







## Canada Doubles Down on Key Strengths to Boost Innovation



#### By Debbie Lawes

anada is getting serious about innovation. After more than a decade of expert reports lamenting our country's low productivity growth and poor track record in translating excellent research into business innovation, the federal government has promised to deliver a "bold, coordinated strategy on innovation" that calls on all sectors of society to take action.

"We don't need another report on what our challenges are. We need fresh ideas and a joint action plan that will make innovation a national priority," Innovation minister Navdeep Bains said in June. The government is currently reviewing more than 1,300 responses to an online consultation that will inform a new innovation agenda, with emphasis on: internships, apprenticeships and continuous learning; collaborative research; and growing small- and medium-sized enterprises (SMEs).

Fortunately, Canada is starting from a strong base. We produce many of the world's best educated students and our academic research is internationally renowned. Canadians have found creative ways to turn

their challenges - vast geography, small population and strained public budgets - into a competitive advantage through partnerships that are breaking barriers between scientific silos and building bridges across industry, academia and government.

This approach has been adopted by the Consortium for Aerospace Research and Innovation in Canada. CARIC links large aerospace companies with SMEs and academic experts from across Canada, and increasingly with Europe and the United

"It's a model that mandates collaboration between at least two academic partners and two industrial partners on a single project," says Marc St-Hilaire, VP Technology and Innovation at Ottawa-based CAE Inc, known worldwide for its training and flight simulators.

CAE is one of Canada's largest research spenders, investing \$1.3 billion in R&D over the past decade. It has since leveraged its experience in modelling, simulation and training to expand into new markets such as mining and healthcare, the latter generating more than \$100 million in sales annually.

St-Hilaire attributes the company's success to its culture of innovation, highly skilled university graduates, and collaborations with suppliers.

"We don't innovate alone, we innovate with our suppliers," says St-Hilaire. "Every year we buy \$380 million of equipment from our Canadian suppliers ... we bring them to the table with their ideas and their innovations and they suggest to us designs for new equipment to be more competitive."

Collaborations are now critical to doing research faster and bringing smaller firms into global supply chains.

"It's very difficult for a small company in this sector to do research in isolation," says Dr. Fassi Kafyeke, Senior Director of Strategic Technology and Advanced Product Development at Bombardier Aerospace. "And it's difficult for a SME to get to the market unless they collaborate with people like us or other OEMs (original equipment manufacturers) or Tier 1 companies that will eventually be their customers."

#### **LINKING SMALL AND** LARGE FIRMS

In one project, Bombardier Aerospace partnered with Quebec SME Texonic, CTT Group - a technology transfer centre associated with the Cégep de Saint-Hyacinthe and others, to develop preforms (preliminary moulds) for manufacturing lighter composite materials for airplanes using high-tech platforms such as 3-D weaving looms.

CTT Group was founded in 1987 in partnership with industry to support Quebec's textile sector. Faced with growing international competition, CTT Group has played a key role in the industry's transition to advanced fibres, smart textiles and geosynethetics.

"Advanced textiles are an important material for the future," says Dr. Olivier Vermeersch, VP of R&D at CTT Group. "Using natural fibers blended into polymers, you can develop a fabric with a lot of capacities to protect people (e.g. first responders and military personnel), measure vital signs and reinforce composite parts for airplanes, automobiles and building construction."

Today, about 80 technicians, engineers and scientists, including 40 students, support CTT Groups' more than 100 member companies. "Not only does it help the companies we work with, it is also valuable professional experience for students," says Vermeersch.

Campuses across Canada are embracing experiential learning as a way to inspire innovation and make graduates more job-ready. Lambton College's Dr. Mehdi Sheikhzadeh says they do research to provide students with real-world training, to keep faculty

up-to-date, and to help companies develop, test and implement solutions that grow sales, minimize costs, create jobs and increase competitiveness and productivity.

'You have students working side by side with people from industry on real-life problems. They are also using equipment, software, infrastructure and methodologies that are not always covered in the classroom," says Sheikhzadeh, Dean, Applied Research and Innovation at the Sarnia, Ontario-based

Its first zone, the DMZ, is now one of Canada's largest business incubators. The 260 start-ups it has helped have since raised \$206 million in seed funding and created more than 2,400 jobs.

These zones see faculty, students, and industry partners collaborate on industry problems, while enabling students to learn by working with industry clients or by creating their own companies.

"We focus on career-ready graduates," says Dr. Usha George, Interim VP, Research

Collaborations are now critical to doing research faster and bringing smaller firms into global supply chains

Every college or university has its own academic and research strengths. Lambton's expertise in green energy helped it win a \$2.3-million grant from the Natural Sciences and Engineering Research Council in September to establish the Lambton Energy Research Centre, which complements the college's experience in bioindustrial and water processes and technologies.

"The centre will operate as a hub for research and development of green energy technologies in this region while supporting the growth of Sarnia-Lambton Sustainable Energy Cluster," says Sheikhzadeh.

#### **EXPORTING PROVEN MODELS**

Canada's more successful innovation models are being adopted in other countries. Most notable among these is Ryerson University's network of 10 "Innovation Zones", which specialize in everything from urban energy and fashion to design and social innovation.

and Innovation at Ryerson. "To catch up with the demands of a knowledge economy we need people who are creative, can innovative and think of different solutions to existing

Ryerson's zone model has been adopted by South Africa's University of the Witwatersrand and in India by the Bombay Stock Exchange, Barclays and Amrita University. Ryerson also recently launched Zone Startups Calgary with GE Canada to focus on industrial Internet and energystart-ups, as well as the Sport Innovation Hub in Toronto to connect sport entrepreneurs with experts from the Canadian sports

"We pride ourselves on being community engaged and a city builder," says George. "Creating knowledge that is useful to the end user drives a lot of our thinking."

Continued on page 10

#### The Future of 5G Communications Starts Here in Canada



Canada and the World are on the doorstep of a revolutionary new technology. 5G communications will revolutionize the way we do business, and the way we live our lives.

For every prediction about a future that includes automated vehicles, ground-breaking medical advances, and miniature devices powering the internet of things, the enabling technology is 5G.

Huawei is proud to be leading the way in bringing this new innovation to life. Our leadership in 5G is one of the reasons we've been recognized as one of the world's most innovative companies\*.

We are also proud that our global 5G research team is based here in Canada. With labs in Ottawa, Waterloo and Toronto, our growing team of over 400 researchers is working in partnership with Canadian carriers and universities to ensure that when 5G is ready, Canada will be ready.

\*Fast Company Magazine 2016 List of World's Most innovative Companies

2015 Nobel Prize in Physics, Dr. Arthur B. McDonald

Third Rembrandt portrait added to collection, Agnes Etherington Art Centre



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LAKEHEAD IS PROUD TO BE RANKED RE\$EARCH INFOSOURCE'S 2016 RESEARCH UNIVERSITY OF THE YEAR FOR THE SECOND CONSECUTIVE YEAR (UNDERGRADUATE CATEGORY)

## **WE'RE CREATING** LEADERS.

#### MEET PHD STUDENT SASHA BUBON

MEDICAL IMAGING INNOVATOR AND ENTREPRENEUR

As a kid growing up in Kiev, Ukraine, I was constantly taking apart my toys and trying to put them back together. So it's no surprise that by the time I started university, I knew that I didn't want to do science just for

That's why I decided to do my graduate studies at Lakehead University where I could work with Professor Alla Reznik's medical imaging group. It was an opportunity to engage in hands-on science that benefits people.

Along with Professor Reznik, I took on the Canadian Breast Cancer Foundation's challenge to create better cancer detection devices.

For the last year, we've been developing a Positron Emission Tomography (PET) scanner that can distinguish between benign and malignant breast lumps. Unlike traditional mammography, this new scanner has zero false positives.

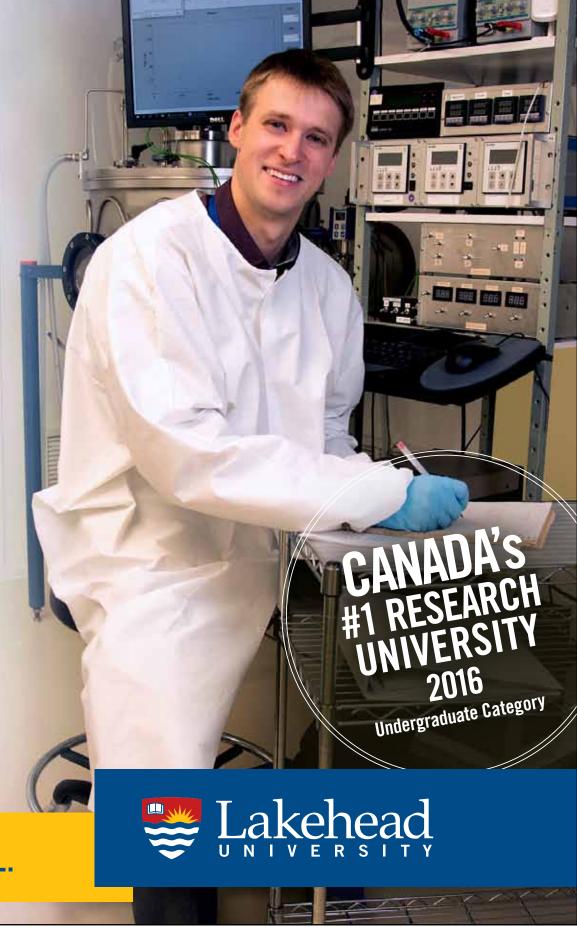
The PET scanner is also portable which means that when it goes on the market, it can be transported on vans and airplanes to under-diagnosed populations throughout North America.

For me, Lakehead University means harnessing research to make life better everywhere, from the smallest northern community to the largest urban centre.

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Dr. Geoffrey W. Payne Interim Vice President Research & Graduate Programs University of Northern British Columbia

### University of Northern BC is Developing Local Solutions that are Globally Relevant

niversity of Northern BC (UNBC) just celebrated its 25th anniversary and is one of four major researchintensive Universities in British Columbia. This past year marked the 2nd time that UNBC was ranked the #1 small University in Canada by Maclean's Magazine. One important aspect of this achievement has been the research activity of our faculty and the

undergraduate and graduate students engaged in research.

Our major research institutes and centres support the UNBC research mission whose focus includes the areas of natural resources, health, community development and climate solutions. UNBC has also six Canada Research Chairs and eight Endowed research chairs who are drivers of innovative research programs.

The UNBC mission is to grow

capacity and opportunities for research and creative activities by engaging our people and partners, leading to the discovery of new knowledge. By building a flourishing research culture, UNBC scholars have undertaken transformative research that is recognized at the national and international level.

· Research on sustainable develop-

ment within the world is achieved

using innovative modeling that

'wild' and should be protected, as well as to identify places suitable for restoration of their natural functions and ecosystem services. • Potential anti-cancer fighting bio-

identifies places that are still largely

logics from traditional plant sources. • As Canada's Green University<sup>TM</sup>, UNBC is committed to being a leader in renewable energy thought and practice. UNBC research explores

solutions for renewable energy

production, reduction of greenhouse gas emissions and energy security for Canada's off-grid communities.

UNBC is engaged in not only finding solutions for the global arena, but also mentoring the next generation of researchers whose diverse lens and critical thinking will take the research skills acquired at UNBC and become the next leaders for transforming research into innovative action.

















































## Canada's ГОР 50 RESEARCH **UNIVERSITIES** 2016

Ra	nk		Sponsor	ed Research I	ncome	Faculty**	Research Intensity	
2015	2014	University	FY2015 \$000	FY2014 \$000	% Change 2014- 2015	2014- 2015 #	\$ per Faculty \$000	Province
1	1	University of Toronto* ++	\$998,519	\$1,041,374	-4.1	2,607	\$383.0	Ontario
2	3	University of British Columbia*	\$541,553	\$547,027	-1.0	2,360	\$229.5	British Columbia
3	2	Université de Montréal* (a)	\$530,858	\$548,849	-3.3	1,879	\$282.5	Quebec
4	4	McGill University*	\$473,107	\$477,843	-1.0	1,708	\$277.0	Quebec
5	5	University of Alberta*	\$470,690	\$462,891	1.7	2,031	\$231.8	Alberta
6	7	University of Calgary*	\$358,298	\$324,212	10.5	1,488	\$240.8	Alberta
7	6	Université Laval*	\$331,792	\$324,803	2.2	1,537	\$215.9	Quebec
8	8	McMaster University*	\$324,624	\$310,608	4.5	906	\$358.3	Ontario
9	9	University of Ottawa*	\$294,215	\$275,266	6.9	1,250	\$235.4	Ontario
10	10	Western University*	\$229,821	\$273,200	-3.4	1,363	\$168.6	Ontario
11	14	Queen's University*	\$187,338	\$148,486	26.2	773	\$242.4	Ontario
12	12	University of Waterloo	\$180,929	\$177,425	2.0	1,115	\$162.3	Ontario
13	11	University of Saskatchewan*	\$168,947	\$177,423	-13.5	1,065	\$158.6	Saskatchewan
14	13	University of Manitoba*	\$162,948	\$154,280	5.6	1,205	\$135.2	Manitoba
15	15	University of Guelph	\$102,548	\$134,280	-2.1	741	\$133.2	Ontario
16	16	Dalhousie University*	\$143,361	\$146,637	10.8	1,127	\$195.6	Nova Scotia
	17	Université de Sherbrooke*		·	4.0	·	\$123.9	
17			\$126,828 \$117,404	\$121,938		1,140		Quebec British Columbia
18	18	Simon Fraser University	\$117,404	\$103,130	13.8	876	\$134.0	
19	20	Memorial University of Newfoundland*	\$104,395	\$87,782	18.9	963	\$108.4	Newfoundland
20	19	University of Victoria	\$102,845	\$95,428	7.8	686	\$149.9	British Columbia
21	21	York University	\$70,358	\$78,719	-10.6	1,325	\$53.1	Ontario
22	22	Université du Québec à Montréal	\$66,775	\$70,384	-5.1	1,153	\$57.9	Quebec
23	24	Carleton University	\$55,335	\$59,144	-6.4	759	\$72.9	Ontario
24	23	Institut national de la recherche scientifique+	\$53,352	\$61,903	-13.8	149	\$358.1	Quebec
25	25	Concordia University	\$45,817	\$45,670	0.3	778	\$58.9	Quebec
26	27	Ryerson University (b)	\$44,815	\$40,782	9.9	760	\$59.0	Ontario
27	26	University of New Brunswick	\$41,039	\$42,505	-3.4	450	\$91.2	New Brunswick
28	28	University of Windsor	\$29,695	\$30,486	-2.6	475	\$62.5	Ontario
29	30	École de technologie supérieure+	\$27,871	\$26,614	4.7	161	\$173.1	Quebec
30	29	Université du Québec à Chicoutimi	\$24,597	\$27,436	-10.3	235	\$104.7	Quebec
31	32	Lakehead University*	\$22,047	\$22,717	-2.9	317	\$69.5	Ontario
32	31	Université du Québec à Trois-Rivières	\$21,086	\$22,942	-8.1	441	\$47.8	Quebec
33	36	Laurentian University*	\$19,811	\$17,139	15.6	391	\$50.7	Ontario
34	35	University of Lethbridge	\$18,323	\$18,227	0.5	335	\$54.7	Alberta
35	33	Université du Québec à Rimouski	\$17,222	\$18,742	-8.1	205	\$84.0	Quebec
36	40	Université du Québec en Abitibi-Témiscamingue	\$16,167	\$14,343	12.7	113	\$143.1	Quebec
37	34	University of Regina	\$15,636	\$18,472	-15.4	406	\$38.5	Saskatchewan
38	39	Trent University	\$14,857	\$14,575	1.9	264	\$56.3	Ontario
39	37	Brock University	\$13,516	\$16,391	-17.5	566	\$23.9	Ontario
40	38	Royal Military College of Canada+++	\$11,913	\$16,021	-25.6	181	\$65.8	Ontario
41	41	University of Prince Edward Island	\$11,667	\$13,236	-11.9	222	\$52.6	Prince Edward Island
42	42	Wilfrid Laurier University	\$11,547	\$12,737	-9.3	544	\$21.2	Ontario
43	43	University of Northern British Columbia	\$11,329	\$12,323	-8.1	185	\$61.2	British Columbia
44	44	Université de Moncton	\$10,079	\$10,763	-6.4	346	\$29.1	New Brunswick
45	45	University of Ontario Institute of Technology	\$9,677	\$9,820	-1.5	199	\$48.6	Ontario
46	46	Saint Mary's University	\$8,661	\$8,735	-0.8	243	\$35.6	Nova Scotia
47	49	University of Winnipeg	\$8,359	\$7,851	6.5	265	\$31.5	Manitoba
48	48	Université du Québec en Outaouais	\$7,485	\$8,067	-7.2	230	\$32.5	Quebec
49	47	St. Francis Xavier University	\$7,156	\$8,643	-17.2	229	\$31.2	Nova Scotia
50	50	Acadia University	\$6,022	\$7,017	-14.2	194	\$31.0	Nova Scotia
Notes:		arch income includes all funds to support research received in	ılı - ( (	*Has a medical sch		*Includes full, ass	Sociate and assista	nt faculty

- 1. Sponsored research income includes all funds to support research received in the form of
- a grant, contribution or contract from all sources external to the institution. 2. Financial data were obtained from Statistics Canada, except where noted.
- 3. Fiscal 2014 research income figures may have been adjusted as more accurate information
- 4. Faculty data were obtained from RE\$EARCH Infosource Canadian University R&D Database. 5. All data are provided for the main university/college including its affiliated institutions,
- where applicable. 6. All institutions are members of the Canadian Association of University Business Officers

Score\* 96.7 83.0 71.7

- <sup>+</sup>Not a full-service university ++Sponsored research income administered by affiliated hospitals was reported one fiscal year in arrears
  +++Sponsored research income figures were obtained directly from the university
- (a) Faculty count based on 2011-2012 data as 2014-2015 data were not available. (b) Starting from Fiscal 2015 Ryerson University was classified as a Comprehensive university.
- RE\$EARCH Infosource Inc. is Canada's source of R&D intelligence.

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#### Research Universities of the Year 2016

Three universities gain RE\$EARCH Infosource's designation of Research University of the Year in their category for their performance on a balanced set of input, output and impact measures for FY2015. These full-service universities demonstrated superior achievement both in earning research income and in publishing research in leading scientific journals.

Rank	Medical/Doctoral	Score*	Rank	Comprehensive
1	University of Toronto	100.0	1	University of Waterloo
2	McGill University	68.5	2	University of Guelph
3	University of British Columbia	64.8	3	Simon Fraser University

Rank	Undergraduate	Score*
_1	Lakehead University	86.9
2	Trent University	78.6
3	University of Lethbridge	78.2

\*The Score in each category is out of a possible 100 points based on the following indicators and weighting: 2 input measures: total sponsored research income (20%), and research intensity (20%); 2 output measures: total number of publications in leading journals (20%) and publication intensity (20%), and 1 impact measure: publication impact (20%). For each measure, the top ranking institution is assigned a score of 100 and the other institutions' scores are calculated as a percentage of the first ranked institution. To be eligible to be included in the Research Universities of the Year Tier Group rankings, full-service universities must first have ranked in the top 50% in their respective tier group for 4 out of 5 measures. See www.researchinfosource.com for details.

## CANADA'S TOP 50 Research Universities

#### **RESEARCH INCOME EDGES UP SLIGHTLY**

The combined research income of *Canada's Top 50 Research Universities* increased by only 0.6% to \$6.71 billion in Fiscal 2015 from \$6.67 billion in Fiscal 2014, compared with the -1.6% decline in Fiscal 2013. This continues the lacklustre research income growth of the past 5 years. Research intensity – research income per faculty member – increased by 1.0% to \$172,400 from \$170,700 the prior year due to a slight drop of -0.4% in faculty.

Another year of a continued decline in total Government funding (-2.9%) has impacted the recovery. In Fiscal 2015, Federal government funding was down -1.9%. Provincial government support retreated even more by -3.8%. Additionally, funding from Municipal governments posted another year of decreased funding (-7.7%); and Foreign funding also dropped significantly in Fiscal 2015 to -19.5%. from 7.5% in Fiscal 2014. Although funds provided by the Natural Sciences and Engineering Research Council reversed course from Fiscal 2014 and increased by 2.0% in Fiscal 2015, funding by the Canadian Institutes of Health Research fell by -0.5%, funding by the Social Sciences and Humanities Research Council declined by -2.7% and funding by Canada Foundation for Innovation was down -19.0%, following on a decline last year as well. On a more encouraging note, Non-Government funding posted a healthy gain of 7.9% in Fiscal 2015. Corporate research funding increased by 10.4%, from -2.3% in Fiscal 2014; Not-for-Profit support rose by 9.3% and funding from Individuals – although a small portion of total research income – reversed itself in Fiscal 2015 with an increase of 6.4%, up from -20.0% in Fiscal 2014.

#### THE \$100 MILLION CLUB

Twenty institutions – up from 18 last year – reported \$100 million or more of research income in Fiscal 2015, qualifying them for inclusion in RE\$EARCH Infosource's \$100 Million Club. Memorial University of Newfoundland and University of Victoria re-joined the Club in Fiscal 2015.

In Fiscal 2015, \$100 Million Club members posted a total of \$5.99 billion of research income, up from \$5.73 billion the prior year – an increase of 4.6%. With the movement of Memorial University of Newfoundland and University of Victoria back into the \$100 Million Club, the 30 non-Club universities saw their combined research income fall by -23.6% over the period. As a result, Club members increased their share of total university research income by 89% in Fiscal 2015 from 86% in Fiscal 2014.

#### PROVINCIAL PERFORMANCE

Eighteen universities in Ontario accounted for 40% of the Top 50 total research income in Fiscal 2015, the same as in Fiscal 2014. Quebec's 13 institutions were responsible for 26% of total research income, down from 27% the prior

year. Alberta's 3 institutions accounted for 13% of the total up from 12% the previous year. British Columbia's 4 institutions also increased their share of the total to 12% in Fiscal 2015 from 11% in Fiscal 2014.

In Fiscal 2015, combined research income in Atlantic Canada increased by 7.9%, reversing the combined -18.4% drop in research income posted in Fiscal 2014 – based on the strength of research income growth in particular in Newfoundland (18.9%) and Nova Scotia (7.4%). Strong combined universities provincial growth was also posted in Manitoba (5.7%) and Alberta (5.2%). Universities in British Columbia posted a combined modest increase of 2.0% in Fiscal 2015, while Ontario's research income increased only slightly by 0.2%. Provinces posting drops in Fiscal 2015 included Quebec (-1.5%), New Brunswick (-4.0%), Prince Edward Island (-11.9%) and Saskatchewan (-13.6%).

Top 50 – Leading Provinces				
Province	% of Total			
Ontario (18)	40			
Quebec (13)	26			
Alberta (3)	13			
British Columbia (4)	12			

#### **RESEARCH INCOME GROWTH**

Although total Top 50 research income expanded by only 0.6% in Fiscal 2015, a number of universities significantly out-performed the national average. Overall, 21 universities expanded their research income versus 29 where research income declined. This is only the second time in the past 5 years that the number of universities with declines exceeded the ones with positive growth.

Heading the list of leading research income growth universities was Queen's University, where year-over-year research income grew by 26.2% in Fiscal 2015. Memorial University of Newfoundland (18.9%), Laurentian University (15.6%), Simon Fraser University (13.8%) and Université du Québec en Abitibi-Témiscamingue (12.7%) rounded off the top 5 universities in research income growth.

#### **RESEARCH INTENSITY**

Overall research intensity – research income per faculty position – expanded by 1.0% in Fiscal 2015 to \$172,400 from \$170,700 the prior year. This was the result of a -0.4% decline in faculty numbers combined with a 0.6% increase in research income. University of Toronto (\$383,000 per faculty), McMaster University (\$358,300) and Institut national de la recherche scientifique (\$358,100) were the top 3 for this leader group.

#### **TIER GROUPS**

In Fiscal 2015, the combined 16 Medical/Doctoral universities attracted \$5.45 billion of research income, which was 81% of the Top 50 total and a 1.1% increase

over Fiscal 2014. Research income at 13 Comprehensive institutions totalled \$967.6 million, representing 14% of Top 50 research income total and a -0.3% decline from last year. The 21 Top 50 Undergraduate universities posted \$299.4 million of research income or 4% of the total and a -4.8% drop in combined research income.

#### **RESEARCH UNIVERSITIES OF THE YEAR**

RE\$EARCH Infosource is pleased to highlight the achievements of 3 Research Universities of the Year – the leading institutions that excelled on a balanced scorecard of research input and output/impact indicators. This year's winners are: University of Toronto in the Medical/Doctoral category, University of Waterloo in the Comprehensive category and Lakehead University in the Undergraduate category.

#### SPOTLIGHT - 15TH ANNIVERSARY OF CANADA'S TOP 50 RESEARCH UNIVERSITIES

In association with its 15th Anniversary, RE\$EARCH Infosource shined the spotlight on the performance of universities over a 15-year period in terms of attracting research income and producing peer-reviewed academic publications. Top place winners were:

Total 15 Years University Research Income FY2001-FY2015: University of Toronto (\$12.10 billion), University of Guelph (\$2.07 billion), Ryerson University (\$318.3 million)

University Research Income Growth FY2001-FY2015: Université de Sherbrooke (205.7%), Simon Fraser University (362.0%), École de technologie supérieure (439.5%)

Total 15 Years University Research Publications 2000-2014: University of Toronto (120,299), University of Waterloo (26,233), Ryerson University (5,219)

University Research Publications Growth 2000-2014: University of Ottawa (157.8%), Concordia University (157.6%), Ryerson University (764.2%)

#### THIS YEAR AND NEXT

Fiscal 2015 was not a stellar year for university research. Total Top 50 research income expanded by only 0.6%. What growth there was, was concentrated among the 16 Medical/Doctoral universities. The majority of Comprehensive and Undergraduate universities suffered declines in their research income. Given that Government sources accounted for the lion's share of research funding (65%), the -2.9% overall fall in Government funding was largely responsible for the negligible growth this year. In contrast combined Non-Government support (Corporate, Noncorporate, Endowments/investment, Other) rose by 7.9%, but was not sufficient to offset the Government decline. Corporate (10.4%) and Not-for-Profit support (9.3%) were bright spots in an otherwise disappointing year.

Last year we wrote "With Canada's economic prospects currently looking uncertain it is difficult to see any strong recovery in universities' research prospects next year". This year's prognosis is much the same. The federal government has initiated a comprehensive review of science policy, but the outcome of that review is not likely to be reflected in the Fiscal 2017/18 budget and much will depend on the state of federal (and provincial) finances in subsequent years. Provincial government funding prospects are also clouded. For the foreseeable future we are in a no-growth environment.

The \$1	00 Million Club	
2015 Rank	Res University	earch Income \$000
1	University of Toronto*	\$998,519
2	University of British Columbia*	\$541,553
3	Université de Montréal*	\$530,858
4	McGill University*	\$473,107
5	University of Alberta*	\$470,690
6	University of Calgary*	\$358,298
7	Université Laval*	\$331,792
8	McMaster University*	\$324,624
9	University of Ottawa*	\$294,215
10	Western University*	\$229,821
11	Queen's University*	\$187,338
12	University of Waterloo	\$180,929
13	University of Saskatchewan*	\$168,947
14	University of Manitoba*	\$162,948
15	University of Guelph	\$143,581
16	Dalhousie University*	\$141,927
17	Université de Sherbrooke*	\$126,828
18	Simon Fraser University	\$117,404
19	Memorial University of Newfoundland*	\$104,395
20	University of Victoria	\$102,845
*Has a med	dical school	

2015 F Research Intensity		Research Ir (\$ per f University	
1	1	University of Toronto*	\$383.0
2	8	McMaster University*	\$358.3
3	24	Institut national de la recherche scientifique <sup>+</sup>	\$358.1
4	3	Université de Montréal*++	\$282.5
5	4	McGill University*	\$277.0
6	11	Queen's University*	\$242.4
7	6	University of Calgary*	\$240.8
8	9	University of Ottawa*	\$235.4
9	5	University of Alberta*	\$231.8
10	2	University of British Columbia*	\$229.5

Top 10 Universities by Growth					
2015 Income Growth		University	% Change 2014-2015		
1	11	Queen's University*	26.2		
2	19	Memorial University of Newfoundland*	18.9		
3	33	Laurentian University*	15.6		
4	18	Simon Fraser University	13.8		
5	36	Université du Québec en Abitibi-Témiscamingue	12.7		
6	16	Dalhousie University*	10.8		
7	6	University of Calgary*	10.5		
8	26	Ryerson University	9.9		
9	20	University of Victoria	7.8		
10	9	University of Ottawa*	6.9		
*Has a med	ical school				



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How can we turn a downturn into an opportunity?

As a research-intensive university located in Canada's most enterprising city, the University of Calgary conducts research that moves our whole world forward.

Every day, our students, faculty and researchers tackle global challenges, ask big questions, make important discoveries and create new knowledge.

As we celebrate our 50th Anniversary this year, we're more committed than ever to translating our discoveries into meaningful change for Canadians and our friends around the world.

Explore new answers to everyday challenges with us.



#### A Healthier Canada

McMaster University professor John Valliant is driven to make his work count where it matters most: advancing Canada's social, health and economic well-being. As founder and CEO of the Centre for Probe Development and Commercialization, he and his team are discovering, developing and distributing a special class of drugs to better treat disease. He's built a globally unique research enterprise that's improving healthcare for cancer patients, creating high-tech jobs and companies, increasing investments in Canadian research, and serving as a fertile training ground for our next generation of leaders. John personifies research at McMaster and we salute him for his innovative and entrepreneurial spirit.

research.mcmaster.ca





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In a changing world, our research could change everything.

#### **PARTNER PERSPECTIVE**

## **People:** Our Greatest Natural Resource



Ian McWalter President & CEO CMC Microsystems

oponents of Canada's innovation economy talk a lot about the need for "highly qualified people." Who are these individuals, and why is this so important?

Landau Gage, a small, innovative Canadian company specializing in auto parts measurement tools, has a 93-per-cent answer.

That's how much inspection time it has saved an international manufacturer of transmission parts,

thanks to a non-contact measuring system developed by graduate students and their professor at University of Windsor.

Dr. Rashid Rashidzadeh, manager of the university's Research Centre for Integrated Microsystems, had done research in 3D integrated circuit testing and smart sensors, using expertise and solutions gained through work with CMC Microsystems. Using that knowledge, and in partnership with Landau Gage, the adjunct professor and his students designed and created a technology that uses lasers and algorithms to quickly scan and analyse the precision of transmission parts, where microscopic differences in dimensions can cause transmission failure.

When tested on a batch of parts on the factory floor, their system reduced the projected inspection time by 93 percent – from 34 hours to 90 minutes, or just under two minutes per part. The patented technology is now part of the company's product line, and is being used

by a global company with 20,000 employees.

Landau Gage was so pleased with the results that it hired one of the students, and created internships for two more.

That's just one example of highly qualified people. Over the past five years, at least 2,500 of these extraordinarily well trained individuals, using tools, prototyping services and expertise provided by CMC Microsystems, were hired by companies in Canada. They are the innovators of the future, helping to create the next wave of advanced technologies that are fundamental to Canada's scientific leadership, industrial know-how, and hightech competitiveness.

These people are our greatest natural resource, and they are essential if Canada is to become even more competitive, wealthier, healthier, greener, and safer. Now more than ever, Cana-da's innovation economy needs the human capability enabled by CMC.



Homes in Canada account for nearly a fifth of the nation's energy use, with the majority of that energy being used to heat space and water. Finding better ways to power our homes can significantly impact Canada's commitment to reducing climate

Carleton University, in partnership with the Canada Foundation for Innovation and Urbandale Construction, has built a full-scale home on its campus that acts as a living lab for researchers with

an interest in solar and geothermal energy. For the next few decades, it will also give students hands-on research

The discoveries made here are about our future. And the future is sustainable. research.carleton.ca







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## 15th ANNIVERSARY OF CANADA'S Top 50 Research Universities

In association with its 15th Anniversary, RE\$EARCH Infosource shines the spotlight on the performance of universities over a 15-year period in terms of attracting research income and producing peer-reviewed academic publications.

	15 Years Research ne FY2001-FY2015	
Rank	Medical/Doctoral	\$000
1	University of Toronto	\$12,097,997
2	Université de Montréal	\$7,003,739
3	University of British Columbia	\$6,653,784
	Tier Average (16)	\$4,323,515
Rank	Comprehensive	\$000
1	University of Guelph	\$2,073,809
2	University of Waterloo	\$1,981,868
3	University of Victoria	\$1,314,233
	Tier Average (12)	\$995,496
Rank	Undergraduate	\$000
1	Ryerson University	\$318,325
2	Royal Military College of Canada	\$264,162
3	Université du Québec à Trois-Rivière	es \$257,990
	Tier Average (16)	\$210,283

Rank	Medical/Doctoral	%
1	Université de Sherbrooke	205.7
2	Memorial University of Newfoundland	204.6
3	University of British Columbia	180.0
	Tier Average (16)	93.7
Rank	Comprehensive	%
1	Simon Fraser University	362.0
2	York University	152.6
3	University of Waterloo	148.2
	Tier Average (12)	101.5
Rank	Undergraduate	%
1	École de technologie supérieure+	439.5
2	Ryerson University	397.1
3	Lakehead University	279.9
	Tier Average (16)	156.1

Publications 2001-2014						
Rank	Medical/Doctoral	#				
1	University of Toronto	120,299				
2	University of British Columbia	69,153				
3	McGill University	61,112				
	Tier Average (16)	38,454				
Rank	Comprehensive	#				
1	University of Waterloo	26,233				
2	University of Guelph	18,351				
3	Simon Fraser University	15,789				
	Tier Average (12)	11,485				
Rank	Undergraduate	#				
1	Ryerson University	5,219				
2	Brock University	3,930				
3	Wilfrid Laurier University	3,375				
	Tier Average (14)	2,622				
Overall un	iversities average (42) = 18,805					

Research Publications Growth 2001-2014						
Rank	Medical/Doctoral	% Change				
1	University of Ottawa	157.8				
2	University of British Columbia	125.1				
3	University of Calgary	124.4				
	Tier Average (16)	105.8				
Rank	Comprehensive	% Change				
1	Concordia University	157.6				
2	University of Regina	154.8				
3	University of Waterloo	140.1				
	Tier Average (12)	120.0				
Rank	Undergraduate	% Change				
1	Ryerson University	764.2				
2	Brock University	243.8				
3	Lakehead University	214.9				
	Tier Average (14)	170.5				
Overall un	iversities average (42) = 110.7%					

	Rank			Sponsored Research Income				
Total 15 Years	2015	2001	University	Total FY2001- FY2015 \$000	FY2015 \$000	FY2001 \$000	% Change 2001-2015	
1	1 1	1	University of Toronto*	\$12,097,997	\$998,519	\$470,062	112.4	
2	3	2	Université de Montréal*	\$7,003,739	\$530,858	\$349,542	51.9	
3	2	5	University of British Columbia*	\$6,653,784	\$541,553	\$193,432	180.0	
4	4	3	McGill University*	\$6,421,987	\$473,107	\$280,267	68.8	
5	5	4	University of Alberta*	\$6,254,614	\$470,690	\$240,548	95.7	
6	8	7	McMaster University*	\$4,624,839	\$324,624	\$184,845	75.6	
7	7	6	Université Laval*	\$4,176,123	\$331,792	\$187,383	77.1	
8	6	8	University of Calgary*	\$3,918,664	\$358,298	\$172,101	108.2	
9	9	9	University of Ottawa*	\$3,592,808	\$294,215	\$150,848	95.0	
10	10	10	Western University*	\$3,129,345	\$229,821	\$131,836	74.3	
11	11	14	Queen's University*	\$2,553,046	\$187,338	\$101,365	84.8	
12	13	12	University of Saskatchewan*	\$2,264,832	\$168,947	\$101,572	66.3	
13	14	13	University of Manitoba*	\$2,180,581	\$162,948	\$101,570	60.4	
14	15	11	University of Guelph	\$2,073,809	\$143,581	\$106,338	35.0	
15	12	15	University of Waterloo	\$1,981,868	\$180,929	\$72,907	148.2	
16	16	16	Dalhousie University*	\$1,707,799	\$141,927	\$70,262	102.0	
17	17	19	Université de Sherbrooke*	\$1,506,059	\$126,828	\$41,481	205.7	
18	20	18	University of Victoria	\$1,314,233	\$102,845	\$41,573	147.4	
19	18	24	Simon Fraser University	\$1,136,777	\$117,404	\$25,414	362.0	
20	19	21	Memorial University of Newfoundland*	\$1,090,016	\$104,395	\$34,278	204.6	
21	23	17	Carleton University	\$969,100	\$55,335	\$46,214	19.7	
22	22	20	Université du Québec à Montréal	\$966,915	\$66,775	\$39,643	68.4	
23	21	23	York University	\$875,818	\$70,358	\$27,859	152.6	
24	24	22	Institut national de la recherche scientifique <sup>+</sup>	\$754,931	\$53,352	\$27,037	83.5	
25	27	25	University of New Brunswick	\$623,723	\$41,039	\$27,007	87.0	
26	25	26	Concordia University	\$555,006	\$45,817	\$20,675	121.6	
27	28	28	University of Windsor	\$335,000	\$43,617	\$20,073 \$13,279	121.6	
28	26	32	Ryerson University	\$318,325	\$29,093 \$44,815	\$13,279	397.1	
29	37	29	University of Regina	\$310,323	\$15,636	\$13,034	20.0	
30	40	27	, 3	1	\$13,030		-12.6	
31	32	31	Royal Military College of Canada Université du Québec à Trois-Rivières	\$264,162		\$13,637 \$10,560	99.7	
	l		·	\$257,990	\$21,086	\$10,560		
32	31	36	Lakehead University*	\$256,402	\$22,047	\$5,803 \$11,763	279.9	
33	33	30	Laurentian University*	\$254,328	\$19,811 \$27,871	\$11,762	68.4	
34	29	41	École de technologie supérieure <sup>+</sup>	\$247,490	\$27,871	\$5,166	439.5	
35	35	35	Université du Québec à Rimouski	\$222,705	\$17,222	\$6,154	179.9	
36	34	38	University of Lethbridge	\$218,407	\$18,323	\$5,281	247.0	
37	38	33	Trent University	\$195,328	\$14,857	\$6,990	112.5	
38	39	42	Brock University	\$191,096	\$13,516	\$5,018	169.4	
39	41	40	University of Prince Edward Island	\$187,407	\$11,667	\$5,167	125.8	
40	36	34	Université du Québec en Abitibi-Témiscamingue	\$180,295	\$16,167	\$6,287	157.1	
41	43	43	University of Northern British Columbia	\$175,257	\$11,329	\$4,514	151.0	
42	42	46	Wilfrid Laurier University	\$145,666	\$11,547	\$3,982	190.0	
43	49	37	St. Francis Xavier University	\$128,106	\$7,156	\$5,510	29.9	

Canada's Top Research Universities by Total 15 Years Research Publications 2000-2014

Rank		Research P	ublications
Total 15 Years	University	Total 2000-2014 #	% Change 2000-2014
1	University of Toronto*	120,299	111.8
2	University of British Columbia*	69,153	125.1
3	McGill University*	61,112	97.7
4	University of Alberta*	52,493	109.6
5	Université de Montréal*	48,221	105.0
6	McMaster University*	36,469	98.6
7	Western University*	35,160	105.8
8	University of Calgary*	35,086	124.4
9	University of Ottawa*	29,770	157.8
10	Université Laval*	26,667	64.5
11	University of Waterloo	26,233	140.1
12	Dalhousie University*	20,902	81.6
13	Queen's University*	20,834	73.7
14	University of Manitoba*	20,763	98.1
15	University of Saskatchewan*	18,987	85.6
16	University of Guelph	18,351	78.1
17	Simon Fraser University	15,789	136.4
18	University of Victoria	14,231	112.3
19	York University	12,888	106.2
20	Carleton University	10,747	123.4
21	Université de Sherbrooke*	10,361	101.0
22	Concordia University	9,384	157.6
23	Memorial University of Newfoundland*	8,990	96.9
24	Université du Québec à Montréal	8,077	134.1
25	University of New Brunswick	6,603	112.9
26	University of Windsor	5,908	97.9
27 28	Ryerson University	5,219	764.2 116.9
29	Institut national de la recherche scientifique <sup>+</sup>	5,178	154.8
30	University of Regina Brock University	4,436 3,930	243.8
31	Wilfrid Laurier University	3,375	243.8
32	University of Lethbridge	3,373	164.0
33	Trent University	3,079	112.0
34	Lakehead University*	2,834	214.9
35	Laurentian University*	2,637	107.2
36	Université du Québec à Trois-Rivières	2,187	81.4
37	University of Prince Edward Island	2,035	58.3
38	University of Northern British Columbia	1,868	89.0
39	Royal Military College of Canada	1,795	121.7
40	St. Francis Xavier University	1,636	59.8
41	Université du Québec à Rimouski	1,593	150.0
42	Université de Moncton	1,315	51.5
Total 15	years universities research publications (42): 789,794	· ·	

Total 15 years universities research income \$000 (44): \$84,486,708

Research Income: Based on universities that have been on the Top 50

1. Based on universities that have been on the lop 50 list for all 15 years FY2001-FY2015.
2. Sponsored research income includes all funds to support research received in the form of a grant, contribution or contract from all sources external to the institution.
3. Financial data were obtained from Statistics Canada.

Research Publications:

Research Publications:

1. Based on universities that have been on the Top 50 list for all 15 years FY2001FY2015; and had 50 or more publications in each of the 15 years 2000-2014.

2. Publications include artiels, notes and reviews published by researchers affiliated with Canadian

universities or research hospitals in peer-reviewed

scientific international journals, covering different fields of natural science, health science and social science and humanities. The number of journals varied from 8,296 in 2000 to 12,124 in 2014.

3. A publication may have authors from multiple institutions and it would then be counted once for each institution.

4. Publication data were obtained from Observatoire des sciences et des technologies' (OST) Canadian bibliometric database which contains data from the SCI-Expanded, SSCI and AHCI databases of Thomson Reuters

\*Has a medical school +Not a full-service university

## We stand out



Among universities with a medical school, our researchers have recorded the highest research income growth in Canada over the last 15 years. And there's a reason for that: We stand out for our successes in technology transfer, entrepreneurial initiatives and open innovation, all accomplished in collaboration with industry and our community.

UdeS has implemented the "Innovation, Partnership and Entrepreneurship Strategy". It facilitates the meeting of science and entrepreneurship and accelerates innovation, Medicine, law, science, engineering, business, and the humanities, all disciplines are involved.

UdeS brings research to a whole new level. In the next 10 years, we are aiming to triple our research partnerships, double the number of inventions in marketing phase and double the number of spin-offs supported through our Accélérateur de création d'entreprises technologiques (ACET).

Find out how to partner with us

USherbrooke.ca/WeStandOut



### York University Intensifies Research, Highlights ROI

**Q&A** with the Vice-President Research & Innovation, York University



**Dr. Robert Haché** Vice-President Research & Innovation York University

York University is engaged in a plan of research intensification. How is the University working to accomplish this?

Over the past decade, research at York has flourished with a high rate of growth in the intensity of publication of research and scholarship in Canada. This is the result of strong community engagement supporting

thoughtful long-term planning. Over the past 18 months, York has developed a collegial Plan for the Intensification & Enhancement of Research through extensive consultations with faculty, staff and students. The plan, now being implemented, contains 21 recommendations, clustered into five areas, to realize York's ambition as a leading research-intensive university: (1) Growing a culture of scholarly inquiry; (2) investing in and promoting people; (3) supporting research growth and development; (4) leadership in research and research advocacy; and (5) building research for the future.

What kind of examples – measures of the success of research intensification at York – stand out for you?

There are many success stories. A prime example is vision research. The Vision: Science to Applications

(VISTA) program was recently recognized by the government of Canada with the nation's most prestigious research grant: A \$33.3 million Canada First Research Excellence Fund (CFREF) grant. This will propel York to a position of international leadership to advance discovery and application of biological and computational vision technologies to improve human health and societal wellbeing and promote economic development.

With a total project envelop of \$120 million, VISTA will enhance the research efforts of over 25 existing core research teams and support the recruitment of 13 new faculty members

Partnerships with industry are increasingly important in today's research landscape. How does York research keep partnerships central in the mix?

York truly nurtures a collaborative, interdisciplinary environment. While developing their work, our researchers are outwardly looking with partnerships top of mind. Community partners, donors and industry are increasingly essential in today's research enterprise.

In developing these partnerships, our researchers are supported through Innovation York (IY), the innovation office. It provides a suite of services to facilitate and maximize the commercial, economic and social impacts of research and innovation, and to create a culture of engaged scholarship and experiential learning. If an idea or intellectual asset looks like a good commercialization opportunity, IY will provide support through its commercialization unit; its entrepreneurship program, LaunchYU; and/or one of its accelerator spaces.

IY had many successes in 2016: It created the LaunchYU Best Hub entrepreneurship centre, engaged with 1,300+ potential entrepreneurs, hosted 38 events and worked with over 100 companies. It also approved 500 Agreements valued at nearly \$30 million, and supported the launch of five start-up companies.

Federal and provincial granting systems, and external partners working in complement, are necessary to advance research in Canada. What kind of return on investment, or ROI, can you show to these key stakeholders?

The importance of the granting systems cannot be understated. Our external industrial and community-based partners and generous donors are also indispensable to the success of our research.

The return on these investments is, in many ways, immeasurable. But I understand essence of the question. York researchers and scholars have played key roles in many of the most important scholarship and discoveries of the past half Century. A few accomplishments can serve as a proxy for ROI. These include York's contributions to discovering the Higgs boson and exploring Mars; changing the way we think about bullying; developing novel approaches to healthcare delivery; exploring the global plight of refugees; generating new insights into brain development in children with autism; encouraging civic dialogue through performance and public art; and mapping the spread of infectious diseases.

You can see how York researchers and scholars are undertaking visionary research that has local, national and international significance. Through this research, we aspire to better understand the human condition and the world around us, and to employ the knowledge we gain in the service of society.



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### The Ma Su-Yin Tan explores how to make our cities safer, SU-YIN TAN our climate more stable and people healthier. DIRECTOR, APPLIED GEOMATICS RESEARCH LABORATORY Tan leads Waterloo's Applied Geomatics Research LECTURER IN GEOMATICS FACULTY OF ENVIRONMEN Laboratory, where her team uses remote sensing and geographic information systems (GIS) to study tough social and environmental problems, from crime rates to climate change. Tan's expertise and interests aren't limited to this planet — she's one of a few geographers who collaborate on research to explore outer space, as chair of the Space Applications Department at the International Space University.

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## >>>> Leaders' Corner <<<<<



Thales is a global technology leader in the Aerospace, Transportation, and Defence and Security sectors. At Thales, inno-

vation is the life blood of our strategy and vision and is why we support a world class Canadian innovation ecosystem that includes academia, industry, and government science & technology labs that can provide critical safety and security solutions for our customers.

Siegfried Usal VP, Strategy & Government Relations Thales Canada Inc.



of Waterloo is defining innovation in Canada with a unique blend of scholarship, real-world work experiences inclively entrepreneurial

The University

and a distinctively entrepreneurial culture. Universities, especially those intensively engaged in research, are equipped to bring together the essential ingredients that will produce the type of people the disruption economy needs to thrive.

Feridun Hamdullahpur President and Vice-Chancellor University of Waterloo



At Sheridan, our focus on building opportunities for our professors and students to engage in a broad range of scholar-

ship, research and creative activities means innovative thinking is taking place across a variety of disciplines – and it's creating meaningful solutions for our diverse network of industry and community collaborators.

Dr. Mary Preece President and Vice Chancellor Sheridan



Hôpital Montfort is Ontario's francophone academic hospital. The purpose of our research institute is to integrate physical and mental health, under

the "Body and mind" theme. Its mission is to improve the health of the population, especially among Francophone communities, by leading collaborative research programs centred on patients' and participants' needs in health care.

Dr. Bernard Leduc CEO Hôpital Montfort, Ottawa



SFU has an impressive and diverse research community, and many strong local, national, and international partners.

Our focus on innovation supports the university's goal to become a global leader in research mobilization. We are proud to be ranked as the number one comprehensive university for our exceptional research income growth over the past 15 years.

Dr. Joy L. Johnson Vice-President Research and International Simon Fraser University



Applied research differentiates Saskatchewan Polytechnic and positions us as an industry-leading institution. Pro-

viding a direct link to the community, applied research builds strong partnerships between employers and facilitates the development of solutions to real-world, everyday problems.

November 17, 2016

Dr. Larry Rosia President and CEO Saskatchewan Polytechnic



With a 175-year history of excellence in scholarship and teaching, Queen's distinguishes itself as one of the leading research-intensive

institutions in Canada. Our research mission is to advance research excellence, leadership and innovation, as well as enhance Queen's impact at a national and international level. Through undertaking leading-edge research, Queen's is addressing many of the world's greatest challenges, and developing innovative ideas and technological advances brought about by discoveries in a variety of disciplines.

Dr. Steven N. Liss Professor and Vice-Principal (Research) Queen's University



Lakehead University is tackling the scientific, social, economic, and political questions of the future – within and outside Northwestern Ontario. Our

pioneering researchers and students are addressing challenges related to resource development, watershed management, health care, and more. They are involved in everything from investigating environmental issues facing Lake Superior to developing advanced medical, engineering, and wireless technologies. Our international research collaborations and high level of citations confirm Lakehead's emergence as a global leader in research innovation.

Dr. Andrew Dean Vice-President, Research and Innovation Lakehead University



Over a century ago, our founding researchers made remarkable discoveries and developed exceptional innovations that transformed

disciplines, and improved lives and livelihoods. This tradition inspires University of Guelph research today – we create and mobilize knowledge that promotes the health and well-being of humans, animals, the environment, agriculture and society on a global scale.

Malcolm M. Campbell, Ph.D. Vice-President (Research) University of Guelph



Ryerson University is on a transformative path to become Canada's leading comprehensive innovation university. Our success stems from

fostering a culture of interdisciplinary inquiry, innovation and creativity. We work with communities, businesses and governments to address society's challenging economic, social and cultural needs. We are leaders in incubation and innovation. We also recognize the challenges of expansion, which is why Ryerson offers access to research, expertise and markets to enable start-ups to scale up.

Dr. Usha George Interim Vice President, Research and Innovation Ryerson University



Your partner at the heart of innovation! The applied research and development team at Collège communautaire du

Nouveau-Brunswick is very dynamic and at the forefront of industrial and social innovation in key socioeconomic sectors along with businesses, communities and government partners.

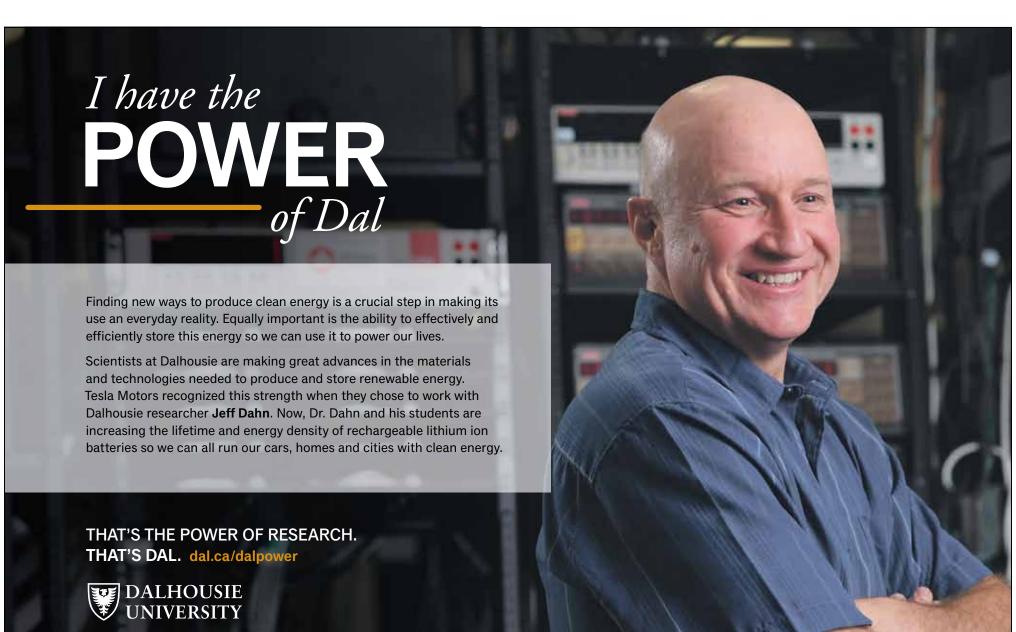
Sylvain Poirier, Ph.D. Executive Director Entrepreneurship & Innovation, CCNB



York University is a global, award-winning leader in Knowledge Mobilization (KMb) – a suite of activities that enhances the

connection between researchers and research users. Our KMb Unit is dedicated to knowledge brokering and partnership support, as well as training and capacity building to maximize the impact of research.

Dr. Robert Haché, Ph.D. Vice-President Research & Innovation York University



## Low-Cost Energy Storage Critical for Widespread Adoption of Green Energy



**Dr. Martha Crago** Vice President Research Dalhousie University



**Dr. Ian Hill**Associate Vice President, Research Dalhousie University

he widespread availability and adoption of clean, renewable sources of energy is one of the top challenges facing humanity today. Inexpensive, clean energy not only alleviates the threat of climate change, but will also have a positive impact on development, as the world-wide demand for energy continues to increase.

Simply put, clean technology is essential to a sustainable economy.

The development and deployment of clean energy sources are receiving major attention and investment both nationally and internationally. The catch is that solar, wind and tidal power are all intermittent and require efficient, low-cost energy storage to deliver an increasing fraction of our energy demands. Since there is currently little capacity to store energy, green power is now sold when available instead of when it's most valuable, or most needed.

Atlantic Canada is in a position

to lead the development of renewable energy production and storage. Traditionally a region that has relied on high-carbon energy production, Nova Scotia has led the country in transitioning to low-carbon sources. We are home to the world's highest tides, steady winds, as well as one of Canada's major research universities. At Dalhousie University, the development of advanced materials for clean technologies is one of our strategic research priorities, including solar cells, tidal generation, heat-storage materials and metal-ion batteries. Nova Scotia has both the renewable resources and the technological expertise to lead Canada's renewable energy revolution.

Dalhousie University's Jeff Dahn is one of the top researchers in battery technologies. His research is funded by Telsa Motors (the company's first partnership with a university), through the Industrial Research Chairs program. Dr. Dahn and his

team are improving rechargeable Lithium-ion batteries, and they've already made significant progress by making cells more cost-effective. Now they're working on increasing battery lifetime and energy density so we'll all have the power to run our cars, homes and lives with clean energy.

with new energy technologies, it is critical to understand not only the benefits, but also the impacts and trade-offs associated with the choices between candidates. For instance, if we attempted to harvest the tidal energy of the Bay of Fundy to the degree that it would take to provide sufficient energy for the province of Nova Scotia, it could lower the height of the tides, creating a Catch 22. The deployment of offshore wind turbines benefits from steadier, more predictable winds, and avoids the concerns of noise pollution near

residential areas, but at a substan-

tially increased cost of electricity

compared to onshore installation. At Dalhousie, our depth in ocean research and atmospheric science, as well as energy policy, enables researchers to work together across disciplines to guide the development of future renewable energy systems that optimally meet the needs of society.

In 2015 at COP21 in Paris, Prime Minister Justin Trudeau stated that "Canada can and will do more to address the global challenge of climate change." This marked a major shift in the country's approach to climate change. It is a conscientious step towards carbon-free energy, and will lead to increased opportunities for businesses and innovation in renewable energy. Going forward, significant research and development will be needed to match ambition with action. Canada has already committed to a number of alliances, including Mission Innova-

tion. Announced on November 30,

2015 by the leaders of 20 countries, Mission Innovation aims to reinvigorate global clean energy innovation with the objective to make clean energy not only affordable, but widely available. Each of the 20 participating countries and the European Union are aiming to double their governmental and/or state directed clean energy research and development investment over five years. For Canada, that means a \$775 million investment.

While important progress has been made in cost reduction and deployment of clean energy technologies, the pace of innovation and the scale of transformation must continue to accelerate. As intermittent renewables contribute to an increased share of our future energy needs, the demand for economical energy storage will skyrocket. Innovative research being done at Dalhousie will help meet these challenges.

## Turning the Tide for Innovation in Canada



**Dr. Gilles G. Patry**President and CEO
Canada Foundation for Innovation

wenty years ago, Canada was faced with a difficult question: "How can we elevate Canadian research to compete, even lead, on a global scale?"

Today, we are faced with an equally thorny and important question: "How can we elevate Canadian innovation to be competitive in the world?"

This country addressed the first problem well; to tackle the latter we should draw lessons from the vision and determination it took to set Canadian research on the right track.

In the 1990s, research in Canada was in trouble. Dilapidated labs prevented researchers from easily querying the cuttingedge questions that would let them lead their fields. Many of them left for other countries that offered more opportunity; it was a trend that had university presidents across this country worried. Canada had historically underinvested in research facilities and equipment and as a result research in Canada simply wasn't keeping up to the rest of the world.

Things changed. The creation of the Canada Foundation for Innovation by the Government of Canada in 1997 played a big part. It was a moment in time when political and research leaders came together to turn the tide for Canadian research. Building world-class research facilities and stocking them with state-of-the-art equipment was itself an experiment – a way to encourage researchers to reach higher, think bigger – and it worked.

The results have been transformative. Today, Canadian campuses boast research facilities that are world-leading. Our campuses now attract global leaders and are magnets for esteemed research partnerships from Germany, France, the U.S., and many other research intensive countries.

The CFI has gathered some 500 world-class labs on our Research Facilities Navigator, an online directory of facilities that have the expertise, state-of-the-art tools and willingness to work with businesses to help them compete. It's a testament to the fact that Canadian research is now well-positioned to help close the gap between ideas and innovation.

Still, 20 years later, most measures of innovation would suggest that, with all the ground we've gained in research in this country, there is still much to be done to make the leap from lab to market-place.

It's not enough to have the best ideas, the best people, the best facilities, though this is what we've worked hard to build in recent decades. The time is ripe, in the midst of Canada's Fundamental Science Review and with a new innovation agenda, to ask where the specific gaps are in the innovation system and to find mechanisms to close them

So what are the missing pieces that remain to propel innovation in Canada to where it ought to be?

In some sense, the answers are obvious. For example, we have a hard time in this country growing companies to be large enough to be globally competitive, leaving our spin-offs and innovative startups vulnerable to being bought out. Our businesses have become the farm team for the big leagues of much larger, more competitive marketplaces.

One way to address challenges like these is to make smart focused investments in areas of strength for Canada - supporting areas of research that position Canada as a global leader has always been a fundamental tenet of how the CFI operates. We see the wisdom of this approach in the clusters of expertise that have arisen across the country - from traditional areas like agricultural research that thrives at institutions like the University of Saskatchewan, to the concentration of high-tech enterprises in the Toronto-Waterloo corridor, to the burgeoning expertise in brain science centred around Montreal, to ocean research in Victoria, Halifax and St. John's.

These critical masses of expertise become the underpinnings of strong economies and hubs of innovation. More than that, they become the training grounds for the next generation of innovators and an incubator for their entrepreneurial spirit.

To continue to generate these successes, it is critical that all players work together to foster a culture of innovation in Canada. The same kind of bold, clear-eyed strategy that rectified a dismal outlook for our research community two decades ago is what will help Canada raise its grade for innovation today.

Gilles Patry is President and CEO of the Canada Foundation for Innovation. Help celebrate the CFI's 20th anniversary, and learn more about its origins at Innovation.ca





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As Canada's engaged university, we're overcoming barriers. We're using robotics to help people overcome physical challenges. We're redefining urban mobility. We're working with NASA to reduce our water footprint around the globe. VentureLabs®, Innovation Boulevard, and RADIUS are just some of the drivers of real innovation at SFU. Where real-world challenges become opportunities for real impact. What's next? What's not?

# BEYOND Binary

Forever curious, Raymond Laflamme has asked many questions throughout his life. But a question to Stephen Hawking, his PhD supervisor at the University of Cambridge, would send him on a path of discovery and set his career in motion.

The question: Did time in a contracting universe move in reverse? Laflamme went on to prove to Hawking that, in fact, it only moved forward.

As a pioneer in information processing and Executive Director of Waterloo's Institute for Quantum Computing, Laflamme is helping usher in the quantum age — a world beyond ones and zeroes that will revolutionize everything, from how we communicate to how our economy is structured.



WATERLOO IS EMPOWERING RESEARCHERS TO GO BEYOND. LEARN MORE.

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#### Canada Doubles Down

BrockU.ca

Continued from page 1

That same thinking led Brock University to create five transdisciplinary research hubs where students and faculty work with community partners to address the development needs and problems of the Niagara Region.

"Each hub is quite different, but what unites them is their transdisciplinarity and their efforts to work with partners," says Dr. Steven Renzetti, Brock's Interim VP Research. "The Social Justice Research Institute, for example, has about 40 partners with very strong ties with the Niagara community, poverty groups, the United Way and groups representing recent newcomers to Canada."

The hubs address complex community challenges that cannot be solved within the narrow silos of traditional academic disciplines. The |Environmental Sustainability Research Centre, for example, sees hydrologists and ecologists working

with social scientists to understand sustainability issues. Other hubs focus on biomanufacturing, health and wellbeing and human development.

"What the world has in many es are issues and challenges and what universities have are departments. We have to get over that," says Renzetti. "When you see this proliferation of centres and institutes at universities, that's the clearest signal of the institution's way of getting around departmental silos."

#### **SHARING RESOURCES** AND EXPERTISE

IBM is using its technology and global footprint to build partnerships and drive innovation. Its Southern Ontario Smart Computing Innovation Platform - one of several IBM research initiatives across Canada - allows companies and researchers from 16 academic institutions to share a distributed network of high performance super computing resources to speed up research and tackle complex challenges.

"For the use of our equipment and technology and mentoring we're helping to build a strong ecosystem" that includes highly skilled workers, says Patrick Horgan, IBM Canada's VP, Manufacturing, Development and Operations. "There is more need for analytic skills and jobs than there are people with those skills so we decided to help push that ball forward in Canada."

Horgan says Canada could up its innovative potential if governments did more to support research collaborations. "That sometimes requires a flexible approach. If you're being too prescriptive on how the rules and programs need to be done then it often slows things down."

And, don't be afraid to favour sectors where Canada excels, such as health care, fresh water and ocean research, energy, natural resources, smart grids, digital media and cybersecurity. "These are things Canadians should lead, and can lead on the world stage," says Horgan.

High-tech clusters often gather round colleges and universities with both the research expertise and skilled graduates companies need to innovate and compete. Metro Vancouver is home to the world's largest hydrogen and fuel cell industry. Big corporate players include Ballard Power Systems, which is opening new markets in China for fuel cell powered buses, and Mercedes, which invested \$70 million in Vancouver to create the world's first automated fuel cell manufacturing plant.

Assisting these companies is Simon Fraser University, one of the strongest institutions globally in the area of fuel cells. "That research excellence is one reason why industries are moving to BC. They want to work with us because they recognize we have really good science happening in that area," says Dr. Joy Johnson, SFU's VP Research.

More universities are abandoning the traditional "push" form of tech transfer that sees inventions developed without consulting with industry first, and then a technology pushed out before it's ready for commercial prime time. To address that infamous "valley of death" between research and commercialization, in 2007 SFU opened the 4D Labs to help companies develop solutions in the areas of fuel cells and other advanced materials.

"4D Labs is an operating model that responds directly to requests from industry partners on particular issues they are struggling with. Smaller companies don't always have good R&D facilities on site so they can come in to get trained on our tools and work within the lab, or they can partner with our researchers and students," says Johnston. "Innovation happens when people solve problems together."

#### THE SCALING UP CHALLENGE

Such is the case in Western Canada, where mining companies have teamed up as part of Canada's Oil Sands Innovation Alliance to codevelop and share technologies that reduce the industry's environmental

Since forming in 2012, COSIA's member companies have shared 819 technologies and innovations. One of those solutions is a centrifuge technology developed by Syncrude Canada that speeds the release of process water from fine fluid tailings,

accelerates tailings reclamation and minimizes the size of tailing ponds. Last year, the company deployed the technology in a \$1.9-billion commercial-scale centrifuge plant north of Fort McMurray. Syncrude has since shared the technology through COSIA with Shell Canada.

"Part of the COSIA model allows us to share data freely among each other and that allows us to accelerate the pace of the application of new technologies," says Mal Carroll, R&D Manager at Syncrude Canada.

Carroll stressed that it's not enough for companies to develop a technology, "you need to be able to scale up, perform pilot tests and carefully and cautiously develop the technology."

Scaling up an innovation often costs more than the actual R&D, he adds. For example, Syncrude recently started a full-scale commercial operation of a new wet crushing technology to more efficiently process oil sands and reduce the amount of bitumen that ends up in tailings ponds. To help offset scale up costs, Syncrude sold the oil that was produced during the pilot testing.

#### **PARTNERING FOR BETTER HEALTHCARE**

Collaborative research is becoming the norm in a growing number of fields, particularly health care. Last year, McGill University Health Centre (MUHC) merged its basic laboratory, clinical and evaluative research into a single hospital complex in Montreal. Along with new state-of-the-art facilities, more opportunities were created for its 460 investigators and over 1,200 students and fellows to work across disciplines on 1,700 ongoing research projects, from infectious diseases and experimental therapeutics to child health and human development.

Dr. Vassilios Papadopoulos, who stepped down in September as Executive Director of the Research Institute of the MUHC, described the new facilities "a dream come true for investigators doing translational

The new facility includes the McConnell Centre for Innovative Medicine - described as a "hospital within a hospital" with beds for patients who participate in clinical studies. "The beauty of this set up is that we're fully immersed in health care," says Dr. Bruce Mazer, the interim head of RI-MUHC. "It allows our researchers to focus on these problems in novel ways and look at piloting new approaches, new drugs and even new apps to improve

patient care." One phone app developed at RI-MUHC to remind children to take their kidney transplant drugs is leading to new apps for diabetes management. "What better way to monitor your diabetes than to have a beep on your cell phone?" says Mazer.

Canada is particularly good at linking pockets of expertise across the country through virtual networks. The University of Ottawa has hosted two such national initiatives - the Canadian Stroke Network and the Stem Cell Network. One of the stroke network's biggest successes was the development and implementation of a national stroke strategy that has improved stroke prevention, care and rehabilitation in communities across Canada.

"We want multidisciplinary research but we're a large country ... Networks of Centres of Excellence are extremely effective vehicles to harness the research strengths from across the country," says Dr. Mona Nemer, VP Research at U of O.

Today, Ottawa is a global leader in clinical trials for innovative stem cell therapies. One recent trial led by U of O scientists found that replacing a diseased immune system with a new one using blood stem cells can halt the progression of multiple sclerosis, allowing it to repair itself.

Looking ahead, Nemer stresses that more funding is needed for fundamental research that cuts across disciplines and for early proof of principle research. "That area is really very critical. Institutions need to have the seed funding to move these things forward."

IBM's Patrick Horgan says Canada's adeptness at collaborative research is demonstrating that such investments pay huge dividends.

"We have a reputation in Canada for being good at collaborations and being able to build on our strengths," he says. "And we're still at really early stages. There's a ton more that can be done."

Debbie Lawes (debbie@dovercourteditorial.ca) is an Ottawabased science and policy writer.



## Championing Government's Role as First Customer of **Innovation**



Dr. Tom Corr President and CEO Ontario Centres of Excellence

s OCE has grown and evolved over the last thirty years, so has our understanding of what it takes to drive innovation.

We've learned that it requires identifying and employing a number of different levers. This includes everything from business advice, seed financing and support for industry-academic collaboration to support for companies to scale up and pursue global ambitions, knowledge transfer through industry-based internships and fellowships, and investment in infrastructure.

OCE is now also employing another extremely important lever -- procurement of innovation by the provincial government.

There is a growing awareness within the innovation system of the important role that governments can play as consumers and first adopters of innovation. This is good for business and for the citizens who use the services and products of the public service. The massive purchasing power of governments represents immense potential to drive fundamental improvements in areas such as health care, education and transportation while also supporting the growth of an economy fueled by innovation.

The benefits of government procurement flow to both businesses and the general public. Ontario businesses acquire valuable customers on their home turf, a chance to validate their products and grow their businesses, and the credibility needed to compete in a global market. Government gains the opportunity to offer improved products and services to those they serve while creating an innovationdriven economy that supports early stage companies and entrepreneurs in Ontario.

With the Province of Ontario, OCE has taken a leadership role in designing and implementing programs supporting public sector innovation adoption and procurement, most notably in the areas of education and health care. In 2014, OCE launched its AdvancingHealth program bringing together health care and industry partners to develop and demonstrate new technologies within the health care system in Ontario. AdvancingHealth has so far funded 10 innovative collaborations between public health care and Ontario industry partners, each demonstrating a new Ontario-made technology in a public health care setting in order build a case for its adoption across the system. Each of two rounds of the program was given a theme based on significant challenges in the health care system, namely community-based virtual care, mental health, and patient engagement.

Under a similar program model, OCE subsequently introduced its AdvancingEducation program, which has recently issued a second call for proposals. Projects from the first funding round include a game-based approach to motivating children, a multisensory chair for children with autism and a new approach to distance education. Our focus on innovation procurement has intensified with the recent addition of two new health related programs aimed at making it easier for our health-care institutions to identify, evaluate, and procure innovative solutions that meet their biggest challenges.

Fostering government procurement helps complete the cycle in the innovation system. As in Ontario, governments invest substantially in the academic institutions that are home to the groundbreaking research that spurs innovation, the campus entrepreneurship programs that support student entrepreneurs and the startups that are getting their footing as they seek private investment. By also adopting technologies as first customers and helping companies grow, the provincial government is helping create a demand for innovation that further fuels an innovation-driven

Dr. Tom Corr is the President and CEO of Ontario Centres of Excellence, which drives the growth of a globally competitive-based economy. Funded primarily by the Ontario government, OCE is a proud member of the Ontario Network of Entrepreneurs (ONE).

Ontario Centres of Excellence

### **HELPING DRIVE** INNOVATION IN ONTARIO

OCE works with innovators and entrepreneurs helping them develop and hone business ideas, secure financing and develop promising technology. We drive these business ideas to the point of industry or institution adoption and scale up, where the game-changing economic and social benefits can be realized.



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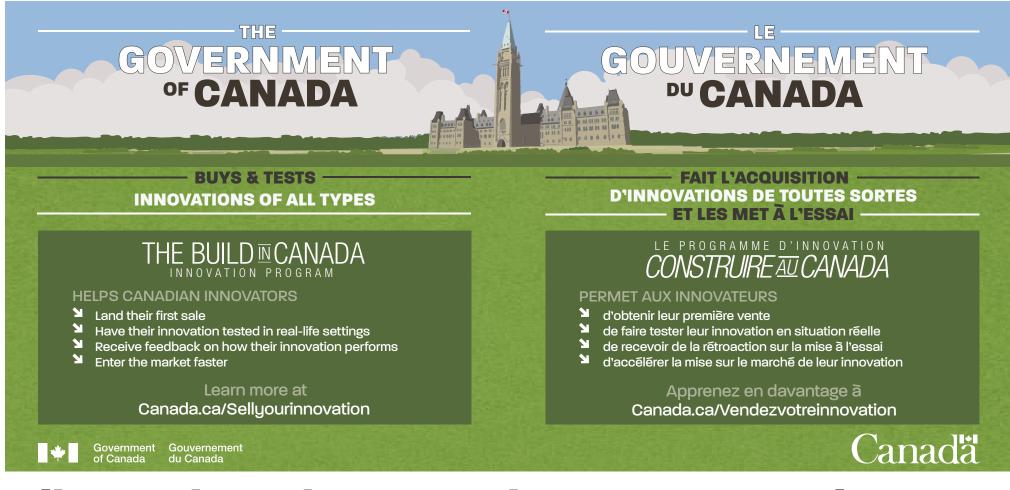
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### Alberta has the Ingredients to Propel **Health System Advancements**



Dr. Kathryn Todd Vice President Research, Innovation and Analytics Alberta Health Services

Then it comes to harnessing research and innovation to drive health system improvement, Alberta Health Services (AHS) and its partners are poised to lead the way in Canada.

As the country's largest health authority with more than 100,000 staff, 15,000 volunteers and 9,000 physician partners serving the needs of more than four million Albertans. AHS is leveraging research and innovation to provide a patient-focused, quality health system that is accessible and sustainable for all Albertans.

Just ask someone like Garry Alberta Health Laxdal, a 54-year-old Calgary man who was diagnosed with cancer in 2015.

Mr. Laxdal took part in a new Alberta program for patients undergoing colorectal surgery that helps them prepare and recover from surgery faster. Through the program, patients spend less time in hospital, have fewer complicadischarge.

tions and fewer return visits after "Immediately after my surgery I felt great," Mr. Laxdal recalls. "In fact, I joked to my wife, 'This wasn't so bad; I don't know what all the fuss was about.' I was back up on my feet the evening of my surgery and then discharged six days later.

gone home on Day 5 if they would have let me.' Mr. Laxdal's relatively smooth encounter with major surgery was a

I felt fabulous. In fact, I would have

result of a program called Enhanced Recovery After Surgery (ERAS), which is the application of international evidence-based ways of providing care before, during and after surgery.

Patients love it because they are part of the team throughout the process and kept well informed about their entire surgery journey.

The results for the health system have been no less remarkable. ERAS began in 2013 for colorectal surgery patients and has spread to six different hospitals in the province, with more planned. To date we estimate a savings to the Alberta health system of about \$3.6 million.

To develop, implement and spread innovative best practices like these requires a mechanism that brings together clinicians, aca-

demic researchers, administrators,

policy-makers and, most importantly,

patients and families, who are passionate and knowledgeable about specific areas of health.

To accomplish this AHS created 13 (soon to be 15) Strategic Clinical Networks<sup>TM</sup> (SCNs) to bring about innovative ways of delivering care that will provide better quality, better outcomes and better value for every Albertan.

They are focused on identifying priorities for improved health outcomes, research, driving innovation, eliminating unnecessary variations in care across the province, and promoting sustainability by ensuring we get the most value out of every health dollar.

SCNs would not be possible without having a single, provincewide health system. The support of our

partners - Alberta Innovates, the

Universities of Alberta, Lethbridge

and Calgary, and many other private

partners and not-for-profit agencies - is instrumental in advancing the research and innovation agenda.

Take ERAS, for example. Not only has ERAS spread beyond the six hospital sites in which it started, but guidelines are also being introduced for several other surgical procedures in several other sites.

The SCNs have brought about other significant improvements. For example, we've introduced guidelines for the appropriate use of anti-psychotics in every long-term care facility in Alberta (170 sites), which have become a model for the country. More than 1,000 of our frail elderly are no longer receiving unnecessary medications and staff

have reported positive changes from this approach. Together, these and many other SCN initiatives are having a sig-

nificant impact on the Alberta

health system and outcomes for Albertans.

Data and information are key to making the best evidence-informed decisions possible. We've made major strides since our formation in 2008 to consolidate and link provincial data to help answer public health questions that are difficult to answer elsewhere.

Fully embedding research and innovation in the health system improves outcomes at both the individual and population levels, and helps us live out our AHS vision: Healthy Albertans. Healthy Communities. Together.

We know we're not alone in our efforts to improve health system performance. We draw from the best practices being generated in other systems across the country. Canadians are the ultimate beneficiaries when all of us share and adopt innovations.









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## Canada's **TOP 40 RESEARCH HOSPITALS 2016**

Ra	nk		Rese	arch Spen	ding		earch nsity		
2015	2014	Hospital/Hospital Network/	FY2015	FY2014	% Change 2014- 2015	Researcher* \$ per Researcher	\$ as % of Total Hospital		Main Affiliated
1	1	Health Authority University Health Network	\$316,300	\$303,100	4.4	\$558.8	Spending 16.9	ON	Research Institute(s)/Centre(s)  Princess Margaret Cancer Centre, Toronto General Research Institute, Krembil Research Institute, Toronto
2	3	Hospital for Sick Children	\$182,020	\$199,927	-9.0	\$742.9	24.8	ON	Rehabilitation Institute, Techna Institute, Peter Gilgan Centre for Research ar Learning
3	4	McGill University Health Centre (MUHC)	\$172,193	\$190,309	-9.5	\$479.6	16.1	QC	Research Institute of the MUHC
4	2	Hamilton Health Sciences	\$167,386	\$212,017	-21.1	\$363.1	13.2	ON	Population Health Research Institut Escarpment Cancer Research Institu Geriatric Education and Research in
5	5	Provincial Health Services Authority	\$133,905	\$142,381	-6.0	\$184.7	4.9	ВС	Aging Sciences  BC Cancer Agency/Research Centre BC Children's Hospital – Child & Fan Research Institute, BC Centre for Disease Control, BC Women's Hospital & Health Centre – Womer Health Research Institute
6	7	Ottawa Hospital	\$133,688	\$123,691	8.1	\$360.3	9.9	ON	Ottawa Hospital Research Institute, Ottawa Heart Institute Research Corporation
7	6	Vancouver Coastal Health Authority	\$129,559	\$124,057	4.4	\$317.5	4.1	ВС	Vancouver Coastal Health Research Institute, Providence Health Care Research Institute
8	8	London Health Sciences Centre/St. Joseph's Health Care London <sup>(a)</sup>	\$115,852	\$113,381	2.2	\$206.5	7.5	ON	Lawson Health Research Institute
9	11	CHU de Québec - Université Laval	\$91,288	\$85,457	6.8	\$269.3	7.5	QC	Centre de recherche du CHU de Québec - Université Laval
10	9	Sunnybrook Health Sciences Centre	\$91,176	\$87,924	3.7	\$302.9	9.5	ON	Sunnybrook Research Institute, Sunnybrook Research Academy
11	10	Sinai Health System	\$88,537	\$88,296	0.3	\$750.3	14.8	ON	Lunenfeld-Tanenbaum Research Institute, Bridgepoint Collaboratory for Research and Innovation
12	12	St. Michael's Hospital	\$73,461	\$69,342	5.9	\$372.9	11.1	ON	Keenan Research Centre for Biomedi Science, Li Ka Shing Knowledge Insti
13	13	Centre hospitalier de l'Université de Montréal (CHUM)	\$67,094	\$66,029	1.6	\$182.3	6.9	QC	Centre de recherche du CHUM
14	14	Sir Mortimer B. Davis Jewish General Hospital+	\$62,445	\$61,129	2.2	\$255.9	14.6	QC	Lady Davis Institute for Medical Research
15	15	Centre for Addiction and Mental Health	\$56,105	\$57,269	-2.0	\$487.9	15.0	ON	Campbell Family Mental Health Research Institute
16		Alberta Health Services - Edmonton Zone	\$53,139	\$54,467	-2.4	\$158.2	na	AB	
17	16	Institut de Cardiologie de Montréal	\$49,329	\$54,320	-9.2	\$624.4	23.9	QC	Centre de recherche de l'Institut de Cardiologie de Montréal
18		Alberta Health Services - Calgary Zone	\$41,677	\$33,177	25.6	\$744.2	na	AB	
19	18	Institut universitaire de cardiologie et de pneumologie de Québec - Université Laval	\$33,924	\$33,347	1.7	\$230.8	10.7	QC	Centre de recherche de l'Institut universitaire de cardiologie et de pneumologie de Québec
20	21	Children's Hospital of Eastern Ontario	\$30,388	\$24,209	25.5	\$135.1	10.8	ON	CHEO Research Institute
21	19	St. Joseph's Healthcare Hamilton	\$27,510	\$27,952	-1.6	\$175.2	4.7	ON	Firestone Institute for Respiratory Health, Peter Boris Centre for Addictions Research, Hamilton Cer for Kidney Research
22	20	Winnipeg Regional Health Authority <sup>(b)</sup>	\$26,558	\$27,090	-2.0	\$136.9	1.4	МВ	Children's Hospital Research Institu of Manitoba, Health Sciences Cent Department of Research, Concordi Joint Replacement Group/Orthopad Innovation Centre
23	22	Douglas Mental Health University Institute+	\$25,687	\$22,522	14.1	\$467.0	18.0	QC	Douglas Hospital Research Centre
24	24	Capital District Health Authority <sup>+</sup>	\$23,662	\$19,049	24.2	\$80.2	2.3	NS	Centre for Clinical Research, Resear Methods Unit, Brain Repair Centre
25	23	Institut universitaire en santé mentale de Québec <sup>+</sup>	\$21,494	\$19,754	8.8	\$311.5	15.7	QC	Centre de recherche de l'Institut universitaire en santé mentale de Québec
26	25	Centre hospitalier universitaire de Sherbrooke (CHUS) <sup>+</sup>	\$18,857	\$18,290	3.1	\$80.6	3.7	QC	Centre de recherche du CHUS
27	28	Kingston General Hospital	\$18,170	\$16,331	11.3	\$86.9	4.1	ON	Kingston General Hospital Research Institute
28		CIUSSS du Nord-de- l'Île-de-Montréal <sup>(c)</sup>	\$16,695	na	na	\$97.1	3.3	QC	Centre de recherche de l'Hôpital d Sacré-Coeur de Montréal, Centre c recherche de l'Hôpital Rivière-des- Prairies, Centre InterActions
29	26	Hôpital Maisonneuve- Rosemont+	\$16,275	\$16,891	-3.6	\$196.1	3.7	QC	Centre de recherche de l'Hôpital Maisonneuve-Rosemont
30	30	IWK Health Centre	\$14,300	\$14,080	1.6	\$143.0	5.3	NS	Centre for Pediatric Pain Research, Biomedical Translation Imaging Cer MicroResearch International
31	27	Baycrest	\$13,822	\$16,855	-18.0	\$493.6	9.5	ON	Rotman Research Institute
32 33	31 29	Women's College Hospital St. Boniface Hospital	\$12,883 \$12,199	\$12,155 \$15,596	6.0 -21.8	\$214.7 \$338.9	10.2 3.3	ON MB	Women's College Research Institute Albrechtsen Research Centre, Aspe
34	33	Holland Bloorview Kids	\$10,505	\$9,038	16.2	\$300.1	12.6	ON	Clinical Research Institute Bloorview Research Institute
35	34	Rehabilitation Hospital Institut universitaire de	\$8,934	\$7,749	15.3	\$168.6	14.3	QC	Centre de recherche de l'Institut
36	39	gériatrie de Montréal <sup>+</sup> The Royal	\$8,578	\$6,319	35.7	\$124.3	5.3	ON	universitaire de gériatrie de Montre University of Ottawa Institute of
37	35	Thunder Bay Regional Health	\$8,425	\$7,597	10.9	\$168.5	2.5	ON	Mental Health Research Thunder Bay Regional Research Insti
38	38	Sciences Céntre Hôpital Montfort	\$6,686	\$6,626	0.9	\$142.3	3.2	ON	Institut de recherche de l'Hôpital
39	36	Health Sciences North	\$6,562	\$7,401	-11.3	\$89.9	1.5	ON	Montfort  Health Sciences North Research Instit
40	40	Bruyère Continuing Care	\$6,380	\$6,071	5.1	\$159.5	4.3	ON	Bruyère Research Institute

- Data were obtained through a survey of research hospitals and from financial statements. Information for Ontario was coordinated in part through CAHO (Council of Academic Hospitals of Ontario).
- 2. Research spending includes all funds (direct and indirect) spent on all sources (internal and
- external) to support research.

  FY2014 figures may have been adjusted as more accurate information became available.

  Data are provided for the main hospital(s) including their affiliated hospitals and research institutes/centres, where applicable.
- \*Head count of researchers/scientists/investigators/clinician-researchers conducting research.

  Does not include research fellows/post docs, technicians, students or support staff.

  \*Current name may differ due to reorganization
- na = Not available
- (a) Research spending amounts were combined as these hospitals have one research institute.
  (b) Data for St. Boniface Hospital are not included with WRHA.

(c) Only includes Hôpital du Sacré-Coeur de Montréal, Hôpital Rivière-des-Prairies and CSSS Bordeaux-Cartierville-Saint-Laurent.

#### CANADA'S TOP 40 Research Hospitals

#### **HOSPITAL RESEARCH SPENDING FLAT**

Research spending at Canada's Top 40 Research Hospitals was flat in Fiscal 2015 (-0.3%) following the growth of 5.0% in Fiscal 2014. Combined research spending for Hospitals, Hospital Networks and Health Authorities totaled \$2.39 billion in Fiscal 2015, from \$2.40 billion in Fiscal 2014. Research spending rose at 26 organizations and declined at 13 others (comparable data were not available for 1 organization). The number of health researchers expanded by 3.5% to 8,280 nation-wide.

Toronto's University Health Network remained the largest research performer with \$316.3 million of spending, up by 4.4% in Fiscal 2015, followed by Hospital for Sick Children (\$182.0 million, down -9.0%) and McGill University Health Centre (\$172.2 million, down -9.5%).

Top 10 Research Hospitals by Growth					
Spendin		Research Hospital	% Change 2014-2015		
1	36	The Royal	35.7		
2	18	Alberta Health Services - Calgary Zone	25.6		
3	20	Children's Hospital of Eastern Ontario	25.5		
4	24	Capital District Health Authority	24.2		
5	34	Holland Bloorview Kids Rehabilitation Hospital	16.2		
6	35	Institut universitaire de gériatrie de Montréal	15.3		
7	23	Douglas Mental Health University Institute	14.1		
8	27	Kingston General Hospita	l 11.3		
9	37	Thunder Bay Regional Health Sciences Centre	10.9		
10	25	Institut universitaire en santé mentale de Québec	8.8		
•					

Hamilton Health Sciences occupied 4th place nationally with \$167.4 million of research spending (down -21.1%). Provincial Health Services in British Columbia rounded out the top 5 performers with \$133.9 million of research spending (down -6.0%).

#### THE \$100 MILLION CLUB

With research spending topping \$100 million each, 8 organizations gained membership in RE\$EARCH Infosource's \$100 Million Club in Fiscal 2015, the same number as in 2014. In total, \$100 Million Club members spent \$1.35 billion last year, compared with \$1.41 billion in Fiscal 2014 – a decline of 4.1%.

#### **PROVINCIAL PERFORMANCE**

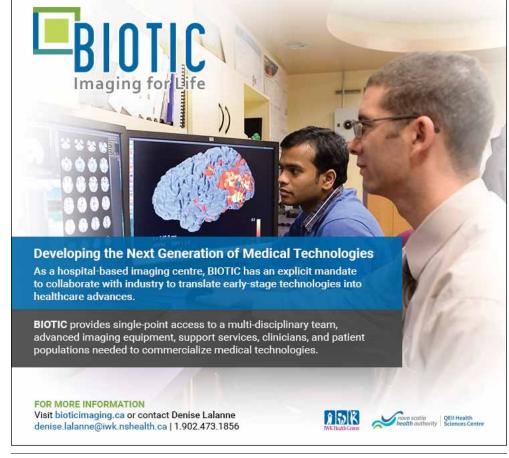
Health research organizations in Ontario accounted for the bulk of the national total. Twenty Ontario research performers accounted for 57.4% of Top 40 spending, down from 59.0% the year before (this largely due to the inclusion this year of Alberta performers). Quebec's 12 performers were responsible for 24.4% of the national total, down from 26.4%. Two performers in British Columbia contributed 11.0% of the national total.

#### **RESEARCH SPENDING GROWTH**

In spite of the flat national result, nine of the Top 40 Research Hospitals expanded their research spending by 10% or more. Activity expanded at The Royal (35.7%), Alberta Health Services - Calgary Zone (25.6%), Children's Hospital of Eastern Ontario (25.5%), Capital District Health Authority (24.2%) and Holland Bloorview Kids Rehabilitation Hospital (16.2%).

#### **RESEARCH INTENSITY**

RE\$EARCH Infosource measures research intensity in two ways: by researcher (research spending per researcher), and by hospital (hospital research spending as a percent of total hospital spending). Alberta



Health Services (Calgary Zone) was tops in researcherintensity among large performers, spending \$744,200 per researcher. In the medium category, Sinai Health System led with \$750,300 per researcher – also tops in the country. Among small hospitals Institut de Cardiologie de Montréal stood out with \$624,400 per researcher.

Measured by hospital intensity (research spending as a % of total hospital spending), the leading large size institution was University Health Network (16.9%), Hospital for Sick Children (24.8%) was the leader in the medium size category, and Institut de Cardiologie de Montréal (23.9%) led the small size performers.

#### THIS YEAR AND NEXT

Fiscal 2015 was a disappointing year for the hospital research sector, with combined activity falling by -0.3% and many of the top performers losing ground. The bulk of health research funds come from federal and provincial government sources, and those sources are under fiscal pressure. Thus, it would be unrealistic for health research spending to continue to grow at a faster rate than

Top 40 – Leading Provinces	
Province	% of Total
Ontario (20)	57.4
Quebec (12)	24.4
British Columbia (2)	11.0

available resources. Last year we said that "... given the current challenge to government budgets at all levels, it is hard to envisage any large expansion of resources next year. From that standpoint, steady-as-she-goes would be a positive outcome". Our forecast was borne out. But with health research costs rising faster than funding, even a steady-state represents a fall in real resources. Regrettably, based on current economic and fiscal trends. next year will most likely see a repeat of this year's tepid result. If the trend continues it will call for funders and performers to further prioritize their efforts so as not to hinder the most productive activities.

The \$100 Million Club							
2015	Research	Spending					
Rank	Research Hospital	\$000					
1	University Health Network	\$316,300					
2	Hospital for Sick Children	\$182,020					
3	McGill University Health Centre (MUHC)	\$172,193					
4	Hamilton Health Sciences	\$167,386					
5	Provincial Health Services Authority	\$133,905					
6	Ottawa Hospital	\$133,688					
7	Vancouver Coastal Health Authority	\$129,559					
8	London Health Sciences Centre/ St. Joseph's Health Care London	\$115,852					

#### Spotlight on Hospital Research Activity TOP RESEARCHER-INTENSIVE ORGANIZATIONS (Research Spending per Researcher) \$000 Rank Medium Rank Large \$000 \$000 Rank Small Institut de Cardiologie **Alberta Health Services -**Sinai Health System \$750.3 Calgary Zone de Montréal \$744.2 Hospital for Sick University Health Children \$493.6 Centre for Addiction and St. Michael's Hospital \$372.9 McGill University Health Mental Health \$479.6 Centre (MUHC) TOP HOSPITAL-INTENSIVE ORGANIZATIONS (Research Spending as a % of Total Hospital Spending) Rank Large % Rank Medium % Rank Small Institut de Cardiologie **University Health Hospital for Sick** Children de Montréal McGill University Health 14.8 Douglas Mental Health Sinai Health System Centre (MUHC) University Institute 16.1 Sir Mortimer B. Davis Jewish Hamilton Health Sciences 13.2 Institut universitaire en General Hospital santé mentale de Québec 15.7 Note: Size is based on total hospital spending: Large = more than \$1 billion;

## small program | BIG RESULTS

In the last 10 years, our research has resulted in 74 peer reviewed and

resulted in 19 articles published and accepted for publication, 7 articles

published research articles. 2016

submitted for publication, with an

but our results are big.

We have been promoting and engaging in cross-cultural and rural hospital-based research for the past 10 years with a range of subjects not limited to:

- cross-cultural care
- maternal-child care
- palliative care
- rural medicine addiction medicine
- rural medical education





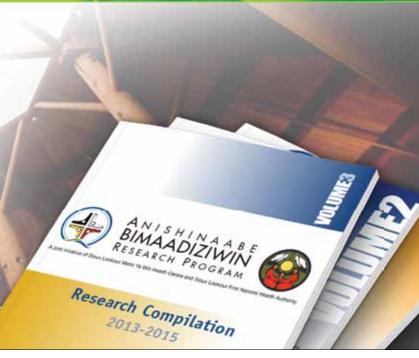


First Nations Health Authority



Let's get started today! Contact us at: abresearch@slmhc.on.ca

We may look small,



#### PARTNER PERSPECTIVE

## Innovation at The Royal Could Lead to Personalized Mental Illness Treatment

he treatment of mental illness is done through a "trial and error" approach instead of precision medicine, with clinicians trying different types of therapeutic interventions (drugs, psychological and/or other modalities) until the most effective treatment (or combination of treatments) is identified for each patient. This is because the brain mechanisms underlying mental illness remain unclear and the diagnoses are still symptom based.

Innovative clinical scientists at The Royal, one of Canada's foremost mental health care, teaching and research hospitals, want to change this approach.

They're exploring new ground in understanding how mental illness affects the brain using the latest in molecular imaging techniques - a cutting-edge PET-fMRI scanner, the first in Canada dedicated to mental health research.

Better understanding will translate into better treatment - and lead to personalized treatment for every patient.

"We cannot see or touch the organ we are treating. The Royal's new state-of-the-art brain imaging machine will help us make the invisible visible and help transform mental health care as we know it," says Dr. Zul Merali, president and CEO of The Royal's Institute of Mental Health Research (IMHR), which is affiliated with the University of Ottawa. This multimillion dollar clini-

cal research tool will be used to investigate the brain circuitry linked to depression, post-traumatic stress disorder, suicide ideation and other mental illnesses. With the help of this new tech-

nology, The Royal will take a significant and innovative step closer to realizing its ultimate goal: to help people living with severe mental illness get better faster.

In-depth knowledge and understanding will lead to the identification of the unique brain biomarkers for individuals with mental illness, and researchers and clinicians at The Royal will then be able to customize



The Royal's Dr. Zul Merali says a new state-of-the-art brain imaging machine will open up new, innovative and personalized treatment for mental illness.

treatments based on a person's biology. Researchers are confident that various research projects involving the PET-fMRI will lead to more effective and efficient diagnoses, treatment and even prevention.

Two Canada Research Chairs (CRCs) are leading this charge -Dr. Georg Northoff who holds the

CRC and heads the research unit in Mind, Brain Imaging and Neuroethics, and Dr. Pierre Blier who holds the CRC in Psychopharmacology. Both CRCs highlight the strong partnership with the University of Ottawa.

Dr. Blier, also director of the IMHR's Mood Disorders Research Unit, wants to reduce the scourge

of suicide, which takes the lives of approximately 4,000 people each year in Canada and some 900,000 worldwide. The sense of hopelessness, the darkness, the stress and the pain that take people to that point of no return are deeply rooted in altered chemical and electrical processes of the brain.

"We hope to identify what brain structures and processes are associated with people experiencing suicidal ideation. We're going to take these clinical observations and then probe further onto these brain areas in our preclinical laboratory work," says Dr. Blier, who with Dr. Northoff is studying the brain circuitry involved in suicide ideation and measuring how ketamine can eliminate these thoughts.

In the study, low doses of ketamine (sub-anesthetic doses) are administered over 40 minutes. "In a majority of the patients - even in those extremely resistant to traditional antidepressant drugs, we get a robust response within hours," says Dr. Blier.

After a week or two, however, many symptoms of depression return, but suicidal thoughts remain at bay for a lot longer. The scanner will help monitor the patient's brain activity before and after treatment, allowing the researchers to see where suicidal ideation 'resides' in the brain.

The Royal's IMHR is very proud to have made the Top 40 Research Hospitals list each year and for achieving the most significant increase since last year.

Mental health research receives only about 5 per cent of medical research dollars, despite the fact mental illness is the No. 1 medical condition in terms of the years lost to disability and the economic and social costs confronting Canadians, more than heart disease, pulmonary diseases and cancer combined.

Dr. Merali remains hopeful that more research funding and effort will be directed towards leadingedge projects such as the one Drs. Blier and Northoff are undertaking.

"Now, access at home to a PET-fMRI that is dedicated to mental health and neuroscience research will stimulate the development of new personalized treatments for severe, persistent mental illness," says Dr. Merali.





























Applied Research & Innovation Lambton College





## Canada's TOP 50 RESEARCH COLLEGES 2016

					4		•		
Ra	nk		Res	search Inco	ome	Faculty*	Research Intensity		
Ku			NC:	Carcii inco	%	2014-			
2015	2014	College	FY2015 \$000	FY2014 \$000	Change 2014- 2015	2014- 2015 #	\$ per Faculty \$000	Prov	Main Research Institute/ Centre/Facility
1	2	Cégep de Saint-Hyacinthe	\$10,283	\$9,365	9.8	50	\$205.7	QC	Groupe CTT/CTT Group
2	4	Cégep de la Gaspésie et des Îles	\$7,870	\$7,090	11.0	44	\$178.9	QC	Merinov
3	11	Lambton College	\$7,025	\$5,292	32.7	40	\$175.6	ON	Centre of Excellence in Energy and Bio-Industrial Technologies
4	7	Cégep de La Pocatière	\$6,650	\$5,622	18.3	35	\$190.0	QC	Solutions Novika
5	5	British Columbia Institute of Technology	\$6,300	\$7,040	-10.5	120	\$52.5	BC	Rehabilitation Engineering Design Laboratory
6	9	Sheridan College	\$6,247	\$5,497	13.6	66	\$94.7	ON	Screen Industries Research & Training Centre
7	10	Niagara College	\$6,069	\$5,340	13.7	91	\$66.7	ON	Canadian Food & Wine Institute
8	6	Cégep Édouard-Montpetit	\$5,806	\$6,206	-6.4	48	\$121.0	QC	Centre technologique en aérospatiale
9	12	Centennial College	\$5,440	\$5,234	3.9	90	\$60.4	ON	Wearable Interactive and Mobile
									Technologies Access Centre in Healthcare
10	13	Cégep de Trois-Rivières	\$5,235	\$4,256	23.0	40	\$130.9	QC MB	Centre de métallurgie du Québec
11	8	Red River College	\$4,876	\$5,581	-12.6	50	\$97.5	MB	Technology Access Centre - Building Envelope
12	15	Cégep André-Laurendeau	\$4,704 \$4,605	\$3,976	18.3	21	\$224.0	QC YT	OPTECH
13 14	14	Yukon College NAIT - Northern Alberta	\$4,695 \$4,629	\$4,184 \$4,073	12.2 13.7	15 79	\$313.0 \$58.6	Y I AB	Yukon Research Centre  NAIT Boreal Research Institute
	17	Institute of Technology							
15 16	17 3	Mohawk College SAIT Polytechnic	\$4,420 \$4,335	\$3,492 \$7,202	26.6 -39.8	24 51	\$184.2 \$85.0	ON AB	iDeaWORKS Unmanned Systems
17	21	Olds College	\$4,220	\$2,812	50.1	25	\$168.8	AB	Olds College Centre for Innovation
18	16	Cégep de Thetford	\$4,018	\$3,787	6.1	45	\$89.3	QC	OLEOTEK and Centre de Technologie Minérale et de Plasturgie
19	1	George Brown College	\$3,829	\$14,227	-73.1	116	\$33.0	ON	Food Innovation & Research Studio
20	24	Algonquin College	\$3,594	\$2,379	51.1	75	\$47.9	ON	Full Spectra Centre
21	22	Cégep de Saint-Jérôme	\$3,462	\$2,811	23.2	37	\$93.6	QC	Centre de développement des composites du Québec
22		Cégep de Victoriaville	\$3,346	\$3,243	3.2	27	\$123.9	QC	·
23	19	Nova Scotia Community College	\$3,319	\$3,438	-3.5	69	\$48.1	NS	Applied Geomatics Research Group
24		Cégep de l'Abitibi- Témiscamingue	\$2,704	\$3,094	-12.6	5	\$540.8	QC	Centre technologique des résidus industriels
25	20	Collège communautaire du Nouveau-Brunswick	\$2,623	\$2,892	-9.3	23	\$114.0	NB	CCNB-INNOV Matériaux composites/Composite Materials
26	23	Seneca College	\$2,517	\$2,745	-8.3	66	\$38.1	ON	Centre for Development of Open Technology
27	25	Collège Shawinigan	\$2,369	\$2,337	1.4	8	\$296.1	QC	Centre National en Électrochimie et en Technologies Environnementales
28		Aurora College	\$2,367	\$2,796	-15.3	7	\$338.1	NT	Aurora Research Institute
29	33	Camosun College	\$2,324	\$1,612	44.2	18	\$129.1	ВС	Camosun Technology Access Centre
30	28	Justice Institute of British Columbia	\$2,204	\$1,792	23.0	23	\$95.8	BC	Centre for Applied Research
31	45	Conestoga College	\$1,875	\$1,435	30.7	97	\$19.3	ON	Centre for Smart Manufacturing
32	49	Fanshawe College	\$1,856	\$617	200.8	38	\$48.8	ON	Canadian Centre for Product Validation
33 34	31 37	Humber College College of the North Atlantic	\$1,851 \$1,821	\$1,676 \$1,293	10.4 40.8	70 17	\$26.4 \$107.1	ON NL	Rapid Prototyping Centre  Applied Minerology and Chemistry
			·						Analysis Lab
35	29	Red Deer College	\$1,700	\$1,753	-3.0	92	\$18.5	AB	Centre for Innovation in Manufacturing
36	39	Holland College	\$1,659	\$1,140	45.5	28	\$59.3	PE	Canada's Smartest Kitchen
37	46	Dawson College	\$1,655	\$912	81.5	35	\$47.3	QC	Centre de recherche pour l'inclusion scolaire et professionnelle des étudiants en situation de handicap
38	43	Cégep de Sept-Îles	\$1,633	\$964	69.4	25	\$65.3	QC	Institut technologique de
39	18	Cégep de Lévis-Lauzon	\$1,631	\$3,453	-52.8	9	\$181.2	QC	maintenance industrielle TransBIOTech
40	35	Fleming College	\$1,626	\$1,492	9.0	10	\$162.6	ON	Centre for Alternative Wastewater
41	27	Cégep de Sainte-Foy	\$1,602	\$1,926	-16.8	26	\$61.6	QC	Centre d'enseignement et de
42	40	Saskatchewan Polytechnic	<b>\$</b> 1,595	<b>\$</b> 1,121	42.3	65	\$24.5	SK	recherché en foresterie de Sainte-Foy Digital Integration Research Group
43		Collège d'Alma	\$1,525	\$1,265	20.6	12	\$127.1	QC	Agrinova
44	34	Cambrian College	\$1,524	\$1,564	-2.6	31	\$49.2	ON	Glencore Centre for Innovation
45 46	36 47	Durham College St. Lawrence College	\$1,451 \$1,385	\$1,455 \$695	-0.3 99.3	19 30	\$76.4 \$46.2	ON ON	Centre for Education, Behavioural
40	47	St. Lawrence College	\$1,363	\$093	99.3	30	\$40.2		Research and Intervention in the Community
47	44	Cégep de Rimouski	\$1,361	\$955	42.5	21	\$64.8	QC	Centres de recherche appliquée pour l'industrie forestière et pour l'industrie maritime
48	32	Grande Prairie Regional College	\$1,233	\$1,649	-25.2	16	\$77.1	AB	National Bee Diagnostic Centre - Technology Access Centre
49	41	Cégep de Sherbrooke	\$1,125	\$1,088	3.4	40	\$28.1	QC	Centre de productique intégrée du Québec
50	26	Collège de Maisonneuve	\$1,104	\$1,964	-43.8	11	\$100.4	QC	Centre d'études des procédés chimiques du Québec
Notes:					*⊔-		./tanahina atalli		ed researchers conducting research.

Notes:

- Data were obtained through a survey of publicly-funded colleges and from financial statements.
- Research income includes all funds (direct and indirect) to support applied and scholarly research received from all sources (internal and external).
- FY2014 figures may have been adjusted as more accurate information became available.
   Data are provided for the main college including their affiliated research institutes/centres, where applicable.
- \*Head count of faculty/teaching staff and/or dedicated researchers conducting research.

  Does not include support staff or student researchers.

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%

92.7

62.0

60.9

#### CANADA'S TOP 50 Research Colleges

#### **RESEARCH INCOME STALLS**

Canada's Top 50 Research Colleges grew their combined research income by only 0.5% in Fiscal 2015, compared with 4.7% growth in 2014 and 30.8% in 2013. Income at all 50 institutions rose to \$168.7 million from \$167.8 million in Fiscal 2014. Research income increased at 33 colleges and fell at 17 schools. The number of college researchers expanded to 2,100 from 2,036 the prior year.

The top research college was Cégep de Saint-Hyacinthe, which attracted a total of \$10.3 million of research income in Fiscal 2015, up 9.8% from fiscal 2014. Cégep de la Gaspésie et des Îles posted \$7.9 million of research income, up 11.0% from the prior year, followed by Lambton College, which gained \$7.0 million, an increase of 32.7% from the year before.

#### **PROVINCIAL PERFORMANCE**

Nineteen Québec colleges accounted for \$68.1 million of research income – 40.4% of the Top 50 total – an increase from 36.3% in Fiscal 2014. Ontario's 15 colleges on the Top 50 list posted \$50.7 million of income and accounted for 30.1% of the total, down from 34.4%. Colleges in all other provinces/territories accounted for 29.5% of national research income.

Top 50 – Leading Provinces	
Province	% of Total
Quebec (19)	40.4
Ontario (15)	30.1
Alberta (5)	9.6
British Columbia (3)	6.4

Top 10 Research Intensive Colleges						
2015 Research	1	Research (\$ per Research College	Intensity faculty) \$000			
1	24	Cégep de				
		l'Abitibi-Témiscamingue	\$540.8			
2	28	Aurora College	\$338.1			
3	13	Yukon College	\$313.0			
4	27	Collège Shawinigan	\$296.1			
5	12	Cégep André-Laurendeau	\$224.0			
6	1	Cégep de Saint-Hyacinthe	\$205.7			
7	4	Cégep de La Pocatière	\$190.0			
8	15	Mohawk College	\$184.2			
9	39	Cégep de Lévis-Lauzon	\$181.2			
10	2	Cégep de la Gaspésie et des Îles	\$178.9			

Top 10 Research Colleges by Growth						
2015 I Income Growth	Rank Overall	Research College	% Change 2014-2015			
1	32	Fanshawe College	200.8			
2	46	St. Lawrence College	99.3			
3	37	Dawson College	81.5			
4	38	Cégep de Sept-Îles	69.4			
5	20	Algonquin College	51.1			
6	17	Olds College	50.1			
7	36	Holland College	45.5			
8	29	Camosun College	44.2			
9	47	Cégep de Rimouski	42.5			
10	42	Saskatchewan Polytechnic	42.3			

Niagara College

APPLIED DREAMS.

Among the 4 leading provinces with more than 1 college reporting, average per-college income was highest in British Columbia (\$3.61 million), Québec (\$3.58 million), Ontario (\$3.38 million) and Alberta (\$3.22 million).

#### **RESEARCH INCOME GROWTH**

In spite of the tepid national result (0.5% increase), many colleges exhibited substantial rates of growth in income last year. Income grew by over 200% at Fanshawe College, by more than 99% at St. Lawrence College and by over 81% at Dawson College. Many other colleges posted substantial research income gains as well.

#### **RESEARCH INTENSITY**

As a consequence of flat revenues and expanding research faculty numbers, average research intensity (research income per faculty) among the Top 50 fell by 2.6% to \$80,330 from \$82,430. Research intensity was highest at Cégep de l'Abitibi-Témiscamingue (\$540,800 per faculty), Aurora College (\$338,100), and Yukon College (\$313,000). Overall, 18 of the 50 research colleges posted intensities higher than the national average.

#### RESEARCH PARTNERSHIPS, PROJECTS AND STUDENTS

Important indicators of the "reach" of college research are: the number of active and completed formal research partnerships and projects that colleges undertake with external organizations; and the number of students involved in research. Total partnerships increased by 12.5% to 2,551 in Fiscal 2015 from 2,268 in Fiscal 2014.

The number of completed projects rose by 13.0% to 2,439 from 2,158 the prior year. Also, 31 of 50 colleges expanded the number of completed projects. Sheridan College led its counterparts both in the number of formal partnerships (298) and completed projects (444) in Fiscal 2015. Cégep de Trois-Rivières (134 partnerships, 162 completed projects) was tops in its category. Cégep de Thetford was the leader among small colleges in forging partnerships (99), while Cégep de La Pocatière led in completed projects (204).

In total, the number of students paid to participate in research projects expanded by 33.2%, to 2,061 from 1,547 the year before. George Brown College (442 paid student researchers), Lambton College (99) and Cégep de la Gaspésie et des Îles (31) headed the large, medium and small categories, respectively.

#### INTERACTION WITH INDUSTRY

One of the colleges' key missions is to work with industry. RE\$EARCH Infosource asked the Top 50 Research Colleges to indicate the amount of research that companies funded in Fiscal 2015, both in absolute terms and as a percentage of their total research income. Overall, industry income fell 8.3% to \$37.2 million from \$40.6 million the prior year.

Among large colleges Northern Alberta Institute of Technology (NAIT) was the leader, attracting \$1.24 million of research income from industry. Cégep de Saint-Hyacinthe was tops among medium colleges (\$5.62 million) and Cégep de La Pocatière led small colleges, with \$3.23 million of research income from industry.

In terms of industry contribution to all research income (percent of total), Saskatchewan Polytechnic led

	Large	#_	Rank	Medium	#_	Rank	Small	#
1	Sheridan College	298	1	Cégep de Trois-Rivières	134	_1	Cégep de Thetford	99
_ 2	Niagara College	149_	2	Collège communautaire du		2	Collège Shawinigan	98
3	George Brown College	130 .		Nouveau-Brunswick	81	3	Cégep de La Pocatière	8
	4DED OF 4044DIETE		3	Cégep Édouard-Montpetit	74			
	ABER OF COMPLETE	# #		Medium	#	Rank	Small	;
1	Sheridan College	444	1	Cégep de Trois-Rivières	162	1	Cégep de La Pocatiè	e 20
2	George Brown College	112	2	Cégep Édouard-Montpetit	t 80	2	Collège d'Alma	10
3	Niagara College	105	3	Cégep de Sainte-Foy	61	3	Cégep de Thetford	9
	Centennial College	235	2	Cégep de Saint-Hyacinthe			et des Îles	
1	George Brown College		1	Cágan do Saint Hyacintha	<b>99</b>	1	Cégep de la Gaspésie et des Îles	3
3	Algonquin College	160	3	Cambrian College	48	_ 2	Cégep de La Pocatière	2
						3	Cégep de Thetford	2
	USTRY RESEARCH IN				\$000_	Rank	Small	\$00
Rank						1	Cégep de La	
	NAIT - Northern		1	Cégep de		•	<b>.</b>	
Rank	NAIT - Northern Alberta Institute of	1 225		Saint-Hyacinthe \$5	5,615		Pocatière	33,22
Rank	NAIT - Northern Alberta Institute of	1,235	2	Saint-Hyacinthe \$5 Cégep	5, <b>615</b> 4,107	2	<b>.</b>	\$3, <b>22</b> \$1,51
Rank		,	1	Cógon do				

**INDUSTRY RESEARCH INTENSITY** (Industry Research Income as a % of Total Research Income)

Cégep de Saint-Hyacinthe 54.6

3 Cégep de Sainte-Foy 40.9

Rank Medium

the way among large colleges, with industry contributing 32.5% of all research income. At medium size Cégep André-Laurendeau, companies contributed 87.3% of the college's research budget. Cégep de Lévis-Lauzon derived 92.7% of its research budget from industry, leading both the small colleges and nationwide.

Size is based on total college income:
 Large: more than \$100 million; Medium = \$50 million to \$100 million;

24.3

#### THIS YEAR AND NEXT

Rank Large

Saskatchewan

SAIT Polytechnic

1. Data are for FY2014-2015.

NAIT - Northern Alberta

Institute of Technology

**Polytechnic** 

From a financial standpoint, the pace of college research has slowed dramatically, to 0.5% growth last year, compared with growth rates of 4.7% in Fiscal 2014, 30.8% in Fiscal 2013 and 33.3% in Fiscal 2012. Encouragingly, the number of college faculty involved with research is on the rise, as is the number of paid student researchers. Similarly, there is strong growth in the number of active research projects and the number of projects being completed. In addition, many individual colleges performed better than the national trends would indicate.

Colleges in Québec performed especially well last year, occupying 5 of the top 10 spots nationally. Québec colleges have affiliated CCTTs – dedicated college centers for technology transfer – which have

proven to be effective mechanisms for linking college research to external organizations. A national Technology Access Centres program was recently launched to help spread the CCTT model more widely across Canada, but is still in a formative stage.

% Rank Small

3

excludes in-kind contributions/donations

\*Research partnerships and completed research projects with external organizations governed by formal written agreements
\*\*Students that were involved in applied research projects that were

<sup>+</sup>Research income from industry sources in the form of grants or contracts;

Cégep de

Lévis-Lauzon

Collège d'Alma

Cégep de Sept-Îles

With most college (and university) research dollars coming directly or indirectly from federal government coffers, college research activity tends to vary with federal largesse. Direct corporate research funding accounts for a small portion of the total. Last year we highlighted some structural impediments to college research: faculty do not generally have a research mandate; there is no dedicated graduate student researcher pool; and, the infrastructure to support additional research is not yet well developed. These continue to be barriers. We also proposed that the colleges work together to establish a national action plan that would focus on moving the sector forward in research. We still believe this would be a good idea.

Colleges will undoubtedly be looking to the federal government's impending science and technology strategy to signal new directions – and new resources – for college research.



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### How College-Industry Partnerships are Addressing Canada's Innovation



**Darren Lawless, PhD**Dean, Applied Research & Innovation
Humber College

anada has an innovation problem. We score a mediocre "C" on innovation according to the recent Conference Board of Canada innovation report card, ranking only ninth among sixteen peer countries. We have become laggards in the innovation game, and if not corrected, Canadian standards of living could deteriorate. Part of the problem is a lack of business investment in innovation and R&D – which scores only a "D" in the same report– suggesting that com-

panies need to see a stronger value proposition that warrants their time and effort. It is time to find new and practical solutions to address this challenge.One idea that Humber is already piloting is to recalibrate how colleges and polytechnics collaborate with industry. Rather than focusing on ideation, institutions such as Humber should turn to their strengths teaching and learning, education and training. After extensive consultation with our industry partners and interested stakeholders, we have launched the Springboard Mentorship program, designed to transition college graduates into the new innovation economy. The program leverages the strengths of Humber faculty while helping recent graduates to develop the skills sought by the industries in which they hope to work. It is a true partnership between Humber, a company, and a funder.

#### HOW DOES THE PROGRAM WORK?

Humber hires recent graduates to work on critical applied research challenges under the guidance of a faculty member. These graduates develop solutions to industrially relevant problems while also providing mentorship to undergraduate students who are engaged in applied research projects. External funding supports their time working at Humber. At the same time, these graduates are employed for two days a week at a company where they can apply and refine their skills, learn about their industry and gain valuable work experience.

#### THE BENEFITS ARE MULTI-LAYERED.

Graduates put their skills into action immediately, generating an influx of new ideas, new designs and new ventures into the marketplace.

They also benefit from the faculty member's expertise and guidance, helping them to polish their applied research skills. In exchange, graduates help to reduce faculty workload by assisting students involved in faculty-run projects or externally-driven work. By acting as mentors to junior students, graduates develop leadership and communication skills while improving their practical knowledge.



Graduates complete the program more employable and better equipped to take the next step in their career, easing their transition into the workforce.

For an employer, the program reduces the risk of hiring new graduates, as they are able to see a graduate's body of real-world work

experience instead of simply hoping that there's talent behind that graduate's credential.

The Springboard Mentorship concept resonates with Humber's partners. Through the generosity of the Barrett Family Foundation and the support of Magna International, Humber has launched the program

with two recent graduates. The results to date are encouraging, and there is hope that the government will see the benefit and allow the program to be expanded. By looking at new approaches, we can begin to address the innovation challenge and get into a game that can impact and improve the quality of life of all Canadians.



## It Takes a Whole Country...



**Dr. Marc Nantel**Associate Vice-President
Research & Innovation
Niagara College Canada

ant to increase Canadian business investments in research and development? Crave more new products on the market and jobs created? Need a better workforce ready to tackle today's complex and shifting world? Supporting applied research at colleges is one of your best bets to collect all three. If you hadn't considered this angle yet, it's maybe because, save a few exceptions, applied research in colleges in Canada is a relatively new phenomenon, barely 15 years old.

In fact, I'd put it at the same age as its human analogue: a 15-year-old teenager who's starting to discover that while a little pocket money is nice, a real part-time job and the keys to the family car would be much better. It's time for a growth spurt in college applied research so it can reach adulthood, to contribute more substantially to the innovation economy with partnerships with industry and enhanced graduates. For this, at least two important processes must take place.

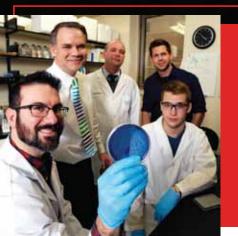
First, a look at the "caloric intake" of that "teenager". It needs to be fed sufficiently, lest its growth be stunted. From 2006 to 2015, the number of NSERC-eligible colleges grew from 6 to 112.1 That's a staggering compound annual growth rate (CAGR) of 34%. Meanwhile, the funding for college applied research from its main sources (industry, colleges, Federal and Provincial governments) went from \$45M to \$253.4M in the same period,2 for a much lower CAGR of 18.9%. It's even worse when one considers that, presently, colleges receive a mere 2.4% of federal funding for higher-education research.3 Looks like the older sibling is eating our lunch... It has to be noted and applauded that NSERC and other federal agencies have shown incredible leadership in establishing programs to seed and grow applied research in the college sector across Canada. But in light of the current federal review of research and inno-

vation, much more can be done. For

every \$1 that the federal government currently puts in college applied research, another \$2.4 are invested by the provinces, the colleges and industry (which matches at more than 1:1).<sup>2</sup> The most effective way of increasing the system's "caloric intake" is for the federal government to put more on the plate.

But, as every teenager has been told: with great power comes great responsibility. Colleges also have to accept the mantle of "research adulthood." At the risk of causing whiplash by switching metaphor in midstream: it's time for the college applied research enterprise to graduate from a start-up to a small- and medium-sized enterprise (SME). The more advanced research colleges are already there, but the whole system will benefit from the newer ones turning the corner. Niagara College was in a highly successful start-up phase in 2002-2007, when the field was wide open. When I came on board in 2011, we had to graduate to the SME status to remain competitive (repeat partners, larger projects, consolidated research focii, more formalized practices, better outcomes and metrics). For the government and industry to see the value of applied research at colleges, through the economic development impact it provides, we must accelerate more colleges into that next phase, that "adult" or SME

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phase. And this starts, like at Niagara College, with upper management being serious about supporting applied research at their college.

Both of the above processes need to happen hand in hand. It's challenging for colleges to make the jump to "research adulthood" without proper support. In Ontario, help comes through programs such as OCE's Industry Innovation Centre funding and the recent commitment from the provincial government of \$20M over three

years for a college applied research envelope. A cross-Canada example is the NSERC-funded Tech-Access Canada network of Technology Access Centres (TACs), launched this year, through which 30 NSERC TACs are sharing best practices and presenting one coherent message to prospective industry clients. Of course, installing a true program to cover the indirect costs of research, such as is available to most university Tri-Council funding programs, should be a top priority.

It has been said that it takes a village to raise a child. Well, it will take a whole country – industry, government and the colleges themselves – to raise the college research sector into its full potential, for the benefit of Canadian businesses, our graduates and the economy.

<sup>1</sup> NSERC data, private communication, 2016. <sup>2</sup> ACCC/CICan Applied Research Reports, 2006/2015. <sup>3</sup> CICan. Pro hydrot Consultations, 2017.

<sup>3</sup> CICan: Pre-budget Consultations – 2017 Federal Budget Canada's Colleges and Institutes – Skills and Innovation for Inclusive and Broad-based Growth in Canada, 2016.

### Nurturing a Culture of Scholarship, Research and Creative Activities



**Cindy Gillett**Director, Office of Applied
Research and Innovation
Sheridan

heridan is committed to cultivating and supporting a differentiated culture of Scholarship, Research and Creative Activities (SRCA) – one which is inclusive, broad, and engages our students, staff, professors and the communities we serve. This commitment enables SRCA to be embedded, where appropriate, within the curriculum of Sheridan credentials. Our focus on

building opportunities for faculty and students to engage in SRCA activities across Faculties means innovative thinking is taking place on every campus, across a variety of disciplines – and it's creating practical solutions for our wide range of partners.

We are very proud to have a broad network of industry and community partners as part of our SRCA ecosystem. Our partners range from young local start-ups to large international market leaders. While each partnership is different, we approach every project with a few common questions: what is the right mix of students and faculty expertise for this particular challenge? How can we apply Sheridan's hallmark creativity to produce a truly practical solution for our partner? How can we ensure this experience will be a meaningful learning opportunity for our students?

Effective academic-community collaborations are win-win situations for all participants in the

process. For our partners, engaging in applied research with institutions like Sheridan provides a path to innovation and commercialization. Collaboration with Sheridan can provide access to resources, skills training and expertise while removing some of the major risks involved with research and development, such as investing in specialized infrastructure.

At our Centre for Advanced Manufacturing and Design Technologies (CAMDT), our partners will find one of the most advanced suites of additive manufacturing infrastructure of any postsecondary institution in Canada. This suite will grow this coming year with the addition of machines capable of working with polyjet and metal materials, opening doors to new collaborations with the health innovation and aerospace industries, among others.

Our Centre for Elder Research can help partners better understand how to create solutions that improve the quality of life for Canada's rapidly growing population of older adults. The Centre's focus on creative aging, and insights into how technology can support our aging population, mobilizes Sheridan's expertise in the arts, applied computing, and much more.

From its central location at Pinewood Toronto Studios, our Screen Industries Research and Training (SIRT) Centre offers partners in film, television and digital media the chance to explore tools like high frame rate cinema, high-speed fibre collaboration, and virtual and augmented reality. SIRT is also collaborating with social innovation partners looking to integrate immersive visualization technologies into global citizenship projects.

Students in our renowned Honours Bachelor of Musical Theatre Performance program are helping Canadian and international composers, lyricists and book-writers develop their ideas as part of our Canadian Music Theatre Project (CMTP), Canada's first incubator for the development of new musical theatre works. Working with a cast of students, writers bring their new musical to life through workshops and staged readings. In the spring of 2017, one of the first musicals incubated at Sheridan, *Come From Away*, will make its Broadway debut.

New in 2016 with the support of the Social Sciences and Humanities Research Council of Canada, Sheridan is now tackling funded social innovation projects in the areas of social isolation and bullying among older adults, the application of creative problem-solving to support a local community foundation, and video games that support the rehabilitation targets of children living with Cerebral Palsy.

Our ranking on this year's list also reflects our commitment to integrating experiential and community-based projects into our curriculum. We've worked hard to ensure students across Faculties have the opportunity to work on projects with industry clients or community partners that help them put into practice their classroom knowledge and collaborate with their peers to address a client's challenge.

In fact, in 2015 60% of fourth-year degree students participated in courses with a community-based project.

A snapshot of these curriculumbased projects illustrates our growing culture of engagement in the broad spectrum of scholarship, research and creative activities.

These include the many initiatives that take place in our Pilon School of Business, such as students developing integrated marketing communications plans and promotional tools to help community clients reach a new audience. In our Faculty of Applied Science and Technology, applied computing students are helping small businesses develop innovative apps, while engineering students are helping our local manufacturing sector integrate advanced manufacturing tools into their workflows.

As we progress on our journey to becoming Sheridan University, integrating high quality experiential learning opportunities for our students and applying purposeful creativity for the enrichment of our communities and local economies will continue to be pillars of our vision.

To learn more about research at Sheridan, please visit http://research. sheridancollege.ca.



research.sheridancollege.ca

Creativity isn't just for artists anymore. Partner with Sheridan and use our Creative Campus for prototypes, feasibility studies, commercialization strategies and skills upgrading.

Sheridan Get Creative



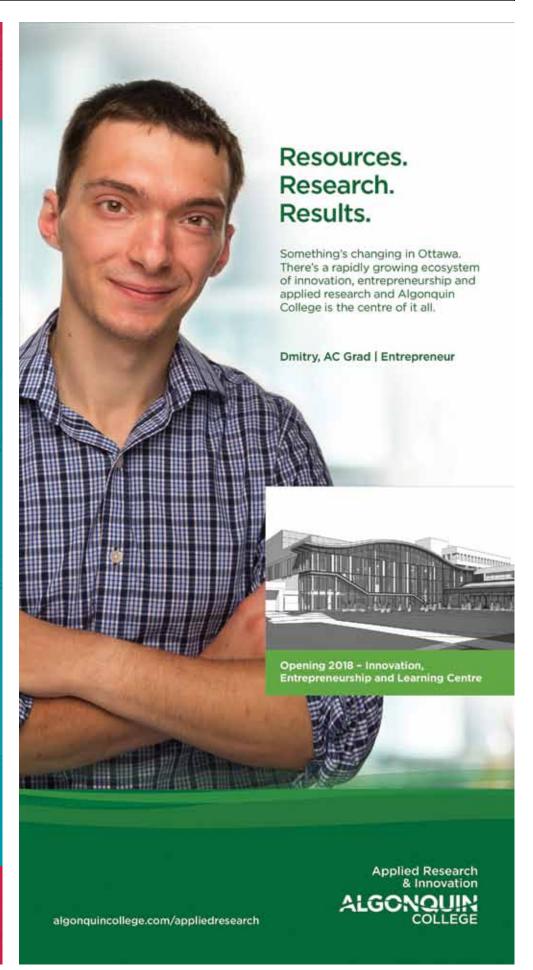
# WE'RE OPEN FOR BUSINESS

Home to the largest applied research program on the Prairies, Red River College matches industry problems and needs with College expertise, resources and facilities.

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Partner with us today at rrc.ca/appliedresearch

THE DIFFERENCE IS HERE













#### THALES

















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is Canada's source of R&D intelligence. Data used for this table were extracted from our proprietary Canadian Corporate R&D Database. Companies wishing to be included in future editions of the Top 100 List, or who wish to adjust their figures should contact us directly.

For further information, please contact Arlene Dwyer at 647-345-3434 Ext 23. arlene@researchinfosource.com www.researchinfosource.com

## Canada's **TOP 100 CORPORATE R&D SPENDERS** 2016

1 2			. ,			Revenue	Intensity	
2	2014	Company	FY2015 \$000	FY2014 \$000	% Change 2014- 2015	FY2015 \$000	R&D as % of Revenue**	Industry
_	1	Bombardier Inc.*	\$2,293,988	\$2,022,340	13.4	\$23,236,536		Aerospace
3	3 2	Magna International Inc.* BlackBerry Limited* ++	\$639,350 \$599,710	\$585,385 \$785,300	9.2 -23.6	\$41,089,746 \$2,761,992	1.6 21.7	Automotive Comm/Telecom Equipment
4	4	BCE Inc.	\$530,300	\$546,000	-2.9	\$21,514,000	2.5	Telecommunications Services
5 6	7 5	Canadian Natural Resources Limited Pratt & Whitney Canada Corp. (fs)	\$527,000 \$518,000	\$450,000 \$542,000	17.1 -4.4	\$12,795,000 nd	4.1	Energy/Oil & Gas Aerospace
7	6	IBM Canada Ltd. (fs)	\$477,000	\$466,000	2.4	nd		Software & Computer Services
8 9	13 8	Valeant Pharmaceuticals International, Inc.* Rogers Communications Inc.	\$427,597 \$425,287	\$271,707 \$418,000	57.4 1.7	\$13,357,940 \$13,414,000	3.2 3.2	Pharmaceuticals/Biotechnology Telecommunications Services
10	12	Constellation Software Inc.*	\$349,325	\$287,518	21.5	\$2,350,646	14.9	Software & Computer Services
11 12	10 11	Ericsson Canada Inc. (fs) Apotex Inc.	\$316,000 \$274,505	\$315,000 \$311,105	0.3 -11.8	nd \$1,875,891	14.6	Comm/Telecom Equipment Pharmaceuticals/Biotechnology
13	14	CGI Group Inc.	\$257,177	\$262,492	-2.0	\$10,287,096	2.5	Software & Computer Services
14 15	16 17	Open Text Corporation* TELUS Corporation	\$251,253 \$206,000	\$195,313 \$194,000	28.6 6.2	\$2,368,046 \$12,502,000	10.6 1.6	Software & Computer Services Telecommunications Services
16	21	Suncor Energy Inc.	\$200,000	\$150,000	33.3	\$29,589,000	0.7	Energy/Oil & Gas
17 18	19 18	Imperial Oil Limited General Motors of Canada Limited (fs)	\$195,000 \$190,000	\$175,000 \$190,000	11.4 0.0	\$26,756,000 nd	0.7	Energy/Oil & Gas Automotive
19	15	AMD Canada (fs)	\$185,422	\$206,000	-10.0	\$372,497	49.8	Electronic Systems & Parts
20	24 20	Mitel Networks Corporation* BRP Inc. <sup>++</sup>	\$168,021 \$164,400	\$130,662 \$158,200	28.6 3.9	\$1,480,351 \$3,829,200	11.4 4.3	Comm/Telecom Equipment Transportation
22	22	CAE Inc.	\$138,900	\$149,000	-6.8	\$2,246,300	6.2	Aerospace
23 24	25 29	Sanofi (fs) <sup>(a)</sup> Hydro-Québec	\$133,300 \$130,000	\$130,471 \$106,000	2.2 22.6	\$694,930 \$13,754,000	19.2 0.9	Pharmaceuticals/Biotechnology Electrical Power & Utilities
25	23	MDA	\$129,266	\$138,951	-7.0	\$2,117,363	6.1	Software & Computer Services
26 27	30 31	Cisco Canada (fs) Sierra Wireless, Inc.*	\$114,926 \$95,390	\$104,156 \$91,286	10.3 4.5	nd \$777,191	12.3	Comm/Telecom Equipment Comm/Telecom Equipment
28	39	Pfizer Canada Inc. (fs)	\$95,185	\$68,302	39.4	\$1,107,055	8.6	Pharmaceuticals/Biotechnology
29 30	44 26	Huawei Canada (fs) Cenovus Energy Inc.	\$93,840 \$91,000	\$52,800 \$124,000	77.7 -26.6	nd \$13,604,000	0.7	Comm/Telecom Equipment Energy/Oil & Gas
31	34	PMC-Sierra Ltd. (fs) * +	\$87,781	\$78,003	12.5	nd		Electronic Systems & Parts
32 33	42 28	Bayer Inc. (fs) GlaxoSmithKline Inc. (fs)	\$84,300 \$80,907	\$57,089 \$110,125	47.7 -26.5	\$860,168 \$848,303	9.8 9.5	Pharmaceuticals/Biotechnology Pharmaceuticals/Biotechnology
34	35	Janssen Inc. (fs)	\$74,749	\$73,916	1.1	\$1,714,964	4.4	Pharmaceuticals/Biotechnology
35 36	36 37	Amgen Canada Inc. (fs) Linamar Corporation	\$72,800 \$71,937	\$73,900 \$70,004	-1.5 2.8	nd \$5,162,450	1.4	Pharmaceuticals/Biotechnology Automotive
37		Amaya Inc.	\$68,312	\$25,384	169.1	\$1,371,040	5.0	Software & Computer Services
38 39	32 50	Westport Innovations Inc.* Arbutus Biopharma Corporation*	\$67,761 \$65,859	\$85,568 \$42,759	-20.8 54.0	\$132,095 \$31,805	51.3 207.1	Transportation Pharmaceuticals/Biotechnology
40	40	Evertz Technologies Limited	\$64,332	\$60,196	6.9	\$363,606	17.7	Comm/Telecom Equipment
41 42	41 46	EXFO Inc.* Novelis Inc. (fs) *	\$64,124 \$63,935	\$57,901 \$49,703	10.7 28.6	\$284,906 \$14,253,669	22.5 0.4	Medical Devices & Instrumentation Mining & Metals
43	9	Atomic Energy of Canada Limited <sup>(b)</sup>	\$63,800	\$64,200	-0.6	\$141,468	45.1	Engineering Services
44 45	38 27	Redknee Solutions Inc.* Syncrude Canada Ltd.	\$61,416 \$58,698	\$68,715 \$112,094	-10.6 -47.6	\$284,818 nd	21.6	Software & Computer Services Energy/Oil & Gas
46	48	SMART Technologies Inc.*	\$55,759	\$45,564	22.4	\$630,296	8.8	Computer Equipment
47 48	45	Novartis Pharmaceuticals Canada Inc. (fs) Shell Canada Limited (fs) *	\$53,000 \$52,427	\$76,000 \$55,225	-30.3 -5.1	nd \$5,632,674	0.9	Pharmaceuticals/Biotechnology Energy/Oil & Gas
49	61	Shopify Inc.*	\$52,145	\$30,053	73.5	\$262,431	19.9	Software & Computer Services
50 51	56 33	ProMetic Life Sciences Inc. Ontario Power Generation Inc.	\$51,570 \$50,000	\$36,635 \$84,000	40.8 -40.5	\$24,534 \$5,476,000	210.2 0.9	Pharmaceuticals/Biotechnology Electrical Power & Utilities
52	78 93	Transition Therapeutics Inc.+ Titan Medical Inc.*	\$49,210	\$17,614	179.4	\$0 \$0		Pharmaceuticals/Biotechnology
53 54	52	Dorel Industries Inc.*	\$48,863 \$48,073	\$11,795 \$39,885	314.3 20.5	\$3,431,209	1.4	Medical Devices & Instrumentation Other Manufacturing
55 56	73 54	Teck Resources Limited TransCanada Corporation	\$47,000 \$46,600	\$20,000 \$38,809	135.0 20.1	\$8,259,000 \$11,300,000	0.6 0.4	Mining & Metals Energy/Oil & Gas
57	47	Pharmascience Inc.	\$46,600	\$45,821	-2.6	\$730,961	6.1	Pharmaceuticals/Biotechnology
58 59	55 60	Enghouse Systems Limited Descartes Systems Group Inc.* ++	\$42,357 \$40,014	\$38,147 \$31,011	11.0 29.0	\$279,313 \$236,551	15.2 16.9	Software & Computer Services Software & Computer Services
60	57	Cascades Inc.	\$37,813	\$36,526	3.5	\$3,861,000	1.0	Forest & Paper Products
61 62	53 49	Martinrea International Inc. Trican Well Service Ltd.	\$36,958 \$34,900	\$38,835 \$45,100	-4.8 -22.6	\$3,866,771 \$1,188,068	1.0 2.9	Automotive Energy/Oil & Gas
63	63	Thales Canada Inc. (fs)	\$33,100	\$26,399	25.4	\$488,800	6.8	Electronic Systems & Parts
64 65	74 59	AstraZeneca Canada Inc. (fs) Monsanto Canada Inc. (fs) +	\$32,914 \$32,864	\$19,235 \$32,309	71.1 1.7	\$668,963 \$729,612	4.9 4.5	Pharmaceuticals/Biotechnology Agriculture & Food
66	58	Pason Systems Inc.	\$31,733	\$35,427	-10.4	\$285,148	11.1	Software & Computer Services
67 68	71 65	Performance Sports Group Ltd.* Avigilon Corporation	\$31,712 \$31,548	\$20,382 \$24,689	55.6 27.8	\$837,153 \$369,411	3.8 8.5	Other Manufacturing Computer Equipment
69	67	Sandvine Corporation*	\$31,214	\$27,952	11.7	\$157,703	19.8	Comm/Telecom Equipment
70 71	62	Cynapsus Therapeutics Inc. SNC-Lavalin Group Inc.	\$27,402 \$26,775	\$6,193 \$28,629	342.5 -6.5	\$9,586,954	0.3	Pharmaceuticals/Biotechnology Engineering Services
72	68	Lockheed Martin Canada (fs)	\$22,635	\$21,032	7.6	\$389,257	5.8	Aerospace
73 74	92 66	Novadaq Technologies Inc.* Celestica Inc.*	\$22,440 \$22,249	\$11,909 \$21,759	88.4 2.3	\$81,596 \$7,411,473	27.5 0.3	Medical Devices & Instrumentation Electronic Systems & Parts
75	64	AEterna Zentaris Inc.*	\$22,106	\$26,367	-16.2	\$1,120		Pharmaceuticals/Biotechnology
76 77	87 80	Canadian Solar Inc.* Kinaxis Inc.*	\$21,810 \$21,464	\$13,317 \$17,034	63.8 26.0	\$4,434,053 \$116,708	0.5 18.4	Energy/Oil & Gas Software & Computer Services
78	82	Ballard Power Systems Inc.*	\$20,723	\$15,788	31.3	\$72,199	28.7	Machinery
79 80	100 83	Aurinia Pharmaceuticals Inc.* Winpak Ltd.*	\$20,436 \$19,643	\$10,106 \$15,767	102.2 24.6	\$300 \$1,019,340	1.9	Pharmaceuticals/Biotechnology Rubber & Plastics
81	98	Concordia Healthcare Corp.*	\$19,170	\$10,273	86.6	\$504,094	3.8	Pharmaceuticals/Biotechnology
82 83	95	Trillium Therapeutics Inc. Clementia Pharmaceuticals Inc.	\$18,604 \$18,595	\$10,919 \$8,617	70.4 115.8	\$0 \$0		Pharmaceuticals/Biotechnology Pharmaceuticals/Biotechnology
84	51	Servier Canada Inc. (fs)	\$18,400	\$40,245	-54.3	\$294,736	6.2	Pharmaceuticals/Biotechnology
85 86	81 75	Computer Modelling Group Ltd. ViXS Systems Inc.* ++	\$18,313 \$18,311	\$16,439 \$19,206	11.4 -4.7	\$84,861 \$33,612	21.6 54.5	Software & Computer Services Electronic Systems & Parts
87 88	76	DragonWave Inc.* ++ Northland Power Inc.	\$17,142	\$18,569	-7.7	\$110,345	15.5	Comm/Telecom Equipment Electrical Power & Utilities
88 89	69 89	Halogen Software Inc.*	\$16,345 \$16,303	\$21,024 \$13,511	-22.3 20.7	\$728,141 \$84,000	2.2 19.4	Software & Computer Services
90 91	77	IMAX Corporation* UrtheCast Corp.	\$16,278	\$17,778	-8.4 414.7	\$477,984 \$36,519	3.4 43.0	Other Services Software & Computer Services
91	86	OrtheCast Corp.  Mediagrif Interactive Technologies Inc.	\$15,688 \$15,347	\$3,048 \$14,381	6.7	\$36,519 \$70,247	21.8	Software & Computer Services
93 94	85 91	Resolute Forest Products Inc. (fs) Absolute Software Corporation*	\$15,300	\$14,500	5.5 20.7	\$2,790,000 \$119,750	0.5	Forest & Paper Products
94 95	90	ShawCor Ltd.	\$14,696 \$13,664	\$12,177 \$13,053	4.7	\$119,750 \$1,810,648	12.3 0.8	Software & Computer Services Other Manufacturing
96 97	84 70	QLT Inc.* + Héroux-Devtek Inc.	\$12,518 \$12,500	\$15,245 \$20,982	-17.9 -40.4	\$0 \$364,916	3.4	Pharmaceuticals/Biotechnology
98		Intertape Polymer Group Inc.*	\$12,095	\$8,696	39.1	\$999,824	1.2	Aerospace Rubber & Plastics
99 100	97	Tesco Corporation* Nymox Pharmaceutical Corporation*	\$11,761 \$11,061	\$10,574 \$5,260	11.2 110.3	\$357,701 \$3,530	3.3 313.3	Energy/Oil & Gas Pharmaceuticals/Biotechnology

- 1. Data were obtained through annual reports, financial statements, securities commission filings, or
- 2. We have attempted, wherever possible, to provide gross R&D spending before deduction of investment tax
- credits or government grants. 3. We have attempted, wherever possible, to provide revenue net of interest and investment income.
- 4. FY2014 R&D spending figures may have been adjusted as more accurate information became available 5. Canadian-owned company results included worldwide revenue and R&D spending; foreign subsidiaries (fs) for their Canadian operations only.
- \*Converted to CDN\$ at annual average 2015 = 1.2787, 2014 = 1.1045 (Bank of Canada)
- \*\*Based on companies with \$2 million or more of revenue
- \*Not current name/acquired/merged \*+Fiscal 2016 figures were used for year-ended January or February fs = Foreign subsidiary (included revenue and R&D spending for Canadian operations only)
- (a) Sanofi Pasteur Limited and Sanofi-Aventis Canada Inc. (including Genzyme Canada).
- (b) Atomic Energy of Canada Limited revised their reporting for FY2015, the FY2014 figure has been adjusted © RE\$EARCH Infosource Inc. 2016. Unauthorized reproduction prohibited

#### CANADA'S TOP 100 Corporate R&D Spenders

#### **HEALTHY GAINS IN CORPORATE R&D SPENDING**

Canada's Top 100 Corporate R&D Spenders expanded their spending on research and development by a healthy 6.9%, in Fiscal 2015 on the heels of a 1.6% reduction in Fiscal 2014. Total spending increased to \$12.8 billion from \$12.0 billion the year before, even though revenues fell by 5.1% to \$360.0 billion from \$379.3 billion, for the 84 Top 100 companies where

figures were available. Research spending rose at

The \$1	00 Million Club	
2015	R&D	Spending
Rank	Company	\$000
1	Bombardier Inc.	\$2,293,988
2	Magna International Inc.	\$639,350
3	BlackBerry Limited	\$599,710
4	BCE Inc.	\$530,300
5	Canadian Natural Resources Limited	\$527,000
6	Pratt & Whitney Canada Corp. (fs)	\$518,000
7	IBM Canada Ltd. (fs)	\$477,000
8	Valeant Pharmaceuticals	
	International, Inc.	\$427,597
9	Rogers Communications Inc.	\$425,287
10	Constellation Software Inc.	\$349,325
11	Ericsson Canada Inc. (fs)	\$316,000
12	Apotex Inc.	\$274,505
13	CGI Group Inc.	\$257,177
14	Open Text Corporation	\$251,253
15	TELUS Corporation	\$206,000
16	Suncor Energy Inc.	\$200,000
17	Imperial Oil Limited	\$195,000
18	General Motors of Canada	
	Limited (fs)	\$190,000
19	AMD Canada (fs)	\$185,422
20	Mitel Networks Corporation	\$168,021
21	BRP Inc.	\$164,400
22	CAE Inc.	\$138,900
23	Sanofi (fs) <sup>(a)</sup>	\$133,300
24	Hydro-Québec	\$130,000
25	MDA	\$129,266
26	Cisco Canada (fs)	\$114,926
Canadian o	n subsidiary (included revenue and R&D spend perations only) asteur Limited and Sanofi-Aventis Canada Inc.	ing for

68 Top 100 companies and fell at 31 others, 1 company

For a fourth year, Bombardier Inc. held on to 1st place among the Top 100, with a 13.4% increase in research spending to \$2.3 billion. Bombardier was the only firm to record more than \$1 billion of research. Auto parts manufacturer Magna International expanded R&D spending to \$639.4 million to capture 2nd place on the Top 100 list. BlackBerry Limited fell to the third spot from second on the heels of a 23.6% drop in spending. BCE Inc. remained in 4th position with \$530.3 million of research investment and Canadian Natural Resources Limited advanced two positions to 5th overall with \$527.0 million of R&D, a year-on-year rise of 17.1%.

Research intensity - R&D spending as a percent of revenues - increased by 13.3% among the 84 companies that reported fully, as spending increased while revenues fell. The research intensity ratio averaged 3.0% for these firms, compared with 2.7% in Fiscal 2014.

#### THE \$100 MILLION CLUB

RE\$EARCH Infosource is pleased to showcase 26 companies (down from 30 last year) whose spending gained them membership in the \$100 Million Club – an elite group of firms that spend \$100 million or more on R&D. The Club includes 19 Canadian companies and 7 foreign subsidiaries.

\$100 Million Club members' Fiscal 2015 spending on research fell by 1.4% to \$9.8 billion, from \$10.0 billion the prior year. Club members accounted for 76.6% of total Top 100 spending, down from 81.2% in Fiscal 2014.

#### **INDUSTRY PERFORMANCE**

Five Aerospace companies on the Top 100 list increased their R&D spending by 8.4% and accounted for 23.2% of the Top 100 total, up from 22.4% in Fiscal 2014. With an R&D spending increase of 12.5%, 17 Software

Top 100 – Leading Industries					
Industry	% of Total				
Aerospace (5)	23.2				
Software & Computer Services (17)	14.5				
Pharmaceuticals/Biotechnology (23)	13.3				
Comm/Telecom Equipment (9)	11.7				
Energy/Oil & Gas (10)	9.6				
Telecommunications Services (3)	9.0				
Automotive (4)	7.3				

& Computer Services companies captured 14.5% of the Top 100 total, up from 13.2% last year. Twenty-three Pharmaceuticals/Biotechnology firms on the Top 100 list increased their combined R&D investments by 16.4% and represented 13.3% of the total. In contrast, 9 Communications/Telecom Equipment companies experienced a 5.4% decline in their R&D spending. Taking all its sub-industries into account (including Medical Devices and Instrumentation), the Information and Communications Technology sector still dominated the R&D scene, accounting for a total of 39.7% of allindustry spending.

#### **R&D SPENDING GROWTH**

A number of companies stood out in terms of their R&D spending growth. Against a backdrop of 6.9% total growth in the Top 100, UrtheCast Corp. increased spending by 414.7%, Cynapsus Therapeutics Inc. recorded 342.5% growth in R&D, followed by Titan Medical Inc. (314.3%), Transition Therapeutics Inc. (179.4%) and Amaya Inc. (169.1%).

#### **RESEARCH INTENSITY**

Available data allowed RE\$EARCH Infosource to calculate the R&D intensity - research spending as a percent of revenues - of 82 of the Top 100 firms (with over \$2 million of revenue). A number of companies posted very high intensity levels. Nymox Pharmaceutical Corporation recorded 313.3% R&D intensity followed by ProMetic Life Sciences Inc. (210.2%), Arbutus Biopharma Corporation (207.1%) and ViXS Systems Inc. (54.5%). Westport Innovations Inc. recorded a strong 51.3% R&D intensity.

#### **LOOKING AHEAD**

The growth of 6.9% in Fiscal 2015 Top 100 R&D spending comes as a welcome relief following a drop of 1.6% in last year's Top 100 total, and a decade of tepid results. (Note that the Top 100 composition changes from year to year and results are not strictly comparable.) Encouragingly, spending rose at 7 of the 10 largest spenders this year, compared with a decline at 7 of the 10 the year before. More impressive is that the spending gains countered a 5.2% drop in revenues. Of course, in the medium-long term, revenue gains will be required to fuel sustained R&D spending growth.

The three major drivers of corporate R&D spending are revenues and profitability, government policy (especially tax incentives and grants), and corporate strategy. Two of these - revenues and profitability, and corporate strategy

Top 10 Research Intensive Companies*								
2015 Rank								
Research		R&D	R&D as %					
Intensity Overall		Company of Re	venue					
1	100	Nymox Pharmaceutical Corporation	313.3					
2	50	ProMetic Life Sciences Inc.	210.2					
3	39	Arbutus Biopharma						
		Corporation	207.1					
4	86	ViXS Systems Inc.	54.5					
5	38	Westport Innovations Inc.	51.3					
6	19	AMD Canada (fs)	49.8					
7	43	Atomic Energy of Canada Limited	45.1					
8	91	UrtheCast Corp.	43.0					
9	78	Ballard Power Systems Inc.	28.7					
10	73	Novadaq Technologies Inc.	27.5					
*Based on companies with \$2 million or more of revenue fs = Foreign subsidiary (included revenue and R&D spending for Canadian operations only)								

Top 10 Companies by Growth 2015 Rank R&D % Change 2014-2015 Growth Overall Company UrtheCast Corp. 414.7 2 Cynapsus Therapeutics Inc. 342.5 3 53 Titan Medical Inc. 314.3 52 Transition Therapeutics Inc.+ 179.4 37 Amaya Inc. 169.1 Teck Resources Limited 135.0 Clementia Pharmaceuticals Inc. 115.8 Nymox Pharmaceutical Corporation 110.3 Aurinia Pharmaceuticals Inc. 102.2 Novadaq Technologies Inc. 10 73 88.4

- are within the control of the firm whereas government policy is not. The new federal government has promised to review innovation policy, although major changes that might result are at least one or two budget cycles away. In the meanwhile, corporate leaders will need to forge their own directions in the context of competitive forces and the existing policy environment.

One warm spring day does not signal a hot summer, but the 2016 Top 100 Corporate R&D results at least fuel hope for a warmer R&D climate to come.



(including Genzyme Canada)

#### POTLIGHT ON

#### 15th ANNIVERSARY OF CANADA'S Top 100 Corporate R&D Spenders

In association with its 15th Anniversary, RE\$EARCH Infosource shines the spotlight on companies reporting the largest total R&D spending over the past 15 years.

+Not current name/acquired/merged

Canada's Top 20		lop 20	O Corporate R&D Spenders 2001-2	2015  R&D Spending				
Total 15 Years	2015	2001	Company	Total FY2001- FY2015 \$000	FY2015 \$000	FY2001 \$000	% Change 2001-2015	Industry Sector
1	1 1	16	Bombardier Inc.* ++ (a)	\$12,598,775	\$2,293,988	\$233,500	882.4	Aerospace
2	3	46	BlackBerry Limited* ++ (a)	\$10,177,958	\$599,710	\$77,761	671.2	Comm/Telecom Equipment
3	2	4	Magna International Inc.*	\$9,001,735	\$639,350	\$359,229	78.0	Automotive
4	6	3	Pratt & Whitney Canada Corp. (fs)	\$6,992,766	\$518,000	\$440,000	17.7	Aerospace
5	7	7	IBM Canada Ltd. (fs)	\$6,281,300	\$477,000	\$250,000	90.8	Software & Computer Services
6	43	9	Atomic Energy of Canada Limited <sup>(b)</sup>	\$4,018,220	\$63,800	\$178,945	na	Engineering Services
7	11	5	Ericsson Canada Inc. (fs)	\$3,711,000	\$316,000	\$270,000	17.0	Comm/Telecom Equipment
8	12	20	Apotex Inc.	\$2,914,283	\$274,505	\$115,000	138.7	Pharmaceutical/Biotechnology
9	8	26	Valeant Pharmaceuticals International, Inc.*	\$2,031,533	\$427,597	\$78,995	441.3	Pharmaceuticals/Biotechnology
10	33	23	GlaxoSmithKline Inc. (fs)	\$1,985,468	\$80,907	\$101,373	-20.2	Pharmaceuticals/Biotechnology
11	28	13	Pfizer Canada Inc. (fs)	\$1,835,976	\$95,185	\$132,235	-28.0	Pharmaceuticals/Biotechnology
12	22	17	CAE Inc.	\$1,811,234	\$138,900	\$122,270	13.6	Aerospace
13	14	50	Open Text Corporation*	\$1,711,974	\$251,253	\$37,643	567.5	Software & Computer Services
14	17	28	Imperial Oil Limited	\$1,710,000	\$195,000	\$71,000	174.6	Energy/Oil & Gas
15	24	22	Hydro-Québec	\$1,521,200	\$130,000	\$103,100	26.1	Electrical Power & Utilities
16	31	10	PMC-Sierra Ltd. (fs) * +	\$1,420,611	\$87,781	\$157,000	-44.1	Electronic Systems & Parts
17	45	39	Syncrude Canada Ltd.	\$1,136,333	\$58,698	\$48,300	21.5	Energy/Oil & Gas
18	51	44	Ontario Power Generation Inc.	\$1,099,000	\$50,000	\$42,000	19.0	Electrical Power & Utilities
19	64	27	AstraZeneca Canada Inc. (fs)	\$1,011,139	\$32,914	\$74,971	-56.1	Pharmaceuticals/Biotechnology
20	78	15	Ballard Power Systems Inc.*	\$978,369	\$20,723	\$128,031	-83.8	Machinery

- Notes:

  1. Based on companies that have been on the Top 100 Corporate R&D Spenders list for all 15 years FY2001-FY2015.

  2. Data were obtained through annual reports, financial statements, securities commission filings, or through a survey. Where possible, R&D spending before deduction of investment tax credits or government grants were
- Canadian-owned company figures included worldwide R&D spending; foreign substidiaries (fs) included R&D spending for their Canadian operations only.
   \*Converted to CDN\$ for some or all of the years
- with year-ends January or February for some or all of the years fs = Foreign subsidiary (included R&D spending for Canadian operations only)
- \*Not current name/acquired/merged +\*R&D spending figures used were one fiscal year ahead for companies
- na = Not applicable (a) R&D spending for Fiscal 2001 has been revised from the amount
- originally reported on Canada's Top 100 Corporate R&D Spenders 2002 list. However, the rank shown for 2001 is the original rank reported.

  (b) Atomic Energy of Canada Limited revised their reporting for FY2015.

Therefore a percent change with FY2001 is not applicable

**PARTNER PERSPECTIVE** 

## Tackling the Tailings Challenge through R&D

ecades of oil sands development has produced billions of barrels of oil and benefitted Canadians from coast to coast to coast. It's a unique industry with its own particular challenges, and one that's been of special interest to researchers is tailings – a byproduct of the bitumen extraction process.

Syncrude's research and development tailings technology program is dedicated to addressing the challenges posed by this byproduct and the results to date may change the way the whole industry manages the material.

Tailings is the mixture of sand, clay particles and water that remains when bitumen is removed from oil sand. Tailings are stored in large settling basins, or tailings ponds, that serve two uses - to recycle water for bitumen extraction and, as a containment area to allow tailings to settle prior to further dewatering and use in reclamation activities.

In the tailings pond, sand quickly drops to the bottom while water moves to the top and is recycled for use in the plant. The middle layer contains fine clay particles that take much longer to consolidate. Over time they form what's called Fluid Fine Tailings – FFT – which can take many years to shed water. Syncrude's challenge is to develop new ways to reduce the volume of tailings and incorporate the clay into reclaimed landscapes. Syncrude is a known leader in

creating innovative technologies and processes for the oil sands industry. It has a dedicated R&D facility that employs about 100 scientists and technologists, with many more engaged through their work at universities and research institutes.

Syncrude is consistently among Canada's top investors in research and development, and has spent more than \$600 million over the last five years on its programs, with more than 40 per cent of the funds focused on tailings research.

The company's strategy to reduce



Syncrude's Sandhill Fen is a recently reclaimed area that was part of a now-depleted oil sands mine. It was built on a foundation of mine tailings called composite tails.

and reclaim tailings currently incorporates three technologies - centrifuged tails, composite tails and water capping - to draw out the solids and free up water for recycle. Recently, large scale tests have been conducted on three additional methods with promising results that could become industry standard.

Co-Mixing is a new innovation that mixes the fluid fine tails with overburden material.

Overburden is the layer of earth directly above the oil sand that is rich in clay and has limited use. Co-mixing combines FFT with overburden to make a useful construction material. Depending on its end use the product can be mixed in different ways with varied results. It can be used to build roads, berms, or as a base for reclamation soils.

Clay is difficult to remove from tailings because the composition and structure of clay particles make them attract water. If the clay can't shed water it remains suspended and behaves like fluid.

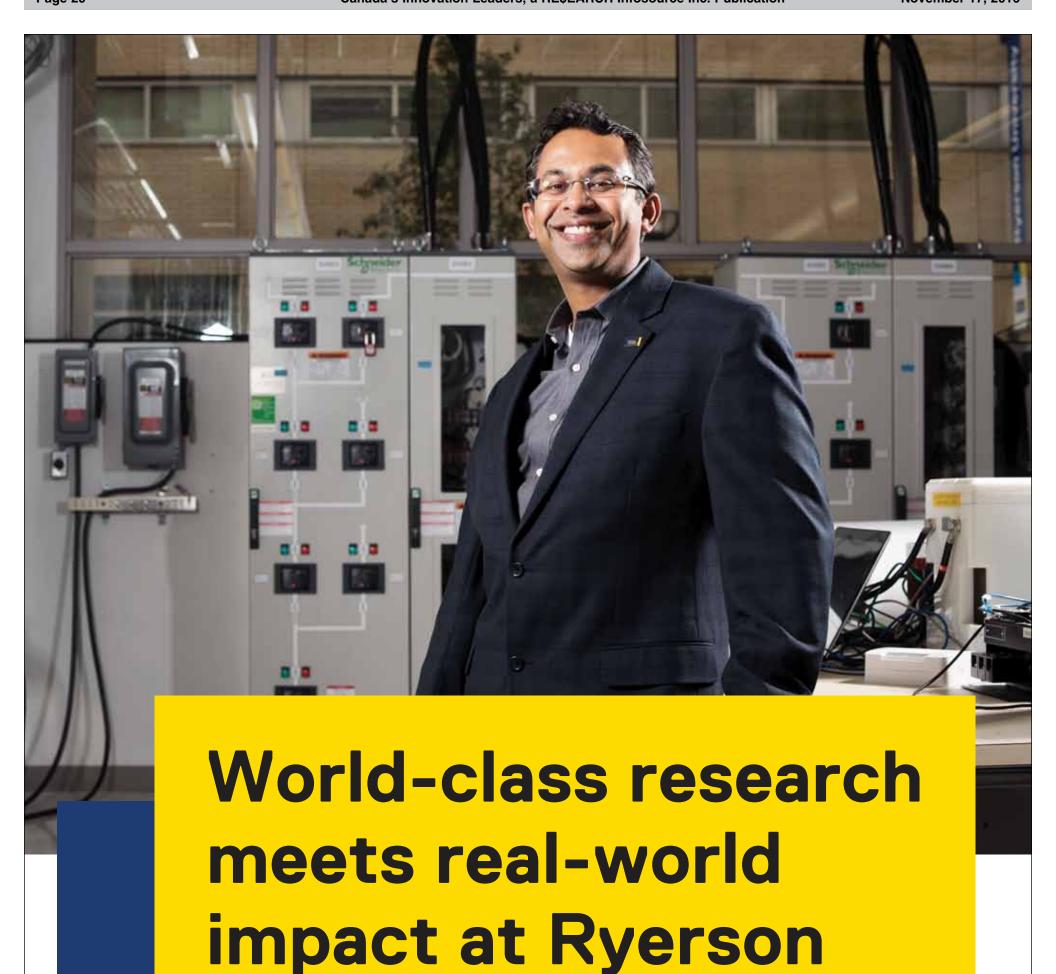
Syncrude has developed a clay treatment method that draws the water out of the clay. The process involves adding a water treatment chemical called flocculant to the FFT material, followed by another chemical "collector" to make the clay surfaces repel water.

Another technology reviewed is CT Tremie. The Tremie placement method is used by the

concrete industry to build structures under water. Syncrude researchers have adopted this technology and applied it to Composite Tailings (CT) - a mixture of FFT, gypsum and sand. Tremie technology uses CT to create landforms at the bottom of a tailings pond that release water for recycling and will one day form a reclaimed upland structure.

"Not only can this Syncrudeengineered device be moved around to different locations, the new, smaller design will save us millions of dollars for years to come and establish landforms that will progress our reclamation efforts," said Jim Lorentz, Leader, Syncrude R&D Tailings Technology.

While tailings management is a challenge for the oil sands industry, Syncrude is doing its part to develop new and innovative technologies to address the issue, return more water to its operation, and create materials that can be used to enhance and accelerate reclamation.



#### Transforming urban energy

Professor Bala Venkatesh is the academic director of Ryerson's Centre for Urban Energy. As director of NESTNet, the NSERC Energy Storage Technology Network, he is bringing researchers, industry and government partners together to improve energy storage technologies and enable their integration into the existing power grid – allowing for greater penetration of renewable energy sources and promoting a more resilient power grid.

## Ryerson researchers are collaborating with industry and community to create innovative solutions to today's challenges

With more than 125 research centres, institutes and labs, and a focus on relevant and interdisciplinary research, Ryerson is a preferred partner for government, industry, not-for-profits, and community.

From introducing new means of energy storage to creating ways to navigate complex data, to improving health outcomes for communities, Ryerson researchers are pushing the boundaries of knowledge to positively impact society.

65%

increase in research funding in the last 5 years

#1

undergraduate university for total research income over the last 15 years (Research Infosource 2016) 190+

local, national and global funding partners

