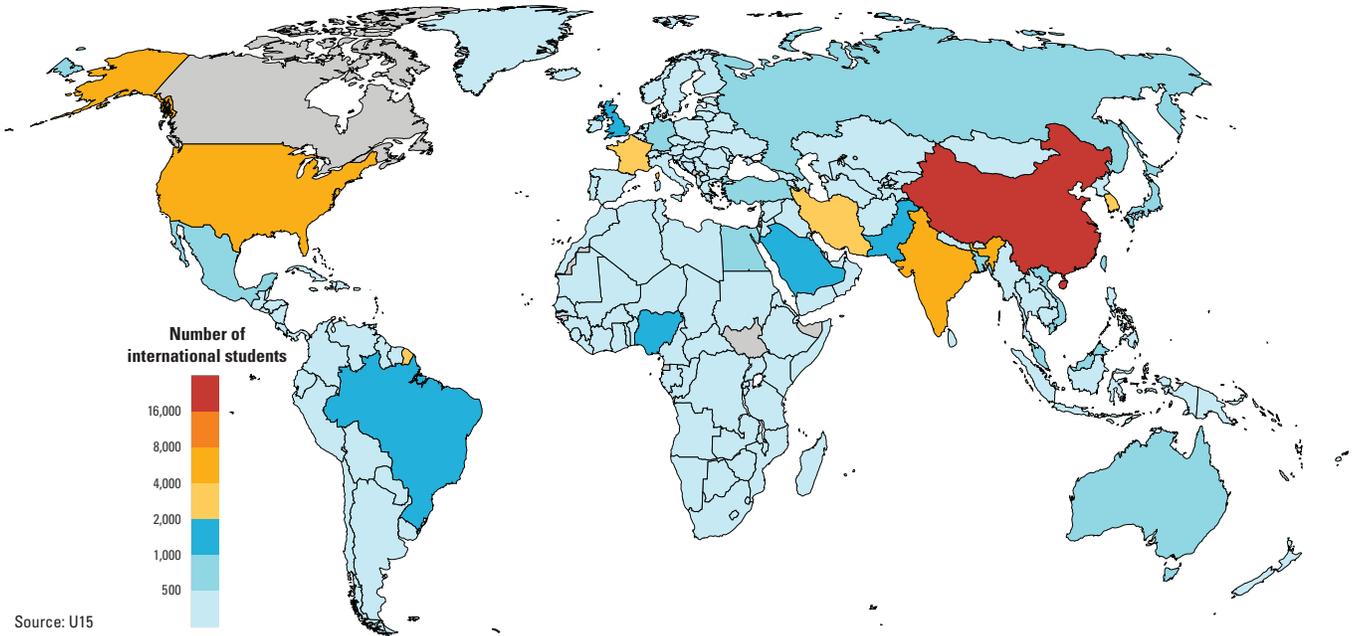
– Guy Breton, U15 Chair

### Timeline

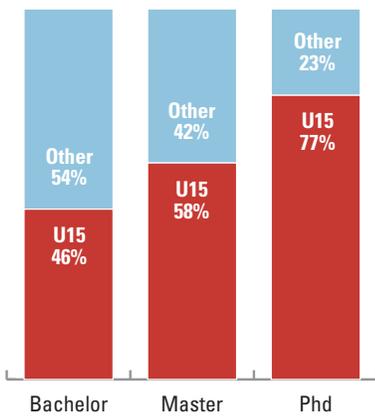
<b>1985</b> Five Ontario research universities begin meeting informally.	<b>1989</b> The Ontario group expands to include three universities in Quebec and BC.	<b>1991</b> The group expands again and is labelled the Group of Ten (G10).	<b>2006</b> The G10 adds Dalhousie, Calgary, and Ottawa to become the G13.	<b>2011</b> Manitoba and Saskatchewan join and the group is renamed The U15.	<b>2012</b> The U15 hires its first Executive Director and creates the U15 Directorate.	<b>2014</b> The U15 joins the Global Network of Research.	<b>2015/16</b> U15 institutions receive 85% of Canada First Research Excellence Fund awards.
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## Attract students from around the world



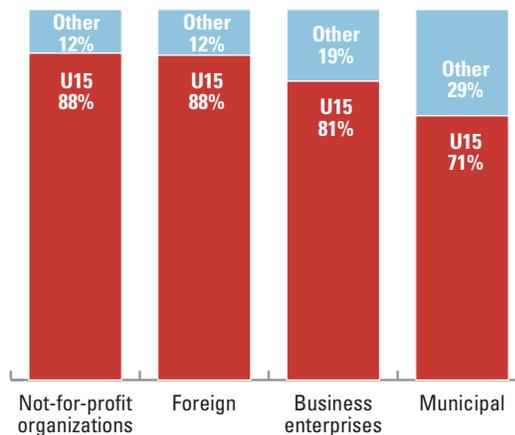
### Educate Canada's top talent



#### DEGREES GRANTED

Source: U15/StatCan

### Partner on research across sectors



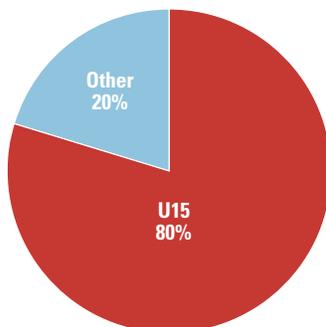
#### RESEARCH INCOME

Source: CAUBO

### Facts

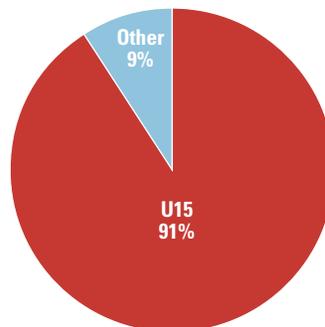
- Educate over 590,000 people annually.
- Perform about \$8.5B worth of research annually.
- Employ over 100,000 people in wide variety of roles.
- Centered in communities where 60% of Canadians live.
- Offer English, French and Bilingual campuses.
- Feature world-class research and educational facilities.

### Attract the most research funding



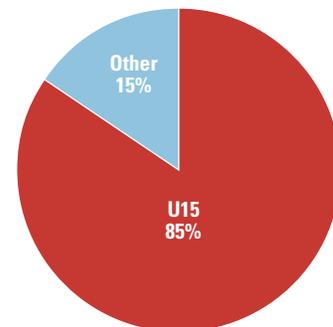
Source: CAUBO

### Receive the most patents



Source: AUTM

### Create the most spin-offs



Source: AUTM

### Profile Fast Facts

Canada Excellence Research Chairs (CERCs) **3**

Canada Research Chairs (CRCs) **84**

Research Income **\$441.2 M**

Undergraduate Enrolment **30,626**

Graduate Enrolment **7,204**

International Students **7,983**

Total Enrolment **37,830**

### Select Research Strengths

1. Energy
2. Environment and climate change
3. Science and technology
4. Health and wellness
5. Agriculture and food
6. Indigenous research
7. Water
8. Social structures and systems
9. Humanities and fine arts



## UNIVERSITY PROFILE

The University of Alberta has a reputation for excellence in translational and discovery-driven research, scholarship and creative activities across diverse areas of impact. It is recognized as one of the world's top 100 universities, and one of Canada's Top Five. With 200 undergraduate and 170 graduate programs spanning 18 faculties, the multi-campus U of A supports learning and discovery by providing contemporary and innovative experiences for students, staff and researchers. This vibrant campus community and dedication to excellence allows the university to play a leading role in addressing complex societal issues on a local, and global, scale.

### Research and Learning Environment

The University of Alberta is committed to advancing 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. Our researchers' full spectrum of inquiry positions the university to make comprehensive contributions towards scientific, social and cultural innovations, while partnerships – including with business incubator TEC Edmonton – support the translation of discoveries to end-users and communities.



### International Engagement

The University of Alberta continually strives to enhance the international dimensions of its teaching, research, service, outreach and administration. The U of A is involved in more than 700 formal teaching, research and student mobility agreements with governments, organizations and institutions in over 80 countries. These multinational networks foster the global exchange of talent and expertise, and expand the university's capacity to address complex global issues in a more robust and effective way.

## RESEARCH EXCELLENCE



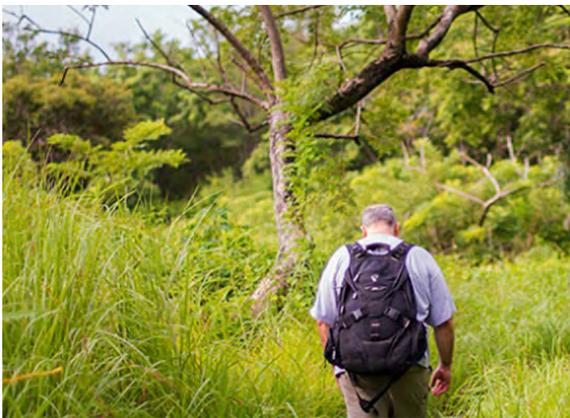
### Leading a Solar Energy Breakthrough

Dr. Jillian Buriak, Canada Research Chair in Nanomaterials, and her research team are set to revolutionize solar power, making it functional and inexpensive to produce. The team uses spray-coating as a means of mass-producing flexible plastic solar cells, offering promise for secure, clean energy. One of the “inks” they have developed for spray-coating is made of nanoparticles – phosphorous and zinc – that can be used for photovoltaic or solar cells on almost any surface. A provisional patent for their discovery is under way and Dr. Buriak expects the discovery could be commercialized in the next five to ten years.



### Powering New Smart Grid Technologies

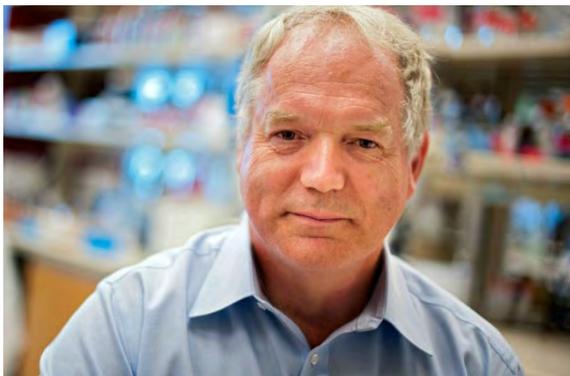
Accommodating renewable energy sources requires a new architecture for power distribution, called the smart grid. The University of Alberta is home to one of North America’s largest research clusters dedicated to smart grid technologies. Researchers are applying their expertise in grid integration of renewable energy sources, power conversion, cyber security, weather forecasting and power quality to address this global challenge. Finding solutions today is critical to guiding investments to meet a blended energy environment. These solutions can also have transformative impacts on remote urban and northern communities not served by traditional power grids.



### Real Time Insight into Climate Change

The University of Alberta’s Centre for Earth Observation Sciences is running a multi-year research project, called Enviro-Net, a game changer for climate change monitoring.

Examining the impact of climate change on ecosystems, Dr. Arturo Sanchez-Azofeifa’s team has deployed sensors across enormous regions of Canada and Latin America. Powerful analytics software from IBM allows the researchers to gain real-time insight into ecosystem changes and to spot warning signs to predict trends of environmental degradation and natural disasters, including droughts and forest fires. This project has major implications for policymakers, providing unprecedented data on the world’s most remote and vulnerable ecosystems.



### A Vaccine Against the Hepatitis C Virus – Research and Clinical Development

University of Alberta researchers have been developing a hepatitis C vaccine. Historically, the vaccine has been considered particularly challenging due to the highly variable nature of the virus, which is even more variable than HIV. The research team has modified the vaccine composition, identified a vaccine cocktail to enhance neutralization of all the world’s genotypes, and developed a simple purification process scalable at a global manufacturing level. The vaccine is expected to begin clinical trials in 2017.



## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **2**

Canada Research  
Chairs (CRCs) **187**

Research  
Income **\$600 M**

Undergraduate  
Enrolment **50,654**

Graduate  
Enrolment **10,459**

International  
Students **13,189**

Total  
Enrolment **61,113**

## Select Research Strengths

1. Advanced materials
2. Brain health
3. Cancer
4. Culture and diversity
5. Digital technologies
6. Economics and business
7. Environment
8. Genomics
9. Heart and lung
10. HIV and AIDS



## UNIVERSITY PROFILE

The University of British Columbia is a global centre for research and teaching, consistently ranked among the top 20 public universities in the world and recently declared Canada's most innovative university by Reuters. Since 1915, UBC's entrepreneurial spirit has embraced innovation and challenged the status quo. UBC encourages its students, staff and faculty to challenge convention, lead discovery and explore new ways of learning. At UBC, bold thinking is given a place to develop into ideas that can change the world.

## Research and Learning Environment

As one of the world's top research universities, the University of British Columbia has created positive change at home and abroad for more than a century. Today our two major campuses – in Vancouver and the Okanagan – attract, nurture and transform more than 60,000 students from Canada and more than 140 countries around the world.



## International Engagement

Times Higher Education ranks UBC as North America's most international university. A key player in tackling and solving global problems, we make our international connections a priority, partnering with 10 of the 15 top-ranked universities in the world.

Our students, faculty and staff come from around the world. Almost half our research publications involve international partnerships. Student exchanges and joint-degree programs complement our many international research partnerships, connecting us with top research talent worldwide.

## RESEARCH EXCELLENCE

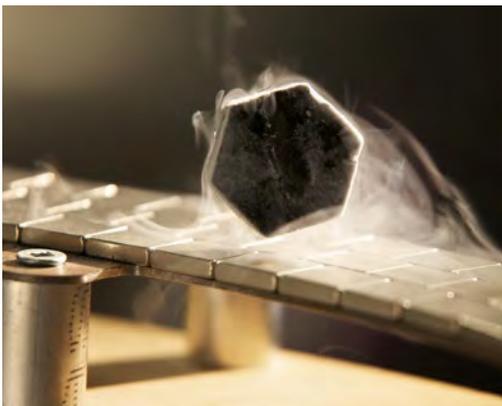


### 30 Years at the Frontline of HIV/AIDS Research

Dr. Julio Montaner and researchers at the BC Centre for Excellence in HIV/AIDS have transformed what was previously a catastrophic diagnosis into a manageable illness with consistent, lifelong treatment.

Dr. Montaner was the principal investigator of a 1996 international study that showed a cocktail combination of drugs known as HAART, or “highly active anti-retroviral therapies”, to be the most effective way to prevent HIV from turning into AIDS.

He has since developed a program he calls “Treatment as Prevention<sup>®</sup>,” or TasP<sup>®</sup>, an approach the United Nations has embraced in its plan to end the AIDS epidemic.



### Leading a Global 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, a recent recipient of a \$66.5-million federal investment through the CFREF program, is at the forefront.

Led by Scientific Director Dr. Andrea Damascelli, and through prestigious partnerships such as the Max Planck–UBC Centre for Quantum Materials, researchers at SBQMI are advancing the fundamental understanding of quantum matter and developing promising applications for quantum materials.



### Breakthrough Developments in Prostate Cancer Treatment

Researchers at the Vancouver Prostate Centre have developed a new way to tackle treatment-resistant prostate cancer, the most prevalent and potentially lethal cancer affecting men.

When advanced prostate cancer spreads, it becomes metastatic and virtually incurable. Current treatments initially slow the spread of the disease but the cancer eventually mutates and becomes drug-resistant. The new treatment, developed by a research team led by UBC’s Paul Rennie and Artem Cherkasov, is designed to outsmart the cancer by targeting a site in the cancer cells that is not prone to mutation. UBC recently licensed the treatment to Roche, in our largest licensing agreement to date.



### Harnessing Genomics to Solve Global Resource, Environment and Food Security Issues

UBC researchers use genomics to tackle critical forestry and natural resource issues. From mapping the genome of pathogens such as the devastating mountain pine beetle to understanding how trees survive drastic climate change, researchers such as Drs. Joerg Bohlmann and Sally Aitken are transforming the way we manage our forests.

Further examples of this research strength at UBC include Dr. Leonard Foster, who uses genomics to aid selective breeding and protect the threatened honeybee from disease, and Dr. Loren Rieseberg, who provides genomic tools to secure vital crops in the global food chain such as the sunflower.



UNIVERSITY OF  
CALGARY

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **1**

Canada Research  
Chairs (CRCs) **67**

Research  
Income **\$360.5 M**

Undergraduate  
Enrolment **24,624**

Graduate  
Enrolment **5,894**

International  
Students **3,504**

Total  
Enrolment **30,518**

## Select Research Strengths

1. Toward low carbon energy
2. Space physics/astrophysics
3. Information security
4. Brain and mental health
5. Cardiovascular sciences
6. Inflammation and chronic diseases
7. Petroleum engineering
8. Biomedical engineering
9. Arctic research
10. Urban studies



## UNIVERSITY PROFILE

The University of Calgary is a global intellectual hub located in Canada's most enterprising city. We are making tremendous progress on our journey to become one of the nation's top five research institutions, 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 North America's top young university five years running and ranks sixth amongst Canadian universities for research income and intensity.

## Research and Learning Environment

UCalgary's research plan contains three major goals: matching our strengths with opportunities, increasing our research capacity, and creating a dynamic environment to promote research excellence. To achieve these goals, we identified six strategic research themes in which we have a critical mass of expertise: Energy Innovations for Today and Tomorrow; New Earth-Space Technologies; Brain and Mental Health; Infections, Inflammation and Chronic Diseases; Engineering Solutions for Health: Biomedical Engineering; and Human Dynamics in A Changing World.



## International Engagement

UCalgary is engaged in a wide range of international activity, producing graduates with global knowledge and forging 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 university partners with organizations in China, Mexico and Israel to implement the Global Research Initiative in Unconventional Hydrocarbon Resources. Development projects are ongoing in Southeast Asia and Eastern Africa.

## RESEARCH EXCELLENCE



### Escape Stroke Trial: New Therapy Benefits Stroke Patients

Michael Hill, Mayank Goyal and Andrew Demchuk led an international randomized controlled trial showing that a clot retrieval procedure, known as endovascular treatment (ET), can dramatically improve patient outcomes after an acute ischemic stroke. The clinical trial, known as ESCAPE (Endovascular treatment for Small Core and Anterior Circulation Proximal occlusion with Emphasis on minimizing CT to recanalization times), shows there is a marked reduction in both disability and death among patients who receive ET for acute ischemic stroke. ESCAPE is the second ET trial that demonstrates the efficacy of the treatment and the first trial to demonstrate reduced mortality.



### Tackling Infections, Inflammation and Chronic Diseases

Alberta's Western Canadian Microbiome Centre (WCMC), led by Paul Kubas, provides a platform for scientists and industry to investigate the microbiome of plants, animals, and physical environments for interactions that lead to chronic diseases. WCMC offers unique resources and expertise in germ-free models, gnotobiotic models, human microbiota and therapeutic translation; world-renowned *in-vitro* and *in-vivo* imaging; innovative microbial biofilm technology; and analytics in genomics, proteomics and metabolomics. The facility fosters collaboration between academia and industry, enabling scientists to deepen their understanding of chronic diseases such as inflammatory bowel disease, asthma, allergies, obesity, diabetes, and atherosclerosis.



### Accelerating the Energy Industry Towards a Greener Future

Canada Excellence Research Chair Steven Bryant is leading efforts to develop unconventional oil technologies that balance the world's energy needs while reducing environmental impact. Researchers are working to bridge the gap between the current technological status of the oil sands industry and the technological status required for a sustainable, globally competitive future. Achieving this requires integrating nanotechnology and materials science research with chemical and petroleum engineering, geoscience, chemistry, and geomicrobiology. Nanomaterials and emerging capabilities in mesoscale science offer an extraordinary opportunity to reduce extraction footprint and develop extraction technologies that minimize environmental impact and maximize productivity.



### University Researchers and City Planner Partnering to Build a Better Calgary

The Urban Alliance, a research partnership between the City of Calgary and the University of Calgary, provides a framework for researchers and city employees to work together to tackle challenges urban centres face. The Advancing Canadian Wastewater Assets (ACWA) facility hosts a research team, led by Lee Jackson, that works with municipal operators to advance wastewater treatment technologies. The Urban Studies group, led by Byron Miller, takes an international perspective on developing sustainable communities through urban design. The Urban Lab, led by Beverly Sandalack, seeks to design communities to maximize walkability, human interactions and health. The Identity-Based Wraparound Intervention project, led by Hieu van Ngo, aims to restore and strengthen positive identities of high-risk youth.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **1**

Canada Research  
Chairs (CRCs) **46**

Research  
Income **\$135-140 M**

Undergraduate  
Enrolment **14,747**

Graduate  
Enrolment **3,261**

International  
Students **3,125**

Total  
Enrolment **18,731**

## Select Research Strengths

1. Ocean studies
2. Advanced materials and clean technology
3. Health and wellness
4. Governance, society and culture
5. Information science and communication
6. Agriculture and food technologies
7. Energy and the environment



## UNIVERSITY PROFILE

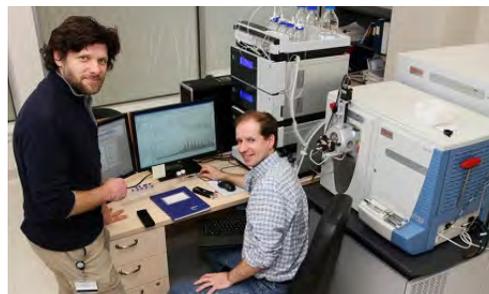
Founded in 1818, Dalhousie University is Atlantic Canada's leading research-intensive university. Located in Halifax, NS, with an agricultural campus in Truro, NS, the university's 6,000 faculty and staff foster a vibrant, purpose-driven community. In close proximity to the ocean, Dalhousie is situated within a cluster identified as one of the world's top three international centres in ocean science.



Dalhousie's students and faculty engage in learning and discovery across 13 faculties, conducting more than \$135 million in research annually with hospitals, industry, governments, non-profit agencies and universities around the globe.

## Research and Learning Environment

Dalhousie has four priority research areas. Ocean Studies' researchers have generated an unprecedented understanding of ocean use and change; Advanced Materials and Clean Technology researchers are creating innovative products working in the lab and with industry; more than 400 Health and Wellness faculty members and clinicians are focused on the causes and cures of disease and illness prevention; and Governance, Society and Culture academics contemplate the dynamics, tensions and way forward within a shrinking world.



## International Engagement

Recognized in world rankings for its high level of internationalization, Dalhousie engages in international activities involving both students and faculty. Dalhousie researchers work with colleagues in more than 100 countries, and lead several global research initiatives. The university is party to 300 partnership agreements with universities from 65 countries, a third of which specifically support the exchange of students. The university welcomes 3,000 international visiting and degree-seeking students each year, from more than 115 countries.

# RESEARCH EXCELLENCE



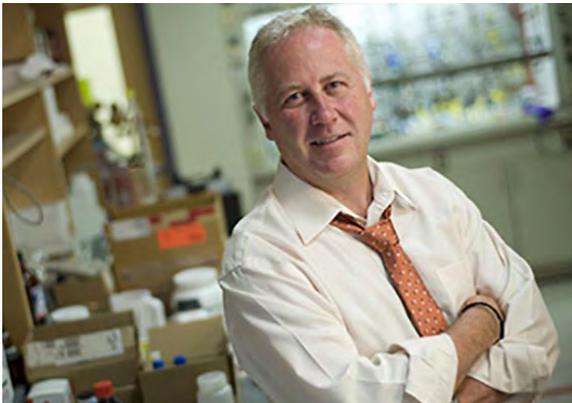
## A World Leader in Ocean Research

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—established through the Networks of Centres of Excellence Program – and a Canada Excellence Research Chair in Ocean Science and Technology. In 2016, Dalhousie announced the opening of the Ocean Frontier Institute (OFI), thanks to a \$94-million federal investment from the Canada First Research Excellence Fund. OFI brings together elite researchers and institutes from around the world to create safe, sustainable solutions for ocean development.



## Sustainable Power from Lithium-Ion Batteries

Dalhousie’s world-renowned researchers in advanced materials and clean technology are developing products to improve performance, productivity and efficiency while reducing costs, energy consumption and waste. Jeff Dahn, Canada Research Chair in Battery and Fuel Cell Materials, has signed a five-year exclusive deal with Tesla Motors to help create lithium-ion cells with longer lifetime (by decades), and higher energy density at lower cost. The collaboration is a first between the leading American electric vehicle company and a university, and will take research on lithium-ion cells to the next level.



## Battling Rare Diseases in Children

Researchers at Dalhousie and its affiliated teaching hospitals are shedding light on the causes and cures of disease as well as developing strategies for illness prevention. Dr. Chris McMaster, Professor of Pediatrics and Biochemistry and Molecular Biology, is undertaking groundbreaking research on rare diseases in children, including familial exudative vitreoretinopathy (FEVR or childhood blinding), the inherited form of Parkinson’s disease, and muscular dystrophies. His goal is to relieve the encumbrances on orphan disease patients, their families, and the health care system. Dr. McMaster’s research has been supported by significant contributions from Genome Canada, the Canada Foundation for Innovation and the Atlantic Canada Opportunities Agency.



## Improving the Resettlement Process for Refugees and Migrants

Dalhousie’s researchers help governments, societies and cultures understand each other, work cooperatively and resolve conflicts – helping to create a safer, more peaceful and connected society. Dalhousie’s Child and Youth Refugee Research Coalition (CYRRC) led the development of the Canadian Refugee Child, Youth and Family Research Coalition and more recently, formed a partnership with the Leibniz Association’s Leibniz Education and Research Network (LERN) in Germany. Led by Dr. Michael Ungar and Dr. Howard Ramos, the collaboration provides an opportunity for Canadian and German researchers to lead world-class research focused on improving the odds of successfully integrating and resettling newly arrived refugees and migrants.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **4**

Canada Research  
Chairs (CRCs) **81**

Research  
Income **\$331 M**

Undergraduate  
Enrolment **33,200**

Graduate  
Enrolment **10,200**

International  
Students **5,600**

Total  
Enrolment **43,400**

## Select Research Strengths

1. Nordic and Arctic research
2. Optics/photonics
3. Noncommunicable diseases and healthy lifestyle
4. Neurobiology and neurophotonics
5. Children's social development and academic success
6. Sustainable development: responsibility, law and governance



## UNIVERSITY PROFILE

Université Laval, located in the world heritage city of Quebec City, is the first French-language university in North America. We are one of Canada's top research universities, ranking 7th among the country's institutions of higher learning with a research budget of \$331 million last year. Université Laval boasts more than 9,370 employees, including 3,685 professors, lecturers, and other teaching and research staff who share their knowledge

with more than 43,400 students. We obtained STARS accreditation in 2014, ranking first in Canada and ninth worldwide for sustainable development. In 2015 Université Laval became Canada's first voluntarily carbon neutral university. We have more than 277,000 alumni.



## Research and Learning Environment

Université Laval ranks as one of Canada's leading research universities, recognized worldwide for the advances of our researchers. Instruction is provided by talented professors who earn high marks for their availability and willingness to help students. Many of our faculty members enjoy international reputation in leading-edge fields. Most UL's bachelors' programs include mandatory or optional internships, a great way to put theory into practice and gain experience.



## International Engagement

Université Laval has built an international reputation in many top fields. Thirteen percent of its student population comes from more than 120 countries, representing 5,600 permanent resident and international students. The university is recognized for its internships and study visits abroad and is a student mobility leader with 750 agreements with some 500 post secondary institutions and other educational organizations in just under 70 partner countries.

## RESEARCH EXCELLENCE



### **Canada Excellence Research Chair in Remote Sensing of Canada's New Arctic Frontier – Professor Marcel Babin**

Using the most recent advances in satellite remote sensing, Marcel Babin and his team work to develop new observation technologies, better digital models of Arctic ecosystems, and powerful data-archiving and analytical tools to deal with the vast streams of data collected from research conducted in the North. Their research findings will help stakeholders in government, industry, and northern communities make effective decisions. The Takuvik Joint Laboratory Program – a Québec City-based joint initiative led by Université Laval and France's Centre national de la recherche scientifique (CNRS), which Professor Babin directs – is a major component of this ambitious research program.



### **Canada Excellence Research Chair in Microbiome-Endocannabinoidome Axis in Metabolic Health – Professor – Professor Vincenzo Di Marzo**

Dr. Vincenzo Di Marzo is an internationally recognized authority on cannabinoid pharmacology. The research he conducts as Canada Excellence Research Chair in the Microbiome-Endocannabinoidome Axis in Metabolic Health focuses on the integrated study of how the intestinal microbiome and the endocannabinoid system influence metabolic syndrome. It is also the first research chair in the world devoted to the study of intestinal microbiota, its alterations, and its influence on obesity-related inflammation and the development of Type 2 diabetes, cardiovascular diseases, and related morbidities. The Chair's objective is to find new therapeutic targets and develop new nutritional and medical strategies.



### **Canada Excellence Research Chair in Neurophotonic – Dr. Pierre Marquet**

Dr. Pierre Marquet, a psychiatrist and engineering physicist, is a researcher known worldwide for his pioneering work in digital holography. He has also made significant contributions to the emerging field of quantitative phase microscopy. These new optical approaches will strengthen and complement the already highly effective arsenal of neuroimaging techniques which are starting to enable detection of discrete anomalies in brain structure and function among children at risk of developing mental disorders. The technology will also help identify new cellular biomarkers, thereby contributing to characterizing developmental risk trajectories among children of patients being treated in multigenerational cohorts.



### **Canada Excellence Research Chair in Photonics – Professor Younès Messaddeq**

Younès Messaddeq is one of the world's most accomplished researchers in materials for optics and photonics. He has published numerous articles in international journals about his work on innovative glass materials. In his Université Laval laboratory, Younès Messaddeq and his team are doing research on glass and optical fibres that will have immediate industrial applications in areas such as biomedicine, national security, and defence. Professor Messaddeq's work will make a lasting contribution to future generations of scientists and has spurred the creation of Canada's first institute for research and training in glass materials.



### Profile Fast Facts

Canada Excellence Research Chairs (CERCs) **1**

Canada Research Chairs (CRCs) **29**

Research Income **\$162.5 M**

Undergraduate Enrolment **25,460**

Graduate Enrolment **3,800**

International Students **4,854**

Total Enrolment **29,929**

### Select Research Strengths

1. Arctic system science and climate change
2. Immunity, inflammation and infectious diseases
3. Population and global health
4. High performance materials, structures and processes
5. Human rights and social justice
6. Sustainable systems for resilient communities
7. Culture and creative works
8. Fundamental research
9. Integrative research in health and well-being
10. Sustainable water management systems



## UNIVERSITY PROFILE

For nearly 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 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

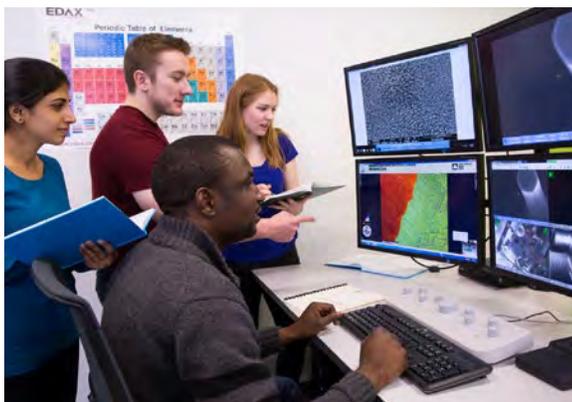
Through projects and collaborative activities around the world, University of Manitoba faculty, staff and students bring international perspectives to learning and research and enrich the overall university experience. They become crucial agents of change in our local and global community. For example, the university engages on two continents through 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



## A Museum of Ideas

The Embodying Empathy Project uses leading-edge technologies to create a prototype virtual Indian Residential School, in partnership with survivors, Indigenous commemorative and educational agencies, archivists, scholars, and technology experts. This virtual “storyworld” is intended to immerse museum visitors in the lives of residential school children. This trailblazing project is designed by sociologist Andrew Woolford and English, film and theatre professors Struan Sinclair and Adam Muller. Psychology professor Katherine Starzyk will then evaluate whether the experience makes users more sensitive to Indigenous issues.



## The Micro-World of Complex Materials

The more scientists know about the molecular makeup of complex materials – be they rock, metal, plant or plastic – the better they can bring “the next big thing” to life. Derek Oliver, associate professor of electrical and computer engineering and Director of the Manitoba Institutes for Materials, is collaborating with researchers at Caltech and the Florida Institute of Technology to build and modify small rods of silicon. The goal is to develop a device that could use sunlight to split water into its constituent parts: hydrogen and oxygen. Hydrogen could solve the energy needs of developing countries.



## Innovative Approach to Global Public Health

Too many of the world’s poorest and most marginalized populations are not benefiting from the modern technologies and medical innovations designed to improve human health, says James Blanchard, Canada Research Chair in Epidemiology and Global Public Health. He and his team bridge the health equity gaps by taking a “program science” approach to the problem. They started by involving sex workers in India in a social mapping process to identify where best to focus resources and efforts, and then moved on to the action phase, which included evolving better ways to implement peer education and community outreach and mobilization efforts.



## Manitoba’s Marine Research Base

The U of M is already home to internationally renowned programs of research in Arctic science, climate change and its effects on Arctic sea ice. Canada Research Chair in Arctic System Science, David Barber, is leading development of the Churchill Marine Observatory. The Observatory is a globally unique facility designed to support detailed investigations of oil, and other transportation-related contaminants, in Arctic sea ice, using a purpose-built Oil in Sea Ice Mesocosm. Together, the studies will provide new knowledge and environmental technologies required to detect, understand the impacts of, and mitigate oil/contaminant spills in sea ice.

### Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **2**

Canada Research  
Chairs (CRCs) **160**

Research  
Income **\$473 M**

Undergraduate  
Enrolment **27,475**

Graduate  
Enrolment **9,473**

International  
Students **10,936**

Total  
Enrolment **40,493**

### Select Research Strengths

1. Neuroscience
2. Sustainability Sciences
3. Public Policy
4. Genomics
5. Digital Humanities
6. Pain
7. Law and Legal Pluralism
8. Astrophysics
9. Music Technology
10. Intelligent Machines and Artificial Intelligence



## UNIVERSITY PROFILE

McGill University is one of Canada's best-known institutions of higher learning and one of the leading universities in the world. Our student body includes students from 150 countries, making McGill the most internationally diverse of any research-intensive university in the country. McGill was founded in 1821 thanks to a generous bequest by James McGill. Since then, we've grown from a small college to a bustling university with two campuses, 10 faculties, some 300 programs of study, and 40,000 students. The university also partners with four affiliated teaching hospitals, graduating more than 1,000 healthcare professionals each year.



## Research and Learning Environment

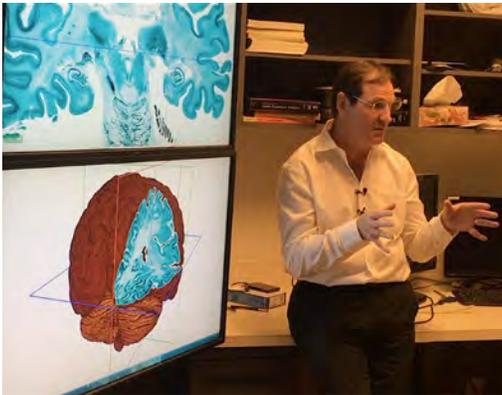
McGill is a research-intensive, student-centred university with an enduring sense of public purpose. Our researchers ask important questions, contributing across disciplines to address the most pressing and complex challenges facing humanity and the natural environment. Our core commitments to ideas, 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 proud to be a Quebec university that is deeply connected to the global community. Half our students come from Quebec, and we have the largest percentage of international students of any Canadian research-intensive university. Our mission to serve means building partnerships across the street and around the globe, be it the Quartier de l'Innovation district in southwest Montreal or with leading institutions in the United Kingdom, Japan, Brazil, France and Israel, among others.

## 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's initial focus is to deepen 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

The McGill Sustainability Sciences and Technologies Lab (MSSTLab) is a global hub for developing scientific research, policy development, and technology solutions to sustainability challenges. MSSTLab includes four world-class research clusters: green chemistry, biodiversity/climate change/environment, advanced materials, and sustainability-linked policy, economics, and governance. MSSTLab tackles highly integrated projects by connecting the environmental, biological, computational, physical and engineering sciences with public policy to yield new entry points for CleanTech. Three McGill leaders are Robin Rogers, Canada Excellence Research Chair in Green Chemistry and Green Chemicals; Andrew Gonzalez, Canada Research Chair in Biodiversity Science, and Elena Bennett, a specialist in ecosystem services.



### Blazing Trails on Earth and in Space

The McGill Space Institute (MSI) examines the most fundamental questions in science – from the evolution of the universe and the nature of gravity, to the search for extraterrestrial life. The MSI brings together scientists in astrophysics and cosmology with researchers from other disciplines whose work involves planetary science and astrobiology. It also supports the development of technology and instrumentation for studying the cosmos, such as the new Canadian Hydrogen Intensity Mapping Experiment telescope. The MSI is led by Victoria Kaspi, who in 2016 became the first woman to win the Gerhard Herzberg Canada Gold Medal for Science and Engineering.



### A New Powerhouse for Policy-Making

In 2016, McGill created the School of Public Policy, which builds on the university's depth and breadth of interdisciplinary expertise in core areas related to public policy. Those areas include social sciences, humanities, law, urban planning, science, environment, education, global development, and medicine. Supported by the Max Bell Foundation with associated researchers who include Antonia Maioni, Dean of the Faculty of Arts, and Daniel Weinstock, Faculty of Law, the School is uniquely positioned to be the bridge between pan-Canadian and global expertise and exchange, by linking evidence, expertise, and policy-making to respond to today's most pressing issues.

### Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **1**

Canada Research  
Chairs (CRCs) **69**

Research  
Income **\$325 M**

Undergraduate  
Enrolment **24,518**

Graduate  
Enrolment **4,274**

International  
Students **3,378**

Total  
Enrolment **29,865**

### Select Research Strengths

1. Healthy aging
2. Advanced manufacturing
3. Materials/biomaterials
4. Antimicrobial resistance/infectious diseases
5. Automotive
6. Population health/clinical trials
7. Smart, sustainable cities
8. Economics and public policy



## UNIVERSITY PROFILE

McMaster has a well-deserved reputation as a centre of excellence for discovery and innovation, with research output rivalling universities more than twice our size. Consistently ranked as one of Canada’s top research-intensive universities and a leader in corporate-sponsored research income, we’re home to more than 70 research centres and institutes. We are committed to knowledge and technology transfer, partnering with industry, and creating a culture of innovation and entrepreneurship among our researchers and students. The “McMaster Model” of problem-based learning continues to change the way professors teach and students learn at universities around the world.



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## 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’re the only 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



## World-Leading Centre for Antimicrobial Resistance and Infectious Disease Research

The Michael G. DeGroot Institute for Infectious Disease Research (IIDR) draws upon the unique and diverse research strengths in infectious disease and drug resistant “superbugs” from across McMaster University and its affiliated hospitals. Attracting almost \$100M in funding from government, corporate-sponsored research and not-for-profit organizations from 2013-2016, some 35 principal investigators and 300 trainees conduct research spanning virology, immunology, antimicrobial resistance, population biology and epidemiology. The IIDR boasts more than a dozen Canada Research Chairs among its PIs, including Dawn Bowdish, Canada Research Chair in Aging and Immunity, whose research program focuses on preventing respiratory infections among the elderly.



## Biomedical Engineering and Advanced Manufacturing

In a new \$33-million research facility, McMaster researchers and their international colleagues will work together to develop novel technologies for eye care, point-of-care medical devices and cancer treatments. The Fraunhofer Project Centre for Biomedical Engineering and Advanced Manufacturing (BEAM) brings together several partners – municipal, provincial and federal governments; small businesses; multinational enterprises; and the German-based Fraunhofer Institute for Cell Therapy and Immunology. The state-of-the-art cell therapy manufacturing and diagnostics centre will help commercialize innovative biomedical technologies, products and services, and accelerate the growth of small business by providing access to facilities, expertise and global value chains.



## Aging – Living Well Longer

Researchers at the McMaster Institute for Research on Aging, led by Parminder Raina, Canada Research Chair in Geroscience, look at biological, behavioural, technological and environmental factors affecting how people age, in an effort to enable older Canadians to live well with health, independence and autonomy. Raina leads the Canadian Longitudinal Study on Aging – the country’s most comprehensive aging study – housed at the McMaster Innovation Park. CLSA, which has received \$75M from the federal government, is tracking 50,000 Canadians over 20 years, gathering information on biological, medical, psychological, social, lifestyle and economic aspects of people’s lives, to better understand all aspects of aging and, ultimately, to promote healthy aging.



## Materials Research and the Canadian Centre for Electron Microscopy

No other facility in the world possesses the advanced tools and capabilities of the Canadian Centre for Electron Microscopy (CCEM). Since becoming operational in 2006, the CCEM’s research activities have been transformative, providing Canadian and international materials researchers, industry, government regulators and students with access to the most sophisticated and technical expertise for electron microscopy. The end users of the knowledge creation generated are diverse: from steel for pipelines, lightweight alloys for cars, to nanoparticle contaminants – the CCEM enables Canadian and international industry to better understand their devices and products and the factors that limit their performance.

### Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **1**

Canada Research  
Chairs (CRCs) **135**

Research  
Income **\$548.8 M**

Undergraduate  
Enrolment **49,995**

Graduate  
Enrolment **17,637**

International  
Students **9,316**

Total  
Enrolment **67,632**

### Select Research Strengths

1. Artificial intelligence and operational research
2. Therapeutic innovation and biomedical engineering
3. Neurosciences
4. Public health
5. Cyberinfrastructure
6. Arts, creativity and experiential learning
7. Astrophysics
8. Sustainable development
9. Globalization
10. New materials



## UNIVERSITY PROFILE

Established in 1878, Université de Montréal, with its affiliate engineering and business schools, Polytechnique Montréal and HEC Montréal, is the largest university in Quebec and the second largest in Canada. With more than 65,000 students from Canada and around the world, UdeM awards more than 13,000 diplomas every year. Deeply rooted in Montreal and dedicated to its international mission, UdeM is the top-ranking comprehensive French-speaking university in the world and included in the 1st percentile of the world's best universities. With more than \$500 million in research funding each year, it is also the second-most active Canadian university in terms of volume of research activities.

### Research and Learning Environment

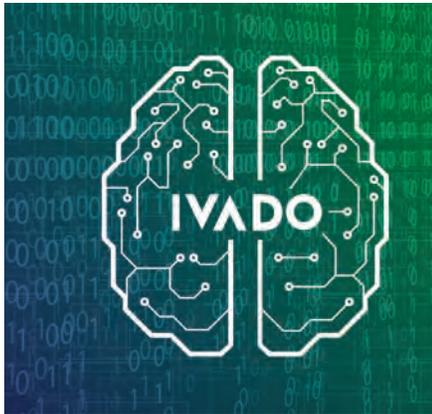
With 16 faculties and 80 departments and schools, Université de Montréal offers programs in almost all academic fields, from music to physics and architecture, and is the only Quebec university offering the full range of disciplines in health sciences. Its network of 37 partner hospitals and health centres is one of the strongest clinical divisions in the country. The UdeM brings together 2,700 professors and researchers, 465 research units, and one of Canada's largest student bodies at the master's and doctoral levels. It enjoys an outstanding reputation in the international scientific community.



### International Engagement

Montreal is a blend of North America and Europe, a safe metropolis built on two major cultures – French and English – with an international outlook and a multicultural reality. The Université de Montréal's partnership agreements with institutions in 65 different countries involving 550 institutions worldwide illustrates this perfectly, along with the fact that more than half our academics' publications are co-authored with one or several international colleagues. At UdeM, expanding research and training networks is a priority, and the proximity of faculty members and students is of the utmost importance.

## RESEARCH EXCELLENCE



### The Institute for Data Valorisation (IVADO) – Spearheading Data-Driven Innovation in Canada

Université de Montréal and its affiliate schools, Polytechnique Montréal and HEC Montréal, build on their research excellence in operations research and artificial intelligence to use big data to enable knowledge-based decision-making and data-driven scientific discovery. In 2016, UdeM launched the Institute for Data Valorisation (IVADO), through a \$93.6-million federal investment from the Canada First Research Excellence Fund. With the leadership of Professor Yoshua Bengio, a pioneer of deep learning and Professor Andrea Lodi, Canada Excellence Research Chair on Data Science for Real-Time Decision-Making, IVADO will empower cutting-edge research, training and innovation in data-driven innovation, linking researchers with industry partners to foster economy-wide digital development.



### IRIC-IRICoR: Successful Cancer Drug Research Translation to Innovation

The Institute for Research in Immunology and Cancer (IRIC), led by Dr. Michel Bouvier, is an integrated cutting-edge research hub including 11 professionally managed technology platforms focused on rapid translation of basic science into drug discovery innovation in cancer research. With the highest concentration of Canada Research Chairs in a single institute, IRIC's discoveries have led to the development of innovative technologies and drug candidates, with commercialization accelerated by its dedicated maturation/commercialization unit IRICoR (IRIC in commercialization of Research). The integration between biology and medicinal chemistry resulted in strong partnerships with biotech and biopharmaceutical companies, leading to the creation of three spin-off companies and four clinical trials within eight years.



### SERENE-RISC: Empowering Canadians to take Control of their Cybersecurity

Funded by the Networks of Centres of Excellence, the Smart Cybersecurity Network, (SERENE-RISC) led by Professor Benoit Dupont, is a knowledge mobilization network. Created in 2014, it's an open, inclusive, and unbiased information exchange on cybersecurity risks, threats and solutions for Canadians.

Known as a national relationship broker, the Network brings together stakeholders from academia, industry and government through bi-annual workshops, discussion forums, and professional development activities. SERENE-RISC also provides valuable on-line resources for the general public, such as cybersecurity safety tips, videos and interactive training products. *The Knowledge Digest*, disseminated globally, is SERENE-RISC's quarterly publication, summarizing the most recent scientific articles.



### The Digital Revolution of Cinema Featured at UdeM

A pioneer of film studies in universities, Professor André Gaudreault heads the Canadian section of the TECHNÈS international research partnership. This initiative, which unites 18 partners including the George Eastman Museum and the Cinémathèque Française, and over 50 researchers, aims to better understand the interrelations among technological changes and film theory, aesthetics, and practice. All partners are organized around the central project of creating a bilingual (French and English) *Encyclopedia of Cinema Technology*. The network operates with a \$7M total budget, which includes a \$2.5M Social Sciences and Humanities Research Council grant.



uOttawa

### Profile Fast Facts

Canada Excellence Research Chairs (CERCs) **1**

Canada Research Chairs (CRCs) **56**

Research Income **\$294 M**

Undergraduate Enrolment **30,340**

Graduate Enrolment **5,600**

International Students **4,355**

Total Enrolment **35,940**

### Select Research Strengths

1. Cardiovascular science
2. Photonics
3. Neuroscience
4. Catalysis and green chemistry
5. Public policy
6. Francophonie
7. Law and technologies
8. Regenerative medicine



## 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 to the promotion of cultural diversity.

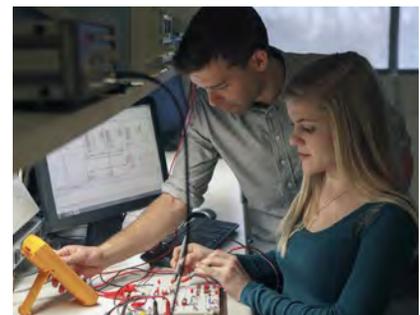
UOttawa, together with its academic hospitals and health research institutes, are acclaimed innovators. Our researchers are world leaders in photonics, cardiac and vascular health, catalysis, human rights and social justice. With more than 20 research centres and seven institutes cutting across faculties 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 largest co-op programs in Canada. The e-Hub, a holistic model of entrepreneurship and the Michaëlle Jean Centre for Global and Community Engagement encourage students to view change as a source of social and economic opportunity, while giving them real-world experience.

The university strategic research priorities center on 4 pillars: Canada and the World, Health, e-Society, and Molecular and Environmental Sciences.



## 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 Ottawa-Shanghai Joint School of Medicine are examples of the international level of our engagements.

## RESEARCH EXCELLENCE



### Novel Ways to Harness the Sun's Energy

The University of Ottawa's SUNLAB is dedicated to increasing the efficiency of solar cells and panels. It is Canada's premier solar cell characterization facility. Electrical engineering Professor Karin Hinzer, who holds the Canada Research Chair in Photonic Nanostructures and Integrated Devices, founded and leads SUNLAB. The cutting-edge nanotechnology lab has spun off three companies in the energy sector. SUNLAB is housed at the university's internationally recognized Centre for Research in Photonics.



### Probing the Brain's Complexities

Understanding how the brain can protect and repair itself is at the core of research conducted at uOttawa's Brain and Mind Research Institute (uOBMRI). The institute is comprised of more than 100 scientists and clinicians from various disciplines who work collaboratively to uncover the brain's complexities, including Director David Park, who specializes in Parkinson's disease and stroke. Their goal is to promote brain health and to heal or prevent neurological and psychiatric disorders such as stroke, depression or neuromuscular disease by tapping the brain's internal potential for regeneration and recovery.



### Privacy in a Digital World

For more than a decade, uOttawa law professor Michael Geist has made it his mission to educate the Canadian public on technology law issues such as copyright, Net neutrality and privacy. The Canada Research Chair in Internet and E-Commerce Law has played a key role in making the public and policymakers aware of how easy access to personal information is a growing threat to privacy. His research is key to informing future legislation on digital issues in Canada.



### North America's *Francophonie* on the World Stage

Linguist and French professor France Martineau leads an extensive international study on the evolution of French in North America over the past 400 years. Her seven-year project, which received a \$2.5-million grant from the Social Sciences and Humanities Research Council, examines how the French language has contributed to building identity in francophone communities. The study involves an international team of 13 co-investigators and more than 80 partners and organizations from Canada, the United States and Europe. The project highlights the University of Ottawa's leadership in research on French-speaking communities around the world.



### Profile Fast Facts

Canada Excellence Research Chairs (CERCs) **1**

Canada Research Chairs (CRCs) **42**

Research Income **\$187.3 M**

Undergraduate Enrolment **18,500**

Graduate Enrolment **4,130**

International Students **2,239**

Total Enrolment **22,630**

### Select Research Strengths

1. Particle astrophysics
2. Chemistry
3. Engineering
4. Health – cancer trials
5. Surveillance studies
6. Clean technology
7. Environment
8. Nationalism and democracy
9. Mental health and healthy relationships
10. Art conservation



## UNIVERSITY PROFILE

Queen's is one of Canada's oldest universities, celebrating its 175th anniversary in 2016-17. It offers a comprehensive research-intensive environment, and an exceptional student learning experience. Queen's researchers lead the way in numerous fields, making notable advances recently in particle astrophysics, cancer research, ecological history and environmental change, and clean energy technology. The university ranks fourth among medical-doctoral universities in Canada.



Its 17 university- and faculty-based research centres provide dynamic, collaborative settings for scholars. To ensure its research has a broader impact, the Queen's technology transfer unit, PARTEQ, works directly with faculty on commercialization, and has created more than 40 spinoff companies. Graduate students are an integral part of the vibrant research community, and master's and PhD programs prepare students for diverse, exciting careers.

## Research and Learning Environment

Queen's research strategy focuses on four interdisciplinary themes that cut across all faculties. Exploring Human Dimensions models the dynamics of human health and behaviour. Understanding and Sustaining the Environment and Energy Systems unites the ecology and engineering fields. Creating, Discovering, and Innovating emphasizes curiosity as the foundation for all research. Securing Safe and Successful Societies examines methods and outcomes of efforts to secure our human, political, and physical assets.



## International Engagement

Through various partnerships, including its membership in the Matariki Network of Universities, Queen's provides students and faculty with rich international learning opportunities and research collaboration. The university is strengthening those partnerships through initiatives such as 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 numerous faculty awards, reinforce Queen's research excellence.

## RESEARCH EXCELLENCE



### The Nobel Prize in Physics and the Canadian Particle Astrophysics Research Centre

Queen's continues to expand its significant contributions in particle astrophysics. In 2015, Professor Emeritus Arthur McDonald won the Nobel Prize in Physics, along with Japanese researcher Takaaki Kajita, for their key discoveries concerning the changing identities of neutrinos. Soon after, Dr. McDonald and his team won the Breakthrough Prize in Fundamental Physics. In 2016, Queen's announced the opening of the Canadian Particle Astrophysics Research Centre, thanks to a \$63.7-million federal investment from the Canada First Research Excellence Fund. The centre, led by Interim Director and Queen's Professor Tony Noble, is part of a network of Canadian universities. It will investigate many of the world's leading dark matter and neutrino physics problems.



### Canadian Cancer Trials Group

The Canadian Cancer Trials Group is led by Director Janet Dancey at its central operations at Queen's University. This Canadian cancer research cooperative is capable of developing and conducting the entire range of cancer trials arising from proposals from the academic cancer research community. It conducts early phase (Phase I-II) studies to large international randomized controlled Phase III trials of all treatment modalities, across all cancer types, providing access to innovative treatments for all age groups. The group is home to more than 100 staff members who coordinate the activities of approximately 2,000 investigators, including oncologists, hematologists, radiologists, surgeons, and nurses.



### Indigenous Research – Employment and Greater Food Security in Nunavut

Indigenous-focused research is an important and growing area of study at Queen's. Biologists Virginia Walker, Peter Van Coeverden de Groot, and Stephen Lougheed, along with colleagues from Carleton University and Gjoa Haven, work in Gjoa Haven and other Nunavut communities. They are integrating traditional ecological knowledge with leading-edge genomic science to gain an understanding of the fish and shrimp populations. The goal of the \$5.6-million project from Genome Canada and multiple other organizations is to develop a science-based fishing plan for arguably the last unexploited fishery in the northern hemisphere, creating opportunities for employment and economic benefits for Nunavut, along with greater food security.



### Engineered Nickel Catalysts for Electrochemical Clean Energy

Queen's Professor and chemist Gregory Jerkiewicz is the lead investigator on a large team of researchers at Queen's and across Canada that received a prestigious NSERC Discovery Frontiers grant. The team is developing new clean energy technology using catalysts made of nickel "foam". The research includes work on a new generation of membranes – a "high-tech version of food wrap" – that can be used with alkaline solutions to break water down into hydrogen and oxygen gases. Hydrogen is a promising carbon-free energy source, and adds to the arsenal of clean energy technologies in support of climate change objectives.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **2**

Canada Research  
Chairs (CRCs) **25**

Research  
Income **\$215 M**

Undergraduate  
Enrolment **18,315**

Graduate  
Enrolment **3,919**

International  
Students **3,033**

Total  
Enrolment **23,691**

## Select Research Strengths

1. Aboriginal Peoples: Engagement and scholarship
2. Agriculture: Food and bioproducts for a sustainable future
3. Energy and mineral resources: Technology and public policy for a sustainable environment
4. One health: solutions at the animal-human-environment interface
5. Synchrotron sciences: innovation in health, environment and advanced technologies
6. Water security: stewardship of the world's freshwater resources



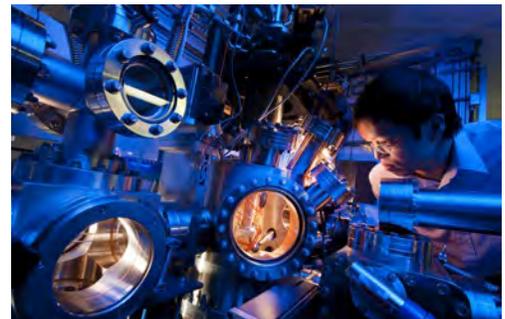
## UNIVERSITY PROFILE

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 100 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 its 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, inter-disciplinary research aimed at solving pressing global issues such as food, water and energy security. U of S 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

The U of S is strongly committed to global engagement. Embracing a diverse student body, the university has one of the highest numbers and percentages of international graduate students, and offers opportunities to learn and engage in all regions of the globe. Strengthening global impact through worldwide networks in areas of research strength, the university currently has 116 international MOUs and 274 international research and development projects with institutions in more than 50 countries.

## RESEARCH EXCELLENCE



### Global Water Futures Network

The university's \$143-M Global Water Futures network – the largest university-led water research program ever funded worldwide – is led by the U of S Global Institute for Water Security and three key university partners. With core federal CFREF funding of \$77.8 million, the aim is to transform 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. Partners include 380 researchers, 19 federal and provincial agencies, 39 industrial collaborators, 15 non-governmental agencies, seven Indigenous communities and governments, and 45 international research institutes.



### Designing Crops for Global Food Security

Funded with a \$37.2-M CFREF award, the Plant Phenotyping and Imaging Research Centre (P2IRC) – led by Maurice Moloney of the university's Global Institute for Food Security Institute – aims to become a unique global resource for plant breeders to develop new targeted crop varieties and boost crop yields. The centre combines plant genomics with crop phenotyping (the identification of useful traits), high-performance computing and digital imaging technology, along with social science research on societal impacts. Multidisciplinary research involves four Canadian universities, three international institutes and more than 15 public and private organizations, including the National Research Council and Agriculture and Agri-Food Canada.



### Shining a Light on Global Shortage of Medical Isotopes

Scientists from around the globe use the university's Canadian Light Source (CLS), millions of times brighter than the sun, for cutting-edge research – from mine waste remediation to cancer research to new materials development. CLS scientists have built the world's first linear accelerator dedicated to medical isotope production, successfully producing radioisotopes through a safe, reliable and fission-free method that uses powerful X-rays. Canadian Isotope Innovations Corp. is a private company recently spun off from the work, aimed at addressing a global shortage of medical isotopes resulting from the impending shutdown of aging nuclear reactors around the world.



### Developing Vaccines for Devastating Viruses

The university's Vaccine and Infectious Disease Organization-International Vaccine Centre (VIDO-InterVac) is a global leader in infectious disease research and vaccine development, combating infectious diseases in animals and humans. Using the new containment Level 3 facility, researchers led by Dr. Volker Gerdt have developed and tested a vaccine against a devastating pig virus, Porcine Epidemic Diarrhea Virus (PEDV). The virus has infected millions of piglets in countries around the world and cost hog producers more than \$400 million in lost income in North America alone. VIDO-InterVac has previously developed eight commercialized animal vaccines, of which six are recognized as world firsts.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **2**

Canada Research  
Chairs (CRCs) **255**

Research  
Income **\$1.1 B**

Undergraduate  
Enrolment **69,761**

Graduate  
Enrolment **16,948**

International  
Students **15,931**

Total  
Enrolment **86,709**

## Select Research Strengths

1. Artificial intelligence and machine learning
2. Regenerative medicine
3. Cleantech and renewable energy
4. Advanced materials and manufacturing
5. Business and Management Science
6. Medieval studies and philosophy
7. Children's health and development
8. Legal studies
9. Genomics
10. 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 700 programs on three campuses to choose from, our undergraduate and graduate students learn from and work with professors recognized as global thought leaders in artificial intelligence, human rights and global security, autism and cancer research, robotics and nanotechnology, and even lie detection. 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

With an annual research budget of \$1.1 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 have nine campus-led accelerators, courses and clubs to help students and faculty transform their ideas into startups. In 2017, U of T will launch an online portal to connect undergrads to research positions.



## International Engagement

U of T welcomes 16,000 international students each year, has more than 552,000 alumni in 150 countries, and actively collaborates with other leading universities, research institutes and industry partners around the world. These partnerships include a material science mobility relationship with the University of Tokyo. More than 50 percent of papers published by U of T researchers are joint efforts with institutions outside Canada.

## RESEARCH EXCELLENCE



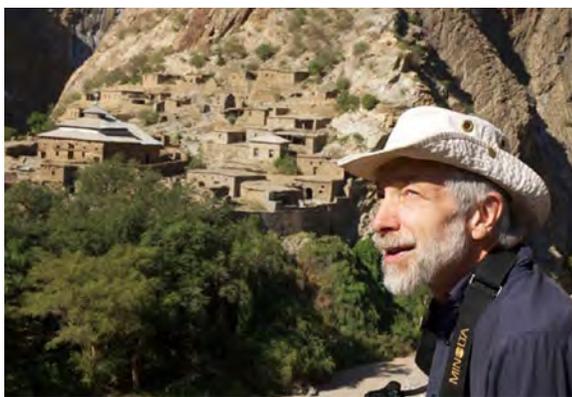
### Medicine by Design

Medicine by Design harnesses U of T's exceptional expertise at the convergence of 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 – the largest research award in U of T's history – it builds on our rich legacy in stem cell research by uniting more than 90 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.



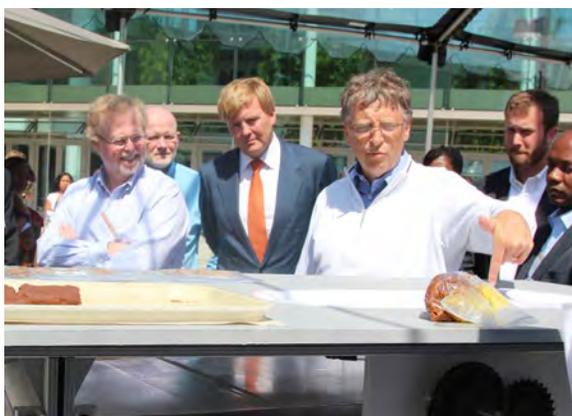
### Billion-Year-Old Water and the Secrets of Life

Barbara Sherwood Lollar, an earth sciences university professor, and her colleagues have gained worldwide attention for pioneering research into billion-year-old water found in Ontario and South Africa. Analysis showed the water contained biologically useful chemicals and much more hydrogen gas than expected – similar to conditions found near deep sea vents, which host thriving microbial ecosystems. The discovery shifts our understanding of how old groundwater can be, expanding our understanding of energy-producing chemical reactions that sustain deep microbial life. Sherwood Lollar surmises similar processes may exist on Mars, where NASA has found rocks of comparable age and geology.



### Preserving and Sharing Ethiopian Culture

History Professor Michael Gervers has long taught one of only a handful of classes in North America on Ethiopian culture and history. Now, he's working with the Ethiopian diaspora community to fund the first Ethiopian studies program in North America. Gervers has "developed into one of the most important scholars in the world today working on the history and culture of medieval Ethiopia," says Professor Suzanne Conklin Akbari, director of U of T's Centre for Medieval Studies. Gervers has created an online database of Ethiopian art and culture (User ID & Password: student) and is documenting how Ethiopia's rock-cut churches are created.



### Reinventing the Toilet to Help Billions

Imagine: a toilet that disinfects waste on site, promising to reduce disease for billions of people in the developing world. That's the goal for Yu-Ling Cheng, director of U of T's Centre for Global Engineering. With support from the Bill & Melinda Gates Foundation, her team is developing a household-scale continuous sanitation process that incinerates human solid waste by a combination of smoldering and catalytic conversion, and uses the heat generated to pasteurize waste liquid. The toilet requires only a small amount of electricity and water, and has a target cost of just pennies a day to operate.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **2**

Canada Research  
Chairs (CRCs) **50**

Research  
Income **\$182 M**

Undergraduate  
Enrolment **30,600**

Graduate  
Enrolment **5,300**

International  
Students **6,355**

Total  
Enrolment **35,900**

## Select Research Strengths

1. Discovery and design of materials and systems
2. Environment and energy
3. Health and wellbeing
4. Information and computing technology
5. Manufacturing and devices
6. Mathematical sciences and computer science
7. Society, culture and governance
8. Quantum information and nanotechnology



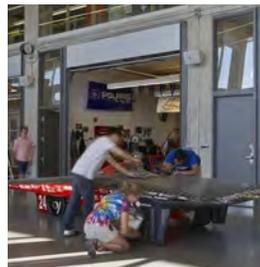
## UNIVERSITY PROFILE

The University of Waterloo – Canada’s innovation university – offers the opportunity to earn and learn in the world’s leading co-operative education program, a research-rich environment, and a broad-based entrepreneurial culture. Waterloo creates higher education unparalleled in depth of learning and breadth of experience. As the academic engine of one of the world’s top startup ecosystems, and with world-class research institutes in quantum information, water, health, energy, information technology and transportation, Waterloo is committed to utilizing new knowledge and ideas for the benefit of all.



## Research and Learning Environment

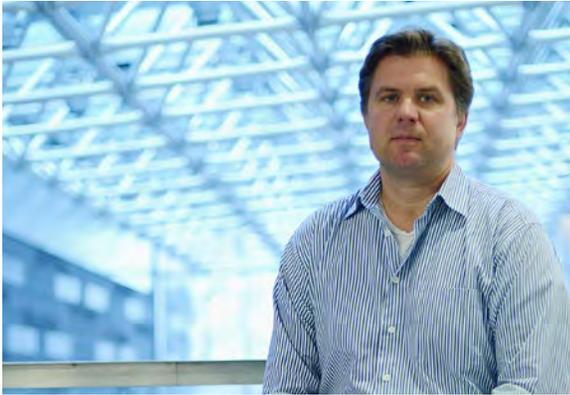
Waterloo’s success is grounded in excellence in teaching, research and scholarship, residing in each of our six faculties: Applied Health Sciences, Arts, Engineering, Environment, Mathematics and Science. Early exposure to research, experience-rich work terms, a wealth of entrepreneurial opportunities and a strong focus on teaching excellence 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 embraces research that ventures beyond conventional boundaries, convening global coalitions of researchers and institutions to tackle the thorniest challenges across frontier disciplines. We are working to become the most internationalized university in Canada by playing to our strengths in co-operative education and research, and affiliating with the most innovative universities and organizations on earth. Waterloo co-op students find work with companies in 65 countries, while alumni are making their mark in 152 countries.

## RESEARCH EXCELLENCE



### Leading the Next Quantum Revolution

Quantum entanglement is a phenomenon of quantum mechanics where an extremely strong correlation exists between quantum particles – even if the particles are separated. Waterloo physicists Thomas Jennewein and Kevin Resch and collaborators at the Institute for Quantum Computing were the first to demonstrate the distribution of three entangled photons at three distinct locations, hundreds of metres apart. Three-particle entanglement can be used to understand the fundamental level of nature and broaden the possibilities of quantum communications technology.



### Combating Cancer with Avocado-Derived Compound

Avocados may hold the key to beating leukemia. Research led by Paul Spagnuolo, professor of pharmacy, has discovered a lipid in avocados that combats acute myeloid leukemia by targeting the root of the disease – leukemia stem cells. Scientists here have filed a patent for the avocado-derived compound that targets cancer cells while leaving healthy cells unharmed.



### Building Better Joint Replacements in 3D

Today's knee replacements require painful metallic implants that last only 10 to 15 years. New Waterloo research aims to help healthcare professionals step in sooner, while the injury is less serious, with 3D-printed additive manufacturing technology that replaces damaged cartilage and underlying bone. Mihaela Vlasea, a professor of mechanical and mechatronics engineering, leads research that prints implants, then adds cultured cells to the implant surface, allowing it to degrade and be replaced with natural bone re-growth.



### Seeking Solutions to Humanitarian Challenges

The struggles of post-war refugees reverberate worldwide and the humanitarian challenges can seem insurmountable. Suzan Ilcan, a professor of sociology, affiliated with the Balsillie School of International Affairs, advises governments and aid organizations on the need to refocus their programs to facilitate sustainable social and economic infrastructures to improve the lives of marginalized populations and support countries that provide asylum.

## Profile Fast Facts

Canada Excellence  
Research Chairs  
(CERCs) **1**

Canada Research  
Chairs (CRCs) **64**

Research  
Income **\$230 M**

Undergraduate  
Enrolment **32,000**

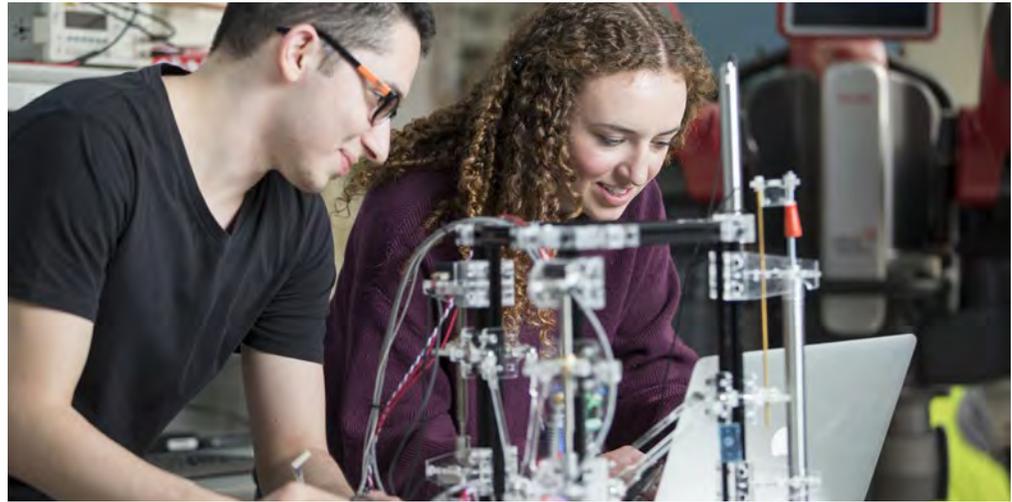
Graduate  
Enrolment **6,000**

International  
Students **4,000**

Total  
Enrolment **38,000**

## Select Research Strengths

1. Neuroscience/brain and mind
2. Imaging
3. Materials and biomaterials
4. Philosophy of Science
5. Planetary science
6. Musculoskeletal health
7. Wind engineering and natural disaster mitigation
8. Environmental sustainability and green energy



## 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 three 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 prepared 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 1,700 Western students participate in international learning abroad. Further, more than 60 percent of Western's publications over the past five years have been co-authored with international partners.

# RESEARCH EXCELLENCE



## Brain Health for Life

For 20 years, Western has been an international leader in cognitive neuroscience and imaging research – two areas that have coalesced through interdisciplinary collaborations at the world-renowned Brain and Mind Institute.

Already home to Canada Excellence Research Chair in Cognitive Neuroscience and Imaging, Western's Adrian Owen has further leveraged this expertise to secure a Canada First Research Excellence Fund grant to establish BrainsCAN. This initiative creates a pan-Canadian brain effort with McGill University and the Canadian Institute For Advanced Research that will radically transform our understanding of brain disorders and deliver effective solutions for maintaining brain function across the lifespan.



## Bridging Science and the Humanities

The Rotman Institute of Philosophy builds upon Western's global reputation for philosophy of science, supporting projects that bring together philosophers, scientists, policymakers and the public at large. The Institute houses a unique, collaborative 'philosophy laboratory' to better engage, explore and exchange ideas related to what is good for science and what science is good for.

By building bridges among philosophy and the sciences, members are better able to address challenges with broad impact for Canada and the world. In 2012, a team led by Rotman member Charles Weijer established the world's first ethical guidelines for cluster randomized trials.



## Seeking a Cure for HIV/AIDS

Western's researchers are developing vaccines to prevent HIV infection and cure those living with the illness. A promising vaccine Dr. Chil-Yong Kang developed, with support from Sumagen Canada, is currently completing Phase II human clinical trials. This is the world's first and only preventative HIV vaccine based on a genetically modified killed whole virus, and the only such vaccine under development in Canada.

This work is complemented by the research of Eric Arts, the Canada Research Chair in HIV Pathogenesis and Viral Control. Arts and his team are broadening our understanding of HIV-1 evolution and pathogenesis to improve vaccine design and drug development.



## Images of the Future

For more than 30 years, Western – including Robarts Research Institute – and its affiliated hospitals have driven Canadian leadership in biomedical imaging research and development. With more than 400 personnel engaged in imaging research through the Biomedical Imaging Research Centre, and world-class infrastructure including the country's highest-field human MRI system, Western and its partners are improving Canadian competitiveness and shaping the future of health care.

This group has made significant advances, including Paula Foster's discovery that MRI can detect a single cell in a living animal, allowing scientists to begin to track cellular movement and disease.







**Group of Canadian Research Universities**

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