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

Innovation Clusters Fueled by Research Universities: Examples from the U15

U15

Group of Canadian Research Universities

Regroupement des universités de recherche du Canada

Please note that the data used in each cluster profile was drawn from a variety of sources that use a variety of different methodologies. While this makes the data non-comparable from cluster to cluster and institution to institution, it illustrates their strengths and the depth of interaction between globally competitive clusters and research universities. Accordingly, we recommend readers consider each unique profile independently.

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U15
Group of Canadian Research Universities
Regroupement des universités de recherche du Canada

U15 MESSAGE

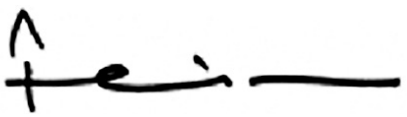
With the tabling of the 2016 Budget, the federal government sparked a national conversation about how globally competitive clusters can contribute to Canada's long-term prosperity. The question now is how to turn this excitement into a national strategy that drives economic growth.

High-performing innovation clusters provide businesses with competitive advantages based on a wide variety of factors, including proximity to natural resources, major markets, large talent pools, or major facilities and installations. These advantages are extremely hard to replicate elsewhere and differ significantly from cluster to cluster.

While every innovation cluster is unique, one thing is clear: most globally competitive clusters are deeply interconnected with world-class research universities. These research institutions help develop a highly talented workforce, make disruptive discoveries and boast world-class facilities. These three pillars — world-class talent, new ideas, and facilities — support the platform on which all world-class innovation clusters are built. The investments Budget 2016 made in campus infrastructure and Canada's granting councils are an important part of ensuring our country's clusters continue to benefit from world-class research universities.

As the government develops Canada's innovation agenda, we thought it might be helpful to look at how U15 institutions currently act as platforms for some of our country's existing innovation clusters. To this end, we asked each of our institutions to profile its contributions to one globally competitive innovation cluster. It was a challenge for U15 universities to choose only one cluster to profile. This booklet compiles one of the cluster profiles each of our member institutions submitted.

In reviewing the responses, we were struck by the number of different ways our institutions interact with clusters. U15 institutions have undertaken everything from creating applied research institutes to creating professional development programs to meet the unique competitive needs of clusters. This diversity is encouraging. The responses of our universities suggest that each institution's engagement with local clusters is strategic and provides unique competitive advantages that will be hard for businesses outside the cluster to replicate. While recommendations are beyond the scope of this document, we hope this compilation serves as a catalyst for an ongoing conversation about how governments, businesses and post-secondary institutions can work together to ensure Canada's innovation clusters remain globally competitive.



Feridun Hamdullahpur
Chair, The U15

Suzanne Corbeil
Executive Director, The U15

Innovation Clusters Fueled by Research Universities: Examples from the U15

U15 Institutions Anchor Innovation Clusters Coast to Coast

Alberta	Health Services
UBC	Life Sciences
Calgary	Clean Tech Energy
Dalhousie	Ocean Technologies
Laval	Optics-Photonics
Manitoba	Advanced Materials
McGill	Life Sciences & Health Tech
McMaster	Manufacturing
Montreal	Data Science
Ottawa	Digital Technology & ICT
Queen's	Clean Tech, Energy & Sustainable Communities
Saskatchewan	Ag Biosciences
Toronto	Regenerative Medicine
Waterloo	ICT
Western	Life Sciences

Perform **$8.5B** in research annually

Receive **$664M** in research funding from business

Perform **83%** of business funded university research

Educate **584K** students annually

Located where **62%** of Canadians live and work

Employ **103K** Canadians from coast to coast

*"At the **heart** of every globally competitive innovation cluster is a **world-class research university** developing the **talent**, making the **discoveries** and providing the **infrastructure** innovators need to thrive."*

- Feridun Hamdullahpur, U15 Chair

UBC | Life Sciences

BC's Life Sciences cluster is the most impactful in Canada in terms of biotech start-up formation and growth. UBC is at the heart of this cluster and Vancouver was recently recognized in the top 10 cities globally for innovation in life sciences.

Calgary | Clean Tech Energy

Calgary's Clean Tech Energy cluster leverages the University of Calgary's research strengths and brings together Canada's major energy companies, the industry's trade associations, and distribution operators. The cluster works to accelerate the responsible development, distribution and use of Canada's unconventional resources.

Alberta | Health Services

The University of Alberta anchors Edmonton's world-class Health Services cluster. Branded Canada's "Health City" based on the strength of its health cluster, Edmonton is home to TEC Health Accelerator, which fosters start-ups helping them integrate into a community of 265 companies.

Dalhousie | Ocean Technologies

Halifax's Ocean cluster, leveraging the research strengths of Dalhousie University and its strategic coastal location, consists of world-leading companies in ocean technology, fisheries and aquaculture, shipbuilding, and ocean observation, as well as marine-centric defence, transportation, and energy.

Laval | Optics-Photonics

Leveraging the strength of Université Laval's Centre for Optics, Photonics and Lasers (COPL), the Greater Quebec City Optics-Photonics cluster has developed into a vibrant ecosystem that employs 4,350 people and generates $700 million in sales.

McGill | Life Sciences & Health Tech

Montreal's LSHT cluster consists of more than 620 organizations, including 150 research organizations and 80 subsidiaries of foreign companies. Comprised of 11 institutions of higher education, the cluster is a fertile breeding ground for innovation and creativity, linking industry with research organizations.

Saskatchewan | Ag Biosciences

Leveraging University of Saskatchewan research strengths, Saskatoon is home to a vibrant Bioscience cluster, whose world-class infrastructure, expertise and global networks distinguish Canada as a food security leader. The unique cluster includes more than 136 companies, institutions and grower organizations.

Manitoba | Advanced Materials

Materials and composites development, which leverages interdisciplinary strengths at the University of Manitoba, plays a crucial role in Manitoba's manufacturing industries. These industries, spanning agricultural, aerospace, health, mining, manufacturing and land transport sectors account for nearly 10% of the province's GDP.

Waterloo | ICT

Waterloo Region is home to a world-renowned ICT cluster that is made up of over 1,000 technology companies. The survival rate for first-year ICT startups is almost double the global industry average, and patents per capita is almost 4x higher than the Canadian average.

Ottawa | Digital Technology & ICT

Over 90% of Canada's ICT R&D is performed in the Ottawa region. An entrepreneurial reinvigoration of the cluster has yielded over 1,000 companies in a sector that includes ICT, photonics, defense & security, software & digital media. The region has the second largest concentration of science & engineering employment in North America.

Montreal | Data Science

Montreal is a diversified and primarily knowledge-based economy containing nine structured innovation clusters. Data-driven innovation emerging from the ICT cluster, and fuelled by the Université de Montréal, is permeating other high-value sectors ranging from Life Sciences and Health Technologies to Transportation and Logistics.

Western | Life Sciences

London's Life Sciences sector employs over 24,000 clinicians and health care workers across seven hospital campuses, nearly 150 commercial enterprises and a dozen premier research centres including two globally renowned research institutions – Robarts and Lawson.

McMaster | Manufacturing

Hamilton, ON is being transformed into a centre for advanced manufacturing. The city is now regarded as one of the province's largest manufacturing areas. Hamilton's manufacturing sector contributes an estimated $17 billion per year to the economy – roughly 3% of Ontario's GDP.

Toronto | Regenerative Medicine

Regenerative Medicine (RM) holds the promise to treat, manage and perhaps cure some of the most devastating and costly diseases. The U of T, partner hospitals and institutes are home to Canada's largest and most productive cluster of RM scientists, clinicians and biomedical engineers. The global market for RM is forecast to reach US$67.6B by 2020.

Queen's | Clean-Tech, Energy & Sustainable Communities

The Kingston region's Clean Tech, Energy and Sustainable Communities cluster consists of leading companies and start-ups that drive innovations in clean energy, clean water, water conservation, and sustainable technologies. The cluster employs more than 1,600 people.

Note: Data related to individual clusters on this map uses a variety of different methodologies. Therefore, individual data points should not be compared, summed or aggregated. Please contact the U15 Directorate if you have questions.

U15

EDMONTON'S HEALTH SERVICES CLUSTER

The University of Alberta anchors Edmonton's Health Services cluster. Edmonton has been branded as Canada's "Health City" because of the strength of its health cluster. TEC Edmonton's Health Accelerator develops start-ups to join a community of 265 companies, which the BioAlberta Industry Association supports. Provincial government support for translational research, through Alberta Innovates, promotes innovation in high-profile institutes at the University of Alberta. Through Alberta Health Services, a living lab of 4.5-million people is served by a single system that enables innovation through strategic clinical networks.

By the Numbers

Cluster Employment:

94,700

Businesses in the Cluster:

265

University-Cluster Alignment

Cluster-Related Graduated Students:

2,825

Cluster-Related Canada Research Chairs:

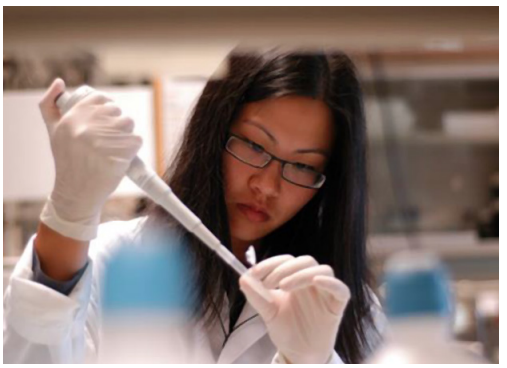
39

Cluster-Related Canada Excellence Research Chairs:

1

Cluster-Related Start-ups & Entrepreneurs Supported Last Year:

139



How the University Engages with the Cluster

At the forefront of University of Alberta's cluster engagement are initiatives such as Canada's first Health Law Institute and the internationally recognized Li Ka Shing Institute of Virology and Mazankowski Alberta Heart Institute. Research translation, supported by Alberta Innovates, tackles a wide range of health issues. The campus-based Translational Science Institutes cover neuroscience, mental health, and cardiovascular research. Alberta Cell Therapy Manufacturing, part of the CellCAN National Centre of Excellence, facilitates the translation of cell-based therapies through training and facility access. Health system needs are aligned with research through Strategic Clinical Networks. Innovative health companies benefit from expertise at the TEC Edmonton, a world-leading incubator that is a joint venture between the University and the City of Edmonton. TEC Edmonton operates the TEC Health Accelerator, where researchers, SMEs, and MNEs connect through industry events, incubation space, and joint projects. The health cluster drives ground-breaking health research and innovative technologies, and has led to over 40 health-related university spin-offs. The University of Alberta's Science Internship Program, coupled with federal programs like IRAP, Mitacs and WED, ensures students are well-prepared to work in this vital sector.

Key Educational Programs

- Biomedical Engineering
- Alberta MBA in Innovation and Entrepreneurship
- Microbiology and Biotechnology
- School of Public Health
- Physical Medicine and Rehabilitation
- Bioinformatics
- Pharmacology
- Neuroscience
- Heritage Youth Researcher Summer Program
- MD/PhD program

Key Research Priorities

- Precision Medicine
- Diabetes and Obesity
- Neurosciences
- Cancer
- Motor Control and Rehabilitation
- Virology
- Transplantation
- Women and Children's Health
- Health Law
- Glycomics and Metabolomics

Key Facilities & Initiatives

- TEC Edmonton Health Accelerator
- Li Ka Shing Institute of Virology
- Medical Isotope and Cyclotron Facility
- Mazankowski Alberta Heart Institute
- Women and Children's Health Research Institute
- Drug Development and Innovation Centre
- Alberta Diabetes Institute
- Indigenous Health Initiatives
- Glyconet, NCE
- Institute for Reconstructive Science in Medicine

BC LIFE SCIENCES CLUSTER

BC's Life Sciences cluster is Canada's most impactful hub for biotech start-up formation and growth. At the cluster's heart, Vancouver was recently recognized as one of the Top 10 cities in the world for innovation in life sciences. The broader health and life sciences sector in British Columbia employs 180,000 people and contributes $14.4 billion to BC's GDP. The core life sciences/biotech cluster employs 11,172 people across 1,154 companies. Fueled by venture capital and private equity investments ($352 million in 2014), the cluster's five-year compound annual growth is 3.4 percent, outpacing the national life sciences rate of 2.2 percent.

By the Numbers

Biotech Cluster Employment:

11,172+

Number of Companies:

1,154

Cluster-University Alignment

Cluster-Related Faculty:

1,545

Cluster-Related Canada Research Chairs:

75

Cluster-Related Graduate Students:

3,097

Clinical Trials Last Year:

840

How the University Engages with the Cluster

UBC is one of the world's top research universities, currently ranked sixth among public universities in North America, and 34th in the world. UBC is particularly strong in life sciences, ranking 20th globally. Spanning 10 faculties, including BC's only medical school, the teaching and research in UBC's life sciences disciplines contribute to the growth and sustained excellence of the province's Life Sciences cluster.

UBC's partnerships with BC's hospital-based research institutes foster highly qualified personnel entering the sector, and provide excellent opportunities for translational research. BC's unique health data platform and UBC's integration with the healthcare system mean discoveries are quickly translated into practice and tested in a clinical environment. These partnerships have spawned successful companies such as Aquinox Pharmaceuticals, Kardium, and Xenon Pharmaceuticals.

UBC has created 180 start-up companies through licensed patents, 13 in 2015/16, with 55 percent of those companies in the Life Sciences cluster. This level of start-up activity puts UBC in the 92nd percentile of North American universities and the 97th percentile for Canadian universities.

Key Educational Programs

- Cell and Developmental Biology
- Experimental Medicine
- Genome Science and Technology
- Medical Genetics
- Microbiology and Immunology
- Neuroscience
- Medicine (BC-wide MD)
- Dental Medicine (DMD)
- Nursing
- Physical Therapy

Key Research Priorities

- Cancer and oncogenomics
- Brain health
- Drug discovery and development
- Personalized medicine
- HIV/AIDS
- Heart and lung
- Microbiome
- Nanomedicines
- Population and public health
- Medical devices

Key Facilities & Initiatives

- Life Sciences Institute
- Vancouver Coastal Health Research Institute
- Providence Health Care Research Institute
- Child and Family Research Institute
- BC Cancer Research Centre
- Genome Sciences Centre
- CDRD/ Accel-Rx
- SPOR SUPPORT Unit and PopData BC
- Entrepreneurship @UBC, UILO
- BC Academic Health Science Network

UNIVERSITY OF CALGARY

CALGARY'S CLEAN TECH ENERGY CLUSTER

The transition to a carbon-neutral energy future poses challenges for the responsible development, distribution and use of Canada's unconventional resources. Calgary's Clean tech Energy Cluster leverages the University of Calgary's research strengths and brings together Canada's major energy companies, the industry's trade associations, and distribution operators. These companies lead in carbon capture and storage, make strategic investments in Clean Tech, and produce a combined 43 percent of Canada's installed wind generation capacity. Through new discoveries and rapid deployment of clean technologies, the cluster aims to supply energy with reduced GHG emissions that will enable Canada to achieve its COP-21 commitments.

By the Numbers

Economic Size of the Calgary Energy Cluster:

$35.4B

Calgary Energy Cluster Employment:

68,500

Number of Businesses in the Cluster:

1,746

University-Cluster Alignment

Faculty Engaged in Energy Research:

270

Research Chairs in Energy-Related Fields:

26

Industry Sponsored Energy Projects:

100+/year

How the University Engages with the Cluster

Located in the capital of Canada's energy industry, UCalgary benefits from unparalleled access to energy corporations, decision-makers, and technology users. Together, they're reducing the environmental and economic costs of unconventional resource extraction in the short-term, while simultaneously seeking new solutions for unlocking vast resources with zero-carbon emissions. More than 150 industry partners support six major industry-specific research consortia and 10 industry research chairs by contributing with their expertise, data, and infrastructure. Our researchers have historically been very active in technology transfer – conducting more than 100 industry-sponsored projects annually. UCalgary also works in close partnership with government and industry to address public policy challenges such as regulatory issues, public acceptance and market access. UCalgary has established partnerships and unique research facilities or collaborations in China, Mexico, and Israel. These secured international sites offer great opportunities for testing new ideas, applying new solutions, and developing new applications at scales that will accelerate industry deployment and adoption and pave the way for Canadian business growth in these jurisdictions.

Key Educational Programs

- Petroleum Engineering
- Geoscience
- Master of Public Policy
- Global Energy Executive MBA
- BSc in Energy Engineering (with SAIT Polytechnic)
- International Energy Lawyers (with UHouston Law Centre)
- MSc in Sustainable Energy Development (interdisciplinary)

Key Research Priorities

- Unconventional resources
- Reservoir engineering
- Petroleum microbiology
- Energy storage and conversion
- Energy policy, law and economics
- Nanomaterials/nanotechnology
- Catalysis
- Hydraulic fracturing
- Carbon capture and storage
- Solar energy conversion

Key Facilities & Initiatives

- Containment and Monitoring Institute
- Kinetica Innovation Centre (prototyping/ scale-up)
- Innovate Calgary tech incubator
- CERC in Materials Engineering for Unconventional Oil Reservoirs
- Global Research Site in Unconventional Resources
- Canadian Network for Energy Analysis and Policy

DALHOUSIE UNIVERSITY

HALIFAX'S OCEAN CLUSTER

Halifax's Ocean cluster, leveraging the research strengths of Dalhousie University and its strategic coastal location, consists of world-leading companies in ocean technology, fisheries and aquaculture, shipbuilding, and ocean observation, as well as marine-centric defence, transportation, and energy. These industries benefit from proximity to major Navy installations – the Defence Research and Development Canada labs, and the Bedford Institute of Oceanography, the Department of Fisheries and Oceans' largest ocean research centre. Natural Resources Canada and the Department of Environment and Climate Change Canada also employ ocean-related research scientists in Halifax. The annual economic impact of the ocean industries is $2.6B, generating 8.1 percent of the province's GDP.

By the Numbers

Economic Impact of the Cluster:

$2.6B

Percentage of Total N.S. Business R&D that is Ocean-related:

33%

University-Cluster Alignment

Percentage of Ocean-Related NSERC Grants Awarded to Dalhousie:

20%

Cluster-Related Faculty:

100

Ocean-Related Research Chairs:

22

Ocean-Related Canada Excellence Research Chairs:

1

How the University Engages with the Cluster

Given the breadth and depth of Dalhousie's educational and research activities, the extent of its engagement with the Ocean cluster is significant. Ocean research is one of the University's four strategic research priorities, cutting across academic programs ranging from marine biology to ocean law. The University's new Ocean Frontier Institute encompasses a broad-based, multidisciplinary and internationally-partnered approach, providing cutting-edge ideas, talented graduates and expertise for diverse businesses. The University is a member of numerous ocean-related industry associations, helping Dal connect businesses with researchers. The University has led the creation of groups such as the Canadian Institute of Fisheries Technology, which provides specialized services to the local food industry, and the Institute for Ocean Research Enterprise, which fosters collaborative ocean research programs involving business, university, and government researchers. An exciting new harbourfront science park/incubator/accelerator called the Centre for Ocean Ventures and Entrepreneurship (COVE) is under development on a former Coast Guard property. COVE will link to the Ocean Frontier Institute, creating a dynamic industry-university innovation space.

Key Educational Programs

- Marine Biology and Aquaculture
- Oceanography
- Physics and Atmospheric Science
- Electrical Engineering
- Petroleum/Oil and Gas Engineering
- Earth Sciences
- Ocean Data Analytics and Visualization
- Environmental Studies
- Marine and Environmental Law
- Marine Management and Marine Affairs

Key Research Priorities

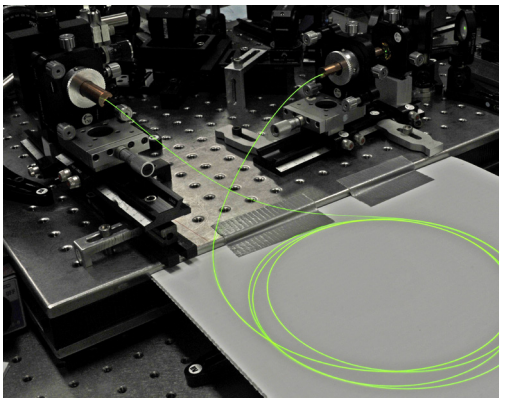
- Marine Biological Resources, Spatial Planning and Conservation of Biodiversity
- Marine Technologies and Genomics
- Aquaculture
- Ocean Environmental Processes
- Telemetry for Tracking Marine Life
- Physical and Chemical Oceanography
- Biogeochemical Modelling
- Arctic Studies
- Atmospheric Science
- Ocean Law and Governance

Key Facilities & Initiatives

- Aquatron
- The Steele Ocean Sciences Building
- Hub of the Ocean Tracking and MEOPAR Networks
- Marine Gene Probe and Genomics Labs
- Ocean Science and Technology Lab
- Institute of Ocean Research Enterprise
- Ocean Frontier and Marine and Environmental Law Institutes
- HOSST-TOSST Helmholtz/NSERC CREATE International Training Program
- Cdn. Institute of Fisheries Technology
- Institute for Big Data Analysis

QUEBEC CITY'S OPTICS-PHOTONICS CLUSTER

Leveraging the strength of Université Laval's Centre for Optics, Photonics and Lasers (COPL), the Greater Quebec City Optics-Photonics cluster has developed, over the past three decades, into a vibrant ecosystem. It consists of 46 companies employing 4,350 people and generating $700 million in sales. Three other major research centres also fuel this development: INO, Canada's largest centre of expertise in applied optics-photonics; DRDC-Valcartier, developing advanced solutions and strategic science and technology capability for Canada's defence and security sector; and the Neurophotonics Centre, which harnesses light-based technology to study the nervous system and to unravel the mysteries of the brain.



How the University Engages with the Cluster

A result of Université Laval's half-century reputation for research excellence in optics-photonics, the COPL ranks among the best centres in the world for training and research in this field. It is therefore not surprising that an industrial cluster has emerged within a 10-kilometre radius of this source of world-leading expertise and highly qualified personnel. Thanks to a CFI-funded state-of-the art facility, students are trained in an exceptional environment. More than 30 students graduate with Master's and PhD diplomas annually. Many elect to stay in the region, finding employment easily within the cluster, and consolidating COPL's role as a vital link in the innovation chain. Former students often strike up partnerships with COPL research teams. This dynamic interaction allows the Centre to remain abreast of emerging trends, as well as to validate the relevance of its research and training activities. Furthermore, cluster members have access to some of COPL's unique facilities and equipment, which benefits their efforts to gain a competitive edge and to capture lucrative niche markets.

By the Numbers

Cluster Revenue (annual):

$700M

University-Cluster Alignment

Centre for Optics, Photonics & Lasers Graduate Students:

150

Centre for Optics, Photonics & Lasers Faculty:

23

Industrial Research Chairs:

2

Canada Research Chairs:

5

Canada Excellence Research Chairs:

2

Key Educational Programs

- Physics Master's and PhD
- Electrical Engineering Master's and PhD
- Chemistry Master's and PhD
- Biophotonics Master's and PhD
- Summer School in Neurophotonics
- NSERC CREATE U Laval-INRS-U of T partnership with German Research Foundation for training in advanced laser science and applications

Key Research Priorities

- Fiberoptics and guided-wave optics
- Lasers and short pulses
- Optical communications
- Biophotonics
- Optical engineering
- Photonic materials

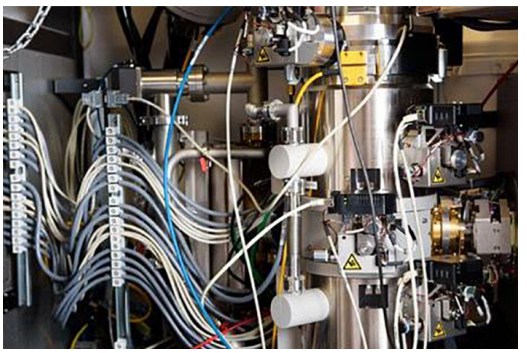
Key Facilities & Initiatives

- The Sentinel North (CFREF) program, a multi-disciplinary initiative linking optics-photonics to Arctic research
- Optics and Photonics building
- Neurophotonics Centre located at the Quebec Mental Health Institute
- Complete optical fibre fabrication facilities
- Optomechanical laboratory facility
- Thin film deposition and optical coating systems
- Focussed ion-beam characterization system

University of Manitoba

MANITOBA'S MATERIAL ADVANTAGE

Materials and composites development leverages interdisciplinary strengths at the University of Manitoba to partner with manufacturing industries spanning agricultural, aerospace, health, mining, manufacturing and land transport sectors. The Royal Canadian Mint and Pollard Banknote Limited complement the largest Canadian-based manufacturer of composite aerospace assemblies, adding to the diversity within this cluster. Winnipeg's centrality and unique road/rail/air interconnections speedily translate the competitive advantages for these industries to relevant markets from coast to coast and throughout the continental USA. This cluster of industries has a combined economic impact of $11.1B, generating nearly 10 percent of the province's GDP.



By the Numbers

Economic Size of the Cluster:

$11.1B

Cluster Employment:

20,000

Number of Companies in the Cluster:

500

University-Cluster Alignment

Cluster-Related Graduate Students:

400

Cluster-Related Canada Research Chairs:

9

Faculty Engaged in Related Research:

66

How the University Engages with the Cluster

The newly opened Manitoba Institute for Materials, a materials and composites characterization facility at the U of M, complements key industrial initiatives, including the Composites Innovation Centre, Precision Advanced Digital Manufacturing and the Orthopedic Innovation Centre. This core facility represents strategic investments by the federal government (WED), the Province of Manitoba, the University and industrial partners including CIC, SFR, FEI and GE. The facility represents a sustainable, shared regional resource. The breadth of the cluster extends beyond traditional metallic composites. Exciting new developments within the cluster include initiatives in additive manufacturing for artificial joints and aerospace components, biocomposite materials for the automotive sector developed from fibre feedstocks, sensor development for the Royal Canadian Mint, aero engine testing, grain quality/spoilage monitoring and remote sensing in Arctic environmental monitoring. Within the cluster, FibreCITY is a world leader in developing the next generation of composite materials from renewable resources. The Manitoba Institute for Materials is a key node within the cluster, bringing researchers and students together with industrial players and developing job-ready employees for future economic growth.

Key Educational Programs

- Biosystems Engineering
- Chemistry
- Civil Engineering
- Dentistry
- Electrical and Computer Engineering
- Food Sciences
- Geological Sciences
- Mechanical Engineering
- Physics and Astronomy

Key Research Priorities

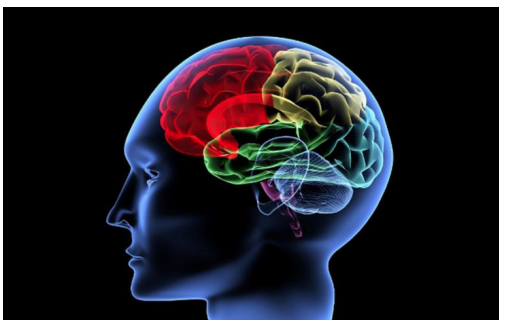
- Additive Manufacturing
- Composite Material Systems
- High-Temp Aerospace Materials
- MEMS/Microfluidic Systems
- Nanostructured Materials
- New Materials for Structures
- Photonic and Phononic Devices
- Quantum Materials
- Soft and Disordered Materials
- Surfaces and Interfaces

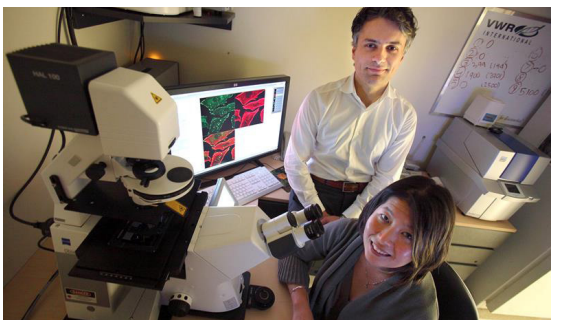
Key Facilities & Initiatives

- Composites Innovation Centre
- FibreCITY
- Interdisciplinary education
- Manitoba Institute for Materials
- Materials Characterization Facility
- Manitoba Materials Annual Conference
- Precision ADM/OIC
- Royal Canadian Mint
- WestCaRD, EnviroTREC

MONTREAL'S LIFE SCIENCE & HEALTH TECHNOLOGIES CLUSTER – FOCUS ON NEUROSCIENCE

Montreal's Life Sciences and Health Technologies (LSHT) cluster consists of more than 620 organizations, including 150 research organizations and 80 subsidiaries of foreign companies. Comprised of 11 institutions of higher education, the cluster is a fertile breeding ground for innovation and creativity, linking industry with research organizations. The cluster acts as a magnet for industry and investors in drug development , medical devices, imaging technology, neuroinformatics, and mental health. Within the Montreal Life Sciences cluster, one area of excellence focuses on Neuroscience and specifically brain research, where the clinical translation of that research is world-renowned.





By the Numbers

Cluster Employment in Greater Montreal:

40,000

Percent of Canada's Total LSHT Employment:

18%

University-Cluster Alignment

Graduates & Postdocs Aligned to the Cluster:

1,023

External Neuroscience Research Funding:

$65M/year

Cluster-Related Canada Excellence Research Chairs:

1

Percentage of Canada Research Chairs in Neuroscience:

20%

How the University Engages with the Cluster

McGill University links together a vast, dynamic and rapidly growing network of scholars, institutes, centres, hospitals, clinicians, and infrastructure for research and innovation related to the cluster. In the field of Neuroscience, McGill and affiliated research hospitals are well-recognized leaders. They have generated 14 active neuroscience spin-off companies, including Nova Molecular, Spectral Neuroscience, Biospective Imaging, and True Positive Medical Device, yielding $17 million in industry contracts over the past five years. Through Canada's largest graduate neurosciences program, the Integrated Program in Neurosciences, McGill is training the next generations of highly skilled personnel to enrich the cluster. McGill Neuroscience is a point of convergence where some of the world's leading scientists and innovators tackle the greatest challenges of the brain and mental health, forging distinctive innovation pathways. For example, the "Open-Science" initiative piloted at McGill's Montreal Neurological Institute has the potential to speed innovation and reduce risk by providing an exciting push toward disruptive new findings. The University is poised to accelerate the process of discovery in collaboration with industry partners, both locally and internationally.

Key Educational Programs

- Integrated Program in Neuroscience
- PhD Neuroscience
- MSc Neuroscience
- BSc Honours, Neuroscience
- BSc Major, Neuroscience
- BSc Minor, Neuroscience
- Graduate Studies in Neurobiology, Physiology, Behavioural Neuroscience, and Pharmacology and Therapeutics

Key Research Priorities

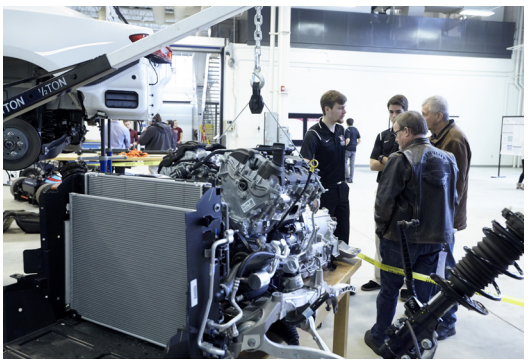
- Neuroinformatics
- Cognitive Neuroscience
- Mental Health
- Epigenetics
- Neurodegenerative Disease
- Chronic Pain
- Neurosurgery and Devices

Key Facilities & Initiatives

- Montreal Neurological Institute (MNI)
- Douglas Mental Health University Institute
- McGill University Health Centre Research Institute
- McGill University and Genome Quebec Innovation Centre
- McGill Centre for Research in Neuroscience
- McConnell Brain Imaging Centre
- Douglas-Bell Canada Brain Bank
- Ludmer Centre for Neuroinformatics and Mental Health

GREATER HAMILTON AREA MANUFACTURING CLUSTER

Hamilton, ON is being transformed into a centre for advanced manufacturing. The city is now regarded as one of the province's largest manufacturing areas. Hamilton's manufacturing sector contributes an estimated $17 billion per year to the economy – roughly 3 percent of Ontario's GDP. Exports (tradable goods) drive the economic wealth the manufacturing cluster generates. The majority of Hamilton manufacturers (close to 80 percent) export their products to U.S. markets, resulting in the receipt of foreign exchange and thereby directly creating wealth in the regional, provincial and national economy.



By the Numbers

Economic Size of the Cluster:

$17B

Cluster Employment:

53,000

University-Cluster Alignment

Student Placements (Co-ops, Interns) Within the Cluster:

800/year

Cluster-Related Research Chairs:

60

Cluster-Related Canada Excellence Research Chairs:

1

McMaster Research Funding in Manufacturing / Materials:

$35M/year

How the University Engages with the Cluster

McMaster University has long held a reputation as a global leader in manufacturing research. Our researchers, scientists, engineers and students are actively engaged in all facets of manufacturing – from R&D to distribution, logistics and policy development. Our manufacturing experts work in tandem with their industry partners in automotive, aerospace, materials and health sectors. McMaster contributes to the success of this cluster through collaborative research and HQP. Our strength in materials research enhances our innovations in advanced manufacturing: from developing new technologies that produce lighter weight materials – ultimately reducing our carbon footprint – to identifying new biomaterials to advance healthcare solutions. Central to our efforts is our critical mass of research chairs, innovative undergraduate and graduate programs, and state-of-the-art research centres and institutes with a materials and manufacturing focus. The McMaster Innovation Park (MIP) has expanded our reach and is now home to Canada's premier materials facility, CANMET Materials Technology Laboratory, and to the McMaster Automotive Resource Centre (MARC). MIP will soon be home to the McMaster-Fraunhofer Project Centre for Biomedical Engineering and Advanced Manufacturing (BEAM).

Key Educational Programs

- Bachelor of Engineering and Management
- Enrichment Programs for Industry
- Industry PhD Program (Canada's only)
- Bachelor of Technology, streams include: Automotive and Vehicle, Process Automation
- Engineering Design
- Engineering and Public Policy
- Engineering/Technology Entrepreneurship and Innovation
- Mechatronics, Electrical and Biomedical Engineering
- EPIC Lab and Hatch Centre
- Student Car Projects (Solar/Eco/Electric/ Autonomous)

Key Research Priorities

- High Performance Manufacturing
- Advanced Materials
- Manufacturing Robotics
- Automation and Mechatronics
- Industry 4.0
- Safety Critical/Smart Systems
- Nanotech Manufacturing
- Advanced Manufacturing in Health/ Biomedical Devices
- Emerging Devices
- Transportation and Logistics

Key Facilities & Initiatives

- Canada Excellence Chair in Hybrid Powertrain Program
- Manufacturing Research Institute (MMRI)
- Brockhouse Institute for Materials Research
- Canadian Centre for Electron Microscopy
- McMaster Steel Research Centre
- McMaster Centre for Software Certification
- McMaster Automotive Resource Centre
- McMaster Centre for Emerging Devices Technology
- McMaster-Fraunhofer Project Centre-BEAM
- Biointerfaces Institute

Université de Montréal

MONTREAL'S DATA SCIENCE DRIVEN CLUSTERS

Montreal is a diversified and primarily knowledge-based economy containing nine structured innovation clusters in high-value sectors ranging from Information and Communications Technologies (ICT) through Life Sciences and Health Technologies (LSHT) and Transportation and Logistics. Data-driven innovation emerging from the ICT cluster and permeating other clusters is the economic growth engine of Montreal. Montreal's ICT cluster alone represents 4,700 companies. At $10B, its GDP is growing twice as fast as the overall economy. Inter-cluster synergies between ICT and LHST clusters represent a driving economic force of $18B.

By the Numbers

Combined Size of LHST, ICT & Logistics Cluster:

$18B

Combined Cluster Employment:

190,000

University-Cluster Alignment

Clusters-Related Graduate Students:

2,000

Montreal Clusters-Related Canada Research Chairs:

75

Clusters-Related Canada Excellence Research Chairs:

1

Partnership Projects within the Clusters:

800

How the University Engages with the Cluster

UdeM and affiliated business and engineering schools, HEC Montréal and Polytechnique Montréal, supply the world-leading expertise at the core of Big Data and Data-Driven Innovation (DDI). UdeM also boasts a history of productive collaborations with the LSHT cluster, ranging from drug discovery to UdeM's presence on the governing or advisory bodies of the industry associations. IVADO, UdeM's Institute for Data Valorization, enhances further DDI by bringing data scientists closer to the LSHT cluster, thereby accelerating data-driven technology transfer, capacity building and industry partnerships. UdeM is also home to world-renowned facilities and experts in Personalized Medicine, Oncology and Cardiology – all increasingly data-driven. The MHICC and the Research Centres of the CHUM and St-Justine's are recognized clinical trial centres, attracting local and foreign investment. The Centre for Commercialization of Cancer Immunotherapy and unique Good Manufacturing Process facility help Canadian health professionals and patients gain early access to promising therapies. While feeding the pipeline of new therapies, UdeM's IRICoR partners with industry to bring novel therapeutics for cancer and cardiovascular patients closer to market, through novel data-driven strategies.

Key Educational Programs

- Computer Science and Engineering
- Mathematics and Statistics
- Bio-Informatics
- Molecular and Systems Biology
- Pharmacogenomics
- Drug Development
- Medical Genomics
- Pharmaceutical Sciences
- Microbiology and Immunology
- Molecular and Cellular Medicine

Key Research Priorities

- Artificial Intelligence and Decision-Making
- Computer Science
- Data Science
- Mathematics and Statistics
- Digital Society
- Cardiovascular and Metabolic Diseases
- Drug Discovery and Development
- Personalized Medicine
- Oncology
- Medical Genomics

Key Facilities & Initiatives

- Institute for Data Valorization
- Montreal Institute for Learning Algorithms
- CIRRELT – Science of Networks
- Institute for Research on Immunology and Cancer (IRIC)
- Center for Commercialization in Cancer Immunotherapy
- Montreal Health Innovations Coordination Center (MHICC)
- CARTaGENE and MHICC Biobanks
- UdeM Pharmacogenomics Center

uOttawa

OTTAWA'S DIGITAL TECHNOLOGY – ICT CLUSTER

The Ottawa region has been the Canadian hub for ICT-related R&D for decades. More than 90 percent of Canada's ICT R&D is performed here. An entrepreneurial reinvigoration of the Digital Technologies cluster has drawn more than 1000 ICT, photonics, defence and security, software and digital media companies. The region has the second-largest concentration of science and engineering employment in North America. Key infrastructure in the region include government labs, academic institutions and a dynamic private sector consisting of multi-nationals: IBM, Cisco, Huawei, Alcatel-Lucent, Mitel, Apple, Blackberry-QNX; growth companies: Shopify, Halogen, YouiTV; and a vibrant start-up community.

How the University Engages with the Cluster

The University of Ottawa has long partnered with the Digital Technologies/ICT cluster in education and training, internships and employment and research. Now e-Society is one of four strategic areas of development for research for uOttawa, cutting across all faculties. Digital technologies affect students, education, entrepreneurship, innovation, government and Canadian society at large. Partnerships with the Digital Technology cluster promote student experiential learning, employment, enhanced training and innovative research. Digital technology-related research at uOttawa offers a spectrum of interactions with our regional industrial partners, including student internships and co-ops, workshops and professional development, collaborative research (from policy creation to technology development), employment of graduates and creation of start-up ventures. The Centre for Research in Photonics, for example, unites scientific and engineering research expertise in numerous interactions with regional industry partners, from multinationals to start-up firms. The Centre for Business Analytics and Performance uses analytics as a means to improve organizational outcomes, and the Centre for Law, Technology and Society works with government and industry to analyze technological innovations from socio-ethical, legal and policy perspectives.

By the Numbers

Companies within the National Capital Region's Digital Technology-ICT sector:

1,000+

ICT Employment:

57,000+

Percent of Canadian ICT R&D in Ottawa Region:

90%

University-Cluster Alignment

Cluster-Related Faculty:

157

Cluster-Related Canada Research Chairs:

15

Cluster-Related Canada Excellence Research Chairs:

1

Key Educational Programs

- Computer Engineering
- Computer Sciences
- Software Engineering
- Biomedical Engineering
- Physics-Photonics
- Engineering Management
- MBA – E-commerce
- JD Law and Technology
- Public Management and Governance
- Globalization and International Development

Key Research Priorities

- Quantum Non-linear Optics
- Fibre Optics
- Attosecond Physics
- Photonic Nanostructures and Devices
- Wireless Networks and Devices
- Mobile Computing Networking
- Biomedical Devices
- Privacy and Cybersecurity
- Algorithms and Data Analytics
- Technology, Law and Society

Key Facilities & Initiatives

- Max Plank-uOttawa Centre for Extreme and Quantum Photonics
- Centre for Research in Photonics
- School of Electrical Engineering and Computer Science
- Centre for Business Analytics and Performance
- Centre for Law, Technology and Society
- Richard L'Abbé Maker Space
- Start-up Garage and Entrepreneurship Hub

KINGSTON'S CLEAN TECH, ENERGY AND SUSTAINABLE COMMUNITIES CLUSTER

The Kingston region's Clean Tech, Energy and Sustainable Communities cluster consists of leading companies and start-ups that drive innovations in clean energy, clean water and water conservation, and sustainable technologies. Queen's, St. Lawrence College and the Royal Military College mobilize talent to offer expertise to support the cluster. Not-for-profit entities, including SWITCH, bring together community-minded organizations dedicated to making the region a leading centre for sustainable energy. The cluster offers industry leaders, including DuPont and Bombardier, an opportunity to transform research breakthroughs into products and services that address quality of life, sustainability and energy requirements for the future.

By the Numbers

Cluster Employment:

1,600

Number of Businesses in the Cluster:

75

University-Cluster Alignment

Cluster-Related Canada Research Chairs:

12

Cluster-Related Canada Excellence Research Chairs:

1

Cluster-Related Industrial Research Chairs:

1

Cluster-Related Start-ups Supported Last Year:

25

How the University Engages with the Cluster

Environment and energy, as well as safe and secure communities, are key thematic areas for Queen's. Synergies that the University's establishment of Queen's Innovation Park have brought about led to the growth of entrepreneurs and SMEs in the cluster. As a partner in the Eastern Ontario Campus Accelerator and Incubator Program, along with Invest Ottawa and Wesley Clover, Queen's advances faculty and student discoveries by offering a suite of programs to accelerate the growth of high-potential technology-based start-ups. A unique partnership with Enviro Innovate Corporation is creating a clean tech accelerator, which is seeking start-ups and established enterprises looking to commercialize or acquire innovative technologies. Queen's is also at the forefront of establishing GreenCentre Canada, a Centre for Excellence in Commercialization and Research, and is attracting significant investment through CFI for state-of-the-art facilities including the Nano-Fabrication Laboratory and the Reactor Materials Testing Laboratory. Queen's is a world-leading university in foundational research in physics. This focus, in conjunction with strong links to SNOLAB and TRIUMF, provides expertise to advance nuclear technologies.

Key Educational Programs

- Nuclear Engineering (UNENE)
- Earth and Energy Resources Leadership
- Environmental Studies
- Physics
- Applied Sustainability
- Geo Engineering
- Civil Engineering
- Mechanical and Material Engineering
- Chemical Engineering

Key Research Priorities

- Geo-Engineering Centre at Queen's and RMC
- The Water Research Centre
- Canada's Waste Flow Research Network
- Queen's Centre for Energy and Power Electronics
- Nuclear Materials Research Group
- Fuel Cell Research Centre
- Green Chemistry and Engineering Groups
- Centre for Advanced Materials and Manufacturing
- Queen's Institute for Energy and Environmental Policy
- Particle Astrophysics

Key Facilities & Initiatives

- Queen's Reactor Materials Testing Lab
- Queen's Coastal Engineering Research Laboratory
- Queen's Biological Station
- Kingston Nano-Fab Laboratory
- Queen's Innovation Park
- Queen's Enviro Innovate Clean-tech Accelerator
- GreenCentre Canada
- Grafoid Global Technology Centre
- DuPont Kingston Technology Centre
- SWITCH Ontario

University of Saskatchewan

SASKATCHEWAN'S AG BIOSCIENCE CLUSTER

Leveraging University of Saskatchewan research strengths, Saskatoon is home to a vibrant bioscience cluster, whose world-class infrastructure, expertise and global networks distinguish Canada as a food security leader. The unique cluster includes more than 136 companies, institutions and grower organizations – including federal Agriculture and Agri-Food Canada and NRC labs and global life science companies at Innovation Place research park. Proximity to two of Canada's top science facilities – the Canadian Light Source and VIDO-InterVac – is a competitive advantage. The cluster fosters sustainable food (plant and animal) and biofuel innovation, placing Saskatchewan among the world's top exporters of lentils, flax, canola, durum, and barley.

By the Numbers

Economic Size of the Cluster:

$3.9B

R&D Personnel in the Cluster:

1,600

University-Cluster Alignment

Cluster-Related Research Chairs:

8

Cluster-Related Enrolment:

1,733

Faculty in Cluster-Related Fields:

160

Cluster-Related CFREF Funding:

$37.2M

How the University Engages with the Cluster

Building on its prominence in agriculture research, training, and innovation, the UofS is uniquely positioned to enable Saskatchewan to become a global leader in ag bioscience by 2020. "Agriculture: Food and Bioproducts for a Sustainable Future" is a UofS signature area, anchored by the College of Agriculture and Bioresources and spanning six other relevant colleges, three graduate schools, and numerous research centres. They include the Global Institute for Food Security, Global Institute for Water Security, and the Johnson-Shoyama Graduate School of Public Policy. The Crop Development Centre has developed 400 commercialized crop varieties. The new Plant Phenotyping and Imaging Research Centre, funded with a Canada First Research Excellence Fund grant, builds on national and international partnerships. It will train more than 100 graduate students and post-doctoral fellows. With a "field to fork approach", researchers work with communities, producers and companies, while the UofS Industry Liaison Office and bioscience industry association Ag-West Bio work with innovators and investors to bring research to market. Total ag bioscience R&D investment (private and public sectors and producer groups) exceeds $241M.

Key Educational Programs

- Plant and animal production
- Soil science and agronomy
- Food, feed and bioproducts
- Environment and ecology
- Business and applied economics
- Veterinary medicine
- Biological engineering
- Water security
- Nutrition
- Public policy

Key Research Priorities

- Plant phenotyping and imaging
- Computational informatics
- Soil-root interaction and sustainability
- Human/plant/animal nutrition
- Socioeconomic policy, impact
- Cereal and pulse crop development
- Bioproducts and biofuels
- Food security and safety
- Biotechnology and social license
- Animal health and performance

Key Facilities & Initiatives

- Crop Development Centre
- Global Institute for Food Security
- Federal AAFC, NRC, CFIA, Ag-West Bio
- Livestock research facilities
- Canadian Feed Research Centre
- Phytotron, 2,000 hectares crop land
- CLS
- SK Structural Sciences Centre
- Global Institute for Water Security
- Canadian Centre Health and Safety in Agriculture

UNIVERSITY OF TORONTO

TORONTO'S REGENERATIVE MEDICINE CLUSTER

Regenerative Medicine (RM) holds the promise to treat, manage and perhaps cure some of our most devastating and costly diseases. Toronto is a world-leading RM hub for fundamental research, clinical application, and the development of stem cell advanced manufacturing technologies. The University of Toronto (U of T), partner hospitals and institutes are home to Canada's largest, most productive cluster of RM scientists, clinicians and biomedical engineers. U of T and partner hospitals, located within Toronto's Discovery District, are potential locations for large-scale clinical trials and innovation. The current global market for RM is US$19.3B, forecast to reach US$67.6B by 2020.

University-Cluster Alignment

Businesses in the Industry Consortium:

48

Percentage of National RM Grants Awarded to UofT & Partner Hospitals:

40%

RM Research Funding Attracted by UofT & Partner Hospitals Over 5 Years:

$910M

Research Chairs in RM Fields:

22

Cluster-Related Faculty:

304

Cluster-Related Graduate Students:

1,520

How the University Engages with the Cluster

U of T leads in research funding and scholarly output within the highly competitive and rapidly advancing field of RM. Our engagement in the cluster is rooted in Till and McCulloch's discovery of blood stem cells in 1961. As a result of a $114-million award from the Canada First Research Excellence Fund, U of T established Medicine by Design to create and manufacture cells, tissues and organs. Our integrated system of specialized facilities dedicated to basic and applied research, clinical translation, advanced manufacturing, and commercialization will help us reach this goal. The Centre for Commercialization of RM is a hub uniting leading experts and key corporations in therapeutic innovations, pharmaceuticals, devices, reagents, tools, biomaterials and cell therapies. The Centre for Advanced Therapeutic Cell Technologies, along with GE HealthCare as an anchor multinational, will accelerate the development and adoption of cell manufacturing technologies. The manufacturing centres support robust job creation, through growth of companies and the diffusion of foreign companies to the cluster.

Key Programs

- Regenerative Medicine
- Bioethics
- Biomaterials and Biomedical Engineering
- Biotechnology
- Clinical Engineering
- High Performance Computing
- Knowledge Translation
- Management of Innovation
- Advanced Manufacturing and Health Technologies

Key Facilities & Initiatives

- Institute for Clinical Evaluative Sciences
- JLabs
- MaRS Innovation
- Ontario-China Stem Cell Research and Commercialization Partnership
- Technion-UHN International Centre for Cardiovascular Innovation
- Karolinska Institute
- UK Regenerative Medicine Platform
- McEwen Centre for Regenerative Medicine
- Ted Rogers Centre for Heart Research

Key Facilities & Initiatives (cont.)

- Centre for Advanced Therapeutic Cell Technologies
- Centre for Commercialization of Antibodies and Biologics
- Ontario Institute for Regenerative Medicine
- Canadian Institute for Advanced Research

UNIVERSITY OF WATERLOO

WATERLOO REGION ICT CLUSTER

Waterloo Region, population 559,000, is 100 km west of Toronto. ICT is a sector of strength for the region, featuring a world-renowned high-tech cluster that is home to more than 1000 technology companies. The survival rate of first-year ICT start-ups here is almost double the global industry average. We have four times the number of patents granted per capita, compared to the Canadian average. The region contains the headquarters of some of Canada's largest software, insurance, and financial companies, including Kik, Google's largest R&D office outside the United States, Shopify Plus, D2L, OpenText, BlackBerry, and Manulife.

By the Numbers

Cluster Revenue:

$22B

Cluster Employment:

30,000

University-Cluster Alignment

Cluster-Related Canada Excellence Research Chairs:

1

Cluster-Related Canada Research Chairs:

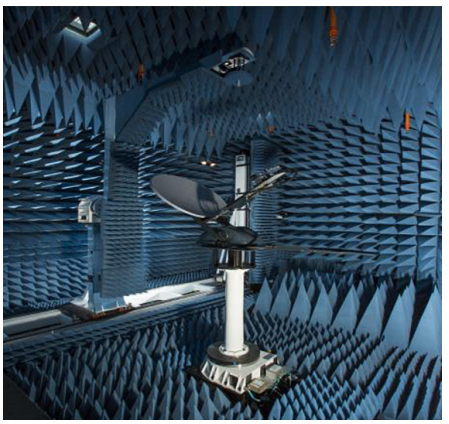
13

Cluster-Related Graduate Students:

998

Cluster-Related Start-ups:

65



How the University Engages with the Cluster

The University of Waterloo plays an active and leading role in the ICT cluster in Waterloo Region and in the broader Toronto-Waterloo Innovation Corridor. Waterloo holds more than 18 Chairs across the Faculties of Engineering, Mathematics and Science, including four industrial research chairs that work collaboratively with corporations such as CISCO. Our centres and institutes – including the Institute for Quantum Computing, the Institute for Computer Research, and the Centre for Applied Cryptographic Research – conduct world-leading research and collaborate with ICT companies. Waterloo operates the largest post-secondary co-operative education program in the world. Last year, more than 5000 global employers hired 17,000 co-op students, who earned $200M in salary. Velocity, the university's entrepreneurship program, is the largest free start-up incubator in North America, with 80+ companies in active incubation. Velocity companies have raised more than $300M and created more than 800 jobs. The Accelerator Centre, located on the university's north campus in the David Johnston Research + Technology Park, facilitates the commercialization of university research and supports high-potential start-ups.

Key Educational Programs

- Computer Engineering
- Computer Science
- Computational Mathematics
- Electrical Engineering
- Master of Business, Entrepreneurship and Technology
- Math Information Technology Mgmt.
- Nano-electronics
- Software Engineering
- Systems Design Engineering
- Quantum Information Science

Key Research Priorities

- Cloud / Networking Technology
- Cryptography, Security, Privacy
- Data Science / Big Data
- Embedded Systems
- Information Systems
- Nano-electronics
- Quantum Computing
- Sensors and Devices
- Software Engineering
- Wireless Communications / IoT / 5G
- Materials Science

Key Facilities & Initiatives

- Applied Cryptographic Research Centre
- Centre for Integrated RF Engineering
- Centre for Intelligent Antenna and Radio Systems
- Centre for Pattern Analysis and Machine Intelligence
- Emerging Radio Systems Group
- Giga-to-Nano Electronics Lab
- Institute for Computer Research
- Institute for Quantum Computing
- Real-time Embedded Software Group
- Waterloo Institute for Nanotechnology

Western
UNIVERSITY · CANADA

LONDON'S LIFE SCIENCES CLUSTER

Since the opening of its first hospital in 1875, London, ON has established itself as one of Canada's largest, most accomplished centres in health care delivery, leading-edge research and education. Collectively, London's life sciences sector employs over 24,000 clinicians and health care workers across seven hospital campuses, nearly 150 commercial enterprises and 12 premier research centres, including two globally renowned research institutions – Robarts and Lawson. London is also home to Western's Schulich School of Medicine & Dentistry, a Top 10, nationally ranked institution engaging nearly 2,400 faculty, 20 Canada Research Chairs and hundreds of world-class research teams and principal investigators.

By the Numbers

Economic Value of Cluster:

$2.9B

Cluster Employment:

24,000

University-Cluster Alignment

Medical Students:

683

Post-Graduate Medical Trainees:

984

Cluster-Related Canada Research Chairs:

20

Cluster-Related Faculty and Clinicians:

2,400

How the University Engages with the Cluster

Recently, in an effort to materially advance research, innovation and industry in London's Life Sciences sector, Western University partnered with health care leaders from London's hospital network and the private sector. The partnership embarked on the development of a new, multi-disciplinary, team-based enterprise to aggressively translate medical research into market-ready health care solutions that generate employment, investment, prosperity and civic pride. This new city-wide enterprise, called the London Medical Network, is expected to blend the expertise of top clinicians and scientists with industry leaders and new entrepreneurs. The Network will focus on resolving some the world's more challenging health care problems in select sectors, and then commercializing these advances for economic and social gain. Commensurate with the Network's launch, Western announced the establishment of its first two clusters of research excellence, Cognitive Neuroscience and Musculoskeletal Health. Western also announced it was setting aside funding to support the establishment of Research Chairs within these clusters and to accelerate the development of experiential learning opportunities for students seeking cross-discipline development opportunities in research and business.

Key Educational Programs

- Medicine
- Dentistry
- Medical Imaging
- Biochemistry
- BioMedical Engineering
- Neuroscience
- Health Sciences
- Health and Bioinformatics
- Medical Biophysics
- Physical Medicine and Rehab
- Immunology

Key Research Priorities

- Neuroscience and Brain Health
- Musculoskeletal Health
- Bio Medical Imaging and Diagnostics
- Cardiovascular, Respiratory Health
- Cancer
- Infection and Immunity
- Family Health
- Innovative Surgery and Simulation
- Population Health and the Environment
- Genomics, Proteomics, Bio-Informatics
- Aging and Geriatrics Health

Key Facilities & Initiatives

- Robarts Research Institute
- Lawson Health Research Institute
- Children's Health Research Institute
- Brain and Mind Institute
- BioMedical Imaging Research Centre
- Canadian Surgical Technologies and Adv. Robotics
- Stiller Biotech Commercialization Centre
- Centre for Studies in Family Medicine
- Centre for Human Immunology
- MSK Medical Innovation Centre
- Additive Design for Surgical Solutions Centre

U15 | Mobilizing University Research

"As an organization representing 15 of Canada's leading research universities, The U15 believes that Canada's future economic prosperity and social progress relies on the fusion of great ideas and talented people. The role of research universities is to create those ideas, teach those people and be a catalyst for the two coming together."

-- Feridun Hamdullahpur, U15 Chair

Knowledge mobilization is the process of turning research into commercial and societal benefits. A comprehensive research and innovation ecosystem requires diverse pathways to mobilize research and discoveries into the public, private and not-for-profit sectors. While knowledge mobilization occurs in many different ways, three of the most important mobilization paths for Canadian businesses are employing graduates, forming research partnerships, and transferring technology through start-ups and licenses.

Graduates

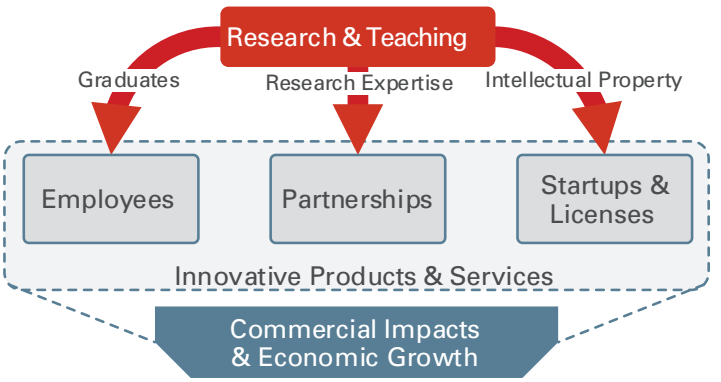
For Canadian businesses to grow and compete globally they need access to talented, adaptable, and creative graduates who apply knowledge in innovative ways. By learning from, and conducting research with world-leading experts, university graduates acquire the cutting-edge knowledge that fuels innovative businesses and enables these firms to capitalize on disruptive discoveries.

Partnerships

Canadian businesses have built strategic partnerships with our research universities. These partnerships bring research universities' world-leading talent, knowledge and facilities to bear on immediate and long-term business challenges. Relative to GDP, Canadian businesses use this mobilization pathway more than firms in most other OECD countries.

Commercialization

Research universities are wellsprings of impactful discoveries. In some cases, such as many public health discoveries, Canadians benefit from simply learning about the research results. In other cases, discoveries are patented, and research universities work to transfer the patented technology to the private sector through licence agreements or new spin-off companies.



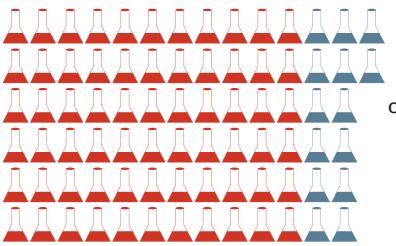
U15 Educates **584K** Students Annually

- **77,454** Bachelor's Graduates
- **25,806** Master's Graduates
- **5,096** Doctoral Graduates

Research Funding from Businesses

U15 Institutions Received: **$664M** in Reseach Funding from Businesses

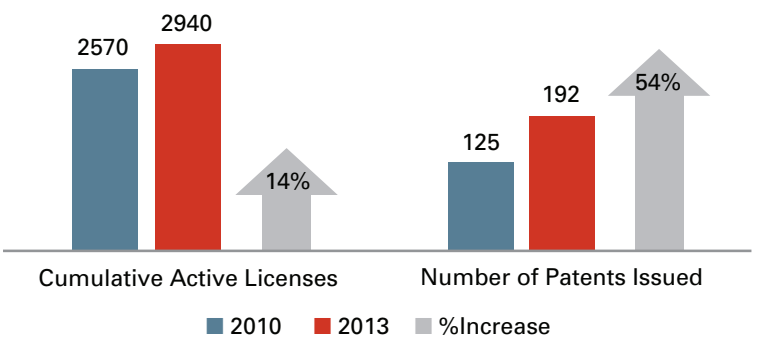
= $10M in Funding to U15



U15 Institutions Account for: **83%** of Reseach Funding from Businesses

= $10M in Funding to Non-U15

Tech Transfer Activities: U15 2015 vs. 2013 Comparison



GLOSSARY

AAFC	Agriculture and Agri-Food Canada
AG	Agriculture
CANMET	Canada Centre for Mineral and Energy Technology
CERC	Canada Excellence Research Chairs
CFI	Canada Foundation for Innovation
CFIA	Canadian Food Inspection Agency
CHUM	Centre hospitalier de l'Université de Montréal
CIC	Composites Innovation Centre
CLS	Canadian Light Source
COP-21	Conference of Parties to the United Nations Framework Convention on Climate Change
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HOSST	Helmholtz Research School for Ocean System Science and Technology
HQP	Highly Qualified Personnel
ICT	Information and Communication Technologies
LSHT	Life Science and Health Technologies
MSK	Musculoskeletal
NCE	Networks of Centres of Excellence
NRC	National Research Council of Canada
NSERC	Natural Sciences and Engineering Research Council
RF	Radio Frequency
RM	Regenerative Medicine
SMEs	Small and Medium-Sized Enterprises
SNOLAB	Sudbury Neutrino Observatory Lab
TECH	Technology
TOSST	Transatlantic Ocean System Science and Technology
TRIUMF	Canada's National Laboratory for Particle and Nuclear Physics and Accelerator-based Science
UHN	University Health Network
WED	Western Economic Diversification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