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CANADA'S
INNOVATION
LEADERS2015

Wanted: Research Partnerships

Turning science into solutions requires a team effort evolving academia, industry and government



By Debbie Lawes

Many believe it to be one of the greatest challenges – and opportunities – of our time. How to turn billions of dollars of research spending into solutions that create jobs, boost productivity, improve our health and wellbeing and safeguard our environment.

Throwing more money at a problem doesn't always work. Neither does a go-it-alone attitude. Instead, countries everywhere have become big believers in the power of public-private partnerships to put good research to good use.

"One of the best ways to address this innovation gap is for academia, government and industry, including small businesses and start-ups, to work more collaboratively on common initiatives," says Dino Trevisani, president of IBM Canada, one of Canada's top 10 industrial research spenders. IBM's model is three-pronged: rapidly transform academic innovation into commercial products and services; leverage the global scale of companies like IBM; and export these made-in-Canada innovations globally.

"Our view can be summed up in four

words: collaborate, innovate, incubate, commercialize," he says.

The Southern Ontario Smart Computing and Innovation Platform (SOSCIP), for example, is a collaboration between IBM Canada Research and Development (R&D) Centre, the Ontario and Canadian governments, the Ontario Centres of Excellence and 14 academic partners. SOSCIP makes it possible for academic and industry researchers to share Canada's fastest supercomputer and the world's largest analytics cloud – rather than duplicating expensive infrastructure.

To date, the partnership has launched 50 projects in areas as diverse as agile computing, health, water, energy, cities, mining, advanced manufacturing, digital media and cybersecurity. It has spun out 38 small businesses and established a pipeline of nearly \$2 billion in revenue for these firms.

One project created a new data management platform that will help protect drinking water, predict floods and safeguard fragile ecosystems along the Grand River, Southern Ontario's longest river. Based on IBM hardware and software, the platform collects and analyzes data every 15 minutes from 120 sensors over 80 square kilometers. Having instant access to data will make it possible to respond more rapidly to heavy rainfalls and other extreme weather events driven by a changing climate.

"These breakthroughs will not only improve the lives of Canadians, but they also represent homegrown technology we can develop and export around the world," says Trevisani.

The need to boost exports while adapting to the effects of climate change is also top of mind in Canada's wheat industry, which generates more than \$5 billion in export revenues every year.

Again, partnerships are becoming the norm. The National Research Council (NRC)

has teamed with Agriculture and Agri-Food Canada, the province of Saskatchewan and the University of Saskatchewan to form the Canadian Wheat Alliance (CWA). Together, they are developing new wheat varieties that increase yields, use less fertilizer and are more resistant to environmental stresses like disease, heat, cold, drought and flood.

In one project, two of the world's leading plant breeding companies, KWS and Syngenta Inc., are working with CWA to develop high-quality wheat plants by improving doubled haploid technologies, which breeders can use to bring new varieties to market faster. Traditional methods can be costly, inconsistent and time-consuming.

"And we're trying to do it all without resorting to GMO techniques so we can maintain access to (global) markets," says NRC president John McDougall. "If we do this, we will have changed the dynamics and economics of the Canadian wheat industry with a very big benefit to Canada, and with technologies that other people can apply in different ways in other parts of the world."

The NRC was established in 1916 to advise government on matters of science and industrial research. More than a century later, it continues to focus on what McDougall describes as "mission-oriented research".

"We're not trying to invent knowledge as much as we're trying to put existing knowledge to work and that takes a lot of time and effort," says McDougall. "It's not about stuffing knowledge down people's throats. It's about ensuring that what you do is likely to be deployed and that requires understanding industry in a holistic way and the challenges they are facing."

BRIDGING THE INDUSTRY-ACADEMIC DIVIDE

Bridging the cultural divide between academia and industry requires mutual trust

and understanding – something that can take years to nurture. One bad experience can prove toxic to future collaborations.

To reduce that risk, the Natural Sciences and Engineering Research Council of Canada (NSERC) has established two types of 'get to know each other' programs – Engage and Connect. They provide small grants of up to \$25,000 for activities like networking, research planning or short-term R&D projects.

Short-term
R&D projects help
companies and academics
get to know each other

"These programs make it very convenient for that first date between academic researchers and business leaders. There's minimum red tape and turnaround time for these applications is only 21 days," says Dr. Mario Pinto, president of NSERC, which works with about 3,500 companies each year.

Some 20% of the companies that worked on Engage projects have since established more formal partnerships with their university partners. As well, one in six students who work on Engage projects end up with full time jobs with the company after graduation. Last year alone, the program supported academic collaborations with nearly 1400 companies.

"We're trying to set up a relationship that is long-term so that when an industrial client has a need – unanticipated at present – they will know who to come back to," says Dr. Pinto.

He cites the example of Dr. Jeff Dahn at Dalhousie University in Halifax who has worked with 3M for 35 years. The Fortune 500 company has brought to market several patented materials based on technology developed by Dahn, including a nickel-manganese-cobalt positive electrode material found today in most electric vehicles and power tools. Starting in 2016, Dr. Dahn will begin a new five-year partnership with Tesla Motors to develop better lithium-ion battery technology. It marks the first time Tesla has collaborated with a Canadian university.

For homegrown multinationals like Bombardier Aerospace, partnering with local universities is a competitive necessity. "I don't know of a single aerospace company in the world that doesn't partner with academia. For us, the bulk of our research activities and partnerships are done in Canada," says Jonathan Hack, Bombardier's manager of strategic technology, university and government relations.

Some of that research is done under the auspices of the Green Aviation R&D Network (GARDN), a Business-Led Network of Centres of Excellence where 30 partners from industry and academia share both the cost and the risk of developing made-in-Canada technologies that reduce the environmental footprint of next generation aircraft, engines and avionics systems.

Such research requires access to specialized facilities like the anechoic (echo-free) wind tunnel at the University of Toronto Institute for Aerospace Studies. The tunnel had fallen into disrepair and Bombardier helped to refurbish it. That investment allowed UTIAS to expand its noise research and Bombardier to test new methods to reduce aircraft noise levels.

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Champions thrive on the best. So when the Toronto Blue Jays wanted a natural grass playing surface at the Rogers Centre, they turned to University of Guelph turfgrass researchers for help. This research partnership is one reason funding awarded to the University of Guelph from business and industry overall rose to nearly \$22 million last year, almost a 60 per cent increase.

For more about research innovation at the University of Guelph, ask for a copy of our annual Return on Research report by contacting inforc@uoguelph.ca or find us online at www.uoguelph.ca/research



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Canada's TOP 50 RESEARCH UNIVERSITIES 2015

Rank		University	Sponsored Research Income			Faculty**	Research Intensity	Province
2014	2013		FY2014 \$000	FY2013 \$000	% Change 2013-2014	2013-2014 #	\$ per Faculty \$000	
1	1	University of Toronto* ++	\$1,041,374	\$1,110,663	-6.2	2,600	\$400.5	Ontario
2	3	Université de Montréal* (a)	\$548,849	\$527,971	4.0	1,879	\$292.1	Quebec
3	2	University of British Columbia*	\$547,027	\$566,789	-3.5	2,395	\$228.4	British Columbia
4	4	McGill University*	\$477,843	\$465,209	2.7	1,696	\$281.7	Quebec
5	5	University of Alberta*	\$462,891	\$417,757	10.8	1,703	\$271.8	Alberta
6	8	Université Laval*	\$324,803	\$306,831	5.9	1,519	\$213.8	Quebec
7	6	University of Calgary*	\$324,212	\$328,736	-1.4	1,525	\$212.6	Alberta
8	7	McMaster University*	\$310,608	\$322,502	-3.7	915	\$339.5	Ontario
9	9	University of Ottawa*	\$275,266	\$297,813	-7.6	1,281	\$214.9	Ontario
10	10	Western University*	\$237,894	\$254,457	-6.5	1,245	\$191.1	Ontario
11	14	University of Saskatchewan*	\$195,264	\$157,976	23.6	1,117	\$174.8	Saskatchewan
12	12	University of Waterloo	\$177,425	\$166,920	6.3	1,106	\$160.4	Ontario
13	16	University of Manitoba*	\$154,280	\$137,281	12.4	1,252	\$123.2	Manitoba
14	11	Queen's University*	\$148,486	\$189,990	-21.8	768	\$193.3	Ontario
15	13	University of Guelph	\$146,657	\$158,255	-7.3	738	\$198.7	Ontario
16	15	Dalhousie University*	\$128,084	\$148,879	-14.0	1,037	\$123.5	Nova Scotia
17	19	Université de Sherbrooke*	\$121,938	\$120,969	0.8	1,134	\$107.5	Quebec
18	20	Simon Fraser University	\$103,130	\$102,643	0.5	831	\$124.1	British Columbia
19	18	University of Victoria	\$95,428	\$124,779	-23.5	700	\$136.3	British Columbia
20	17	Memorial University of Newfoundland* (b)	\$87,782	\$127,816	-31.3	935	\$93.9	Newfoundland
21	21	York University	\$78,719	\$72,040	9.3	1,348	\$58.4	Ontario
22	22	Université du Québec à Montréal	\$70,384	\$71,262	-1.2	1,139	\$61.8	Quebec
23	23	Institut national de la recherche scientifique+	\$61,903	\$55,778	11.0	149	\$415.5	Quebec
24	24	Carleton University	\$59,144	\$55,160	7.2	748	\$79.1	Ontario
25	26	Concordia University	\$45,670	\$44,358	3.0	777	\$58.8	Quebec
26	25	University of New Brunswick	\$42,505	\$49,115	-13.5	440	\$96.6	New Brunswick
27	27	Ryerson University	\$40,782	\$32,400	25.9	794	\$51.4	Ontario
28	28	University of Windsor	\$30,486	\$29,734	2.5	471	\$64.7	Ontario
29	29	Université du Québec à Chicoutimi	\$27,436	\$27,418	0.1	236	\$116.3	Quebec
30	31	École de technologie supérieure+	\$26,614	\$23,883	11.4	155	\$171.7	Quebec
31	30	Université du Québec à Trois-Rivières	\$22,942	\$24,039	-4.6	418	\$54.9	Quebec
32	32	Lakehead University*	\$22,717	\$22,465	1.1	325	\$69.9	Ontario
33	34	Université du Québec à Rimouski	\$18,742	\$20,580	-8.9	200	\$93.7	Quebec
34	33	University of Regina	\$18,472	\$20,778	-11.1	398	\$46.4	Saskatchewan
35	36	University of Lethbridge	\$18,227	\$17,228	5.8	335	\$54.4	Alberta
36	38	Laurentian University*	\$17,139	\$16,442	4.2	400	\$42.8	Ontario
37	41	Brock University	\$16,391	\$14,285	14.7	568	\$28.9	Ontario
38	39	Royal Military College of Canada	\$16,021	\$14,962	7.1	186	\$86.1	Ontario
39	40	Trent University	\$14,575	\$14,310	1.9	257	\$56.7	Ontario
40	37	Université du Québec en Abitibi-Témiscamingue	\$14,343	\$16,511	-13.1	102	\$140.6	Quebec
41	35	University of Prince Edward Island	\$13,236	\$17,391	-23.9	239	\$55.4	Prince Edward Island
42	42	Wilfrid Laurier University	\$12,737	\$12,961	-1.7	534	\$23.9	Ontario
43	44	University of Northern British Columbia	\$12,323	\$10,105	21.9	173	\$71.2	British Columbia
44	47	Université de Moncton	\$10,763	\$8,596	25.2	353	\$30.5	New Brunswick
45	43	University of Ontario Institute of Technology	\$9,820	\$10,562	-7.0	187	\$52.5	Ontario
46	48	Saint Mary's University	\$8,735	\$8,306	5.2	247	\$35.4	Nova Scotia
47	45	St. Francis Xavier University	\$8,643	\$8,845	-2.3	221	\$39.1	Nova Scotia
48	46	Université du Québec en Outaouais	\$8,067	\$8,704	-7.3	219	\$36.8	Quebec
49	49	University of Winnipeg	\$7,851	\$8,177	-4.0	265	\$29.6	Manitoba
50	50	Acadia University	\$7,017	\$6,966	0.7	202	\$34.7	Nova Scotia

Notes:

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.
3. Fiscal 2013 research income figures may have been adjusted as more accurate information became available.
4. Faculty data were obtained from RESEARCH 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 (CAUBO).

*Has a medical school

*Not a full-service university

**Sponsored research income administered by affiliated hospitals was reported one fiscal year in arrears

(a) Faculty count based on 2011-2012 data as 2013-2014 data were not available.

(b) Faculty count based on 2012-2013 data as 2013-2014 data were not available.

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Research Universities of the Year 2015

Three universities gain RESEARCH 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 FY2014. These universities demonstrated superior achievement both in earning research income and in publishing research in leading scientific journals.

Rank	Medical/Doctoral	Score*	Rank	Comprehensive	Score*	Rank	Undergraduate	Score*
1	University of Toronto	100.0	1	University of Waterloo	95.2	1	Lakehead University	89.3
2	McGill University	68.4	2	University of Guelph	81.6	2	Université du Québec à Rimouski	84.0
3	University of British Columbia	64.4	3	Simon Fraser University	70.3	3	Trent University	83.2

*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, universities must first have ranked in the top 50% in their respective tier group for all 5 measures. See www.researchinfosource.com for details.

CANADA'S TOP 50 Research Universities

RESEARCH INCOME REVERSES COURSE

For the first time in 14 years the combined research income of Canada's Top 50 Research Universities declined by -1.6% in Fiscal 2014. This follows several years of weak growth in the 1% range. Total research income slipped to \$6.67 billion in Fiscal 2014 from \$6.78 billion in Fiscal 2013. Research intensity – research income per faculty position – declined by -1.4%, moderated by a -0.2% drop in faculty numbers. Average research intensity fell to \$173,500 from \$175,900 the year before.

The drop in Top 50 research funding resulted from a cascade of funding declines, including a fall of -1.0% in funds available from a number of major national granting agencies. Resources from the Natural Sciences and Engineering Research Council fell by -2.8%, and money received from the Canada Foundation for Innovation fell by -3.2%. However, grants from the Canadian Institutes of Health Research rose by 1.3%, as did funding from the Social Sciences and Humanities Research Council, which rose by 0.9%. Total Federal Government funding declined by -2.6%, whereas Provincial Government funding fell by -6.7%. In addition, universities reported a striking -20.0% fall in funding by Individuals and a -2.3% fall in Corporate funding. On a more positive note, Non-Profit funding (9.2%) and Foreign Government funding (7.5%) both had solid increases in Fiscal 2014.

THE \$100 MILLION CLUB

The disappointing overall Top 50 results were mirrored in the composition of RESEARCH Infosource's \$100 Million Club – an elite group of universities that attracted \$100 million or more of research funding in Fiscal 2014. The Club's membership declined to 18 from 20 last year as Memorial University of Newfoundland and University of Victoria fell off the list.

In Fiscal 2014, the \$100 Million Club universities reported research income of \$5.73 billion, a drop of -5.1% over last year. Research income fell at 9 of the 18 Club institutions. With 2 universities leaving the Club, its share of Top 50 research income dropped to 86% of the total in Fiscal 2014 from 89% in Fiscal 2013.

PROVINCIAL PERFORMANCE

With 18 universities, Ontario led the way among provinces, accounting for 40% of total research income

in Fiscal 2014, down from 41% last year. Quebec's 13 institutions increased their share of the total to 27% from 25% in Fiscal 2013. Alberta's 3 universities accounted for 12% of total research income, up from 11% the previous year. British Columbia's 4 universities accounted for 11% of the total compared to 12% the year before. Disappointingly, research income fell in all 4 Atlantic Provinces by a combined -18.4%, as it did in British Columbia (-5.8%) and Ontario (-5.0%). However, each of the 3 Prairie Provinces saw their research income increase – notably by 19.6% in Saskatchewan, 11.5% in Manitoba and 5.4% in Alberta. Research income also increased in Quebec (3.3%).

Top 50 – Leading Provinces	
Province	% of Total
Ontario (18)	40
Quebec (13)	27
Alberta (3)	12
British Columbia (4)	11

RESEARCH INCOME GROWTH

Overall in Fiscal 2014, 27 universities recorded gains in research income versus 23 where research income dropped. This compares with Fiscal 2013 when 29 universities posted research income growth versus 21 where research income dropped.

The top 10 universities for research income growth were led by Ryerson University, where research income expanded by 25.9%, closely followed by Université de Moncton (25.2%), University of Saskatchewan (23.6%), University of Northern British Columbia (21.9%) and Brock University (14.7%).

RESEARCH INTENSITY

Overall research intensity – research income per faculty position – fell by -1.4% in Fiscal 2014, due both to declines in research income and in faculty numbers. On average, the Top 50 had research intensity of \$173,500, down from \$175,900 the year before. Institut national de la recherche scientifique (\$415,500 per faculty), University of Toronto (\$400,500) and McMaster University (\$339,500) led the ranking.

TIER GROUPS

The combined research income at the 16 Medical/Doctoral universities fell by -1.7% to \$5.39 billion in Fiscal 2014, as did the research income at the

12 Comprehensive universities (-2.2%) to \$929.9 million. Research income at the 22 Undergraduate universities, on the other hand, posted an overall increase of 2.9% to \$355.1 million.

RESEARCH UNIVERSITIES OF THE YEAR

RESEARCH 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 ON CORPORATE AND NON-PROFIT RESEARCH PARTNERSHIPS

RESEARCH Infosource shined the spotlight on university research partnerships as measured by grants or contracts received from corporate and non-profit sources during the period FY2010-FY2014 for the following metrics:

Total corporate research income: winners were McMaster University (\$588.7 million) in the Medical/Doctoral category, University of Guelph (\$98.6 million) in the Comprehensive and Université du Québec à Chicoutimi (\$38.3 million) in the Undergraduate category.

Total non-profit research income: winners were University of Toronto (\$1.24 billion) in the Medical/Doctoral category, University of Waterloo (\$98.8 million) in the Comprehensive category and Lakehead University (\$18.3 million) in the Undergraduate category.

Corporate research income as percent of total university research income: winners were McMaster University (35.1%) in the Medical/Doctoral category, University of Regina (12.9%) in the Comprehensive category and Université du Québec à Chicoutimi (31.7%) in the Undergraduate category.

Non-profit research income as percent of total university research income: winners were University of Toronto (24.8%) in the Medical/Doctoral category, Simon Fraser University (14.6%) in the Comprehensive category and Université de Moncton (21.3%) in the Undergraduate category.

THIS YEAR AND NEXT

Last year we wrote that “*overall next year looks to be one of restrained funding growth*”. As indicated by this year's disappointing findings we were somewhat optimistic. Most of the key indicators suffered declines. Because government sources account for the bulk of university research funding, as go their budgets so goes research funding in the higher education sector.

The raw research income data tend to mask a difficult underlying situation. Although general price inflation is currently low, research input costs typically rise somewhat faster than overall prices. This places additional pressure on available resources.

The \$100 Million Club		
2014 Rank	University	Research Income \$000
1	University of Toronto*	\$1,041,374
2	Université de Montréal*	\$548,849
3	University of British Columbia*	\$547,027
4	McGill University*	\$477,843
5	University of Alberta*	\$462,891
6	Université Laval*	\$324,803
7	University of Calgary*	\$324,212
8	McMaster University*	\$310,608
9	University of Ottawa*	\$275,266
10	Western University*	\$237,894
11	University of Saskatchewan*	\$195,264
12	University of Waterloo	\$177,425
13	University of Manitoba*	\$154,280
14	Queen's University*	\$148,486
15	University of Guelph	\$146,657
16	Dalhousie University*	\$128,084
17	Université de Sherbrooke*	\$121,938
18	Simon Fraser University	\$103,130

*Has a medical school

Top 10 Research Intensive Universities			
2014 Rank	Research Intensity Overall	University	Research Intensity (\$ per faculty) \$000
1	23	Institut national de la recherche scientifique+	\$415.5
2	1	University of Toronto*	\$400.5
3	8	McMaster University*	\$339.5
4	2	Université de Montréal* ++	\$292.1
5	4	McGill University*	\$281.7
6	5	University of Alberta*	\$271.8
7	3	University of British Columbia*	\$228.4
8	9	University of Ottawa*	\$214.9
9	6	Université Laval*	\$213.8
10	7	University of Calgary*	\$212.6

*Has a medical school ++Not a full-service university
**Based on 2011-2012 faculty counts; 2013-2014 were not available

Top 10 Universities by Growth				
2014 Rank		University	% Change	
Income	Overall		2013-2014	
1	27	Ryerson University		25.9
2	44	Université de Moncton		25.2
3	11	University of Saskatchewan*		23.6
4	43	University of Northern British Columbia		21.9
5	37	Brock University		14.7
6	13	University of Manitoba*		12.4
7	30	École de technologie supérieure ⁺		11.4
8	23	Institut national de la recherche scientifique ⁺		11.0
9	5	University of Alberta*		10.8
10	21	York University		9.3

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

LAKEHEAD CELEBRATES 50 YEARS AND IS RANKED RESEARCH UNIVERSITY OF THE YEAR IN THE CATEGORY OF UNDERGRADUATE UNIVERSITIES BY RESEARCH INFOSOURCE

WE'RE CREATING LEADERS.

When I decided to pursue an HBSc in biology, I struggled with where to go. I looked at big schools, small schools, and even a few out-of-province schools, and then I came to Thunder Bay. My decision was made from the moment I set foot on campus.

Not because Maclean's ranks Lakehead as one of the top ten undergraduate universities in the nation, but because I love the people who choose Lakehead. My professors know my name. They care about how I do in their class. From undergraduate through doctoral research, Lakehead offers all students the opportunity to work with brilliant, innovative researchers, who challenge convention while looking for solutions to real-world problems.

I hope to join the long tradition of innovators and leaders who have come from Lakehead. Dr. Andrew Dean, Lakehead's VP of Research and Innovation, is already reaching out to provide me with the resources to make my start.

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PARTNER PERSPECTIVE

ULaval takes Northern Research to New Heights

By Debbie Lawes

Canada is stepping up its game when it comes to monitoring the rapid changes underway in the Arctic. In July, the federal government announced that its largest investment ever in northern research would go to a Quebec university with the world’s largest concentration of scholars specializing in northern and Arctic studies.

Université Laval, which jumped to #6 from #8 in the current Top 50 Research Universities ranking, is also a global leader in photonics, neuroscience, cardio-metabolic health, microbiology and food and nutrition.

The \$98-million grant from the highly competitive Canada First Research Excellence Fund (CFREF) – Laval’s biggest research award ever – enables the university to link these specialties to develop better

tools for probing and predicting the effects of climate change and industrialization on northern ecosystems and populations.

Sentinel North brings together researchers from 15 universities from around the world, indigenous organizations and communities (e.g. Nunavut Research Institute and the Grand Council of the Crees) and provincial, territorial and federal governments. Also participating are some 20 companies, including those working in photonics (e.g. Ericsson Canada Inc. and TeraXion), drug discovery (Pfizer Canada), natural health products (Nutra Canada and Atruim Innovation) and transportation (e.g. Airbus).

One priority is to create a network of connected sensors robust enough to withstand the unforgiving conditions of northern regions. These devices need to be portable, energy conserving, remotely accessible and

sensitive enough to measure changes as they happen.

“We have 8 field stations currently monitoring conditions in the north, but the technologies they use take longer to produce results and they monitor mostly for weather and climatic conditions,” explains Dr. Edwin Bourget, VP research and innovation at Laval. “With Sentinel North, we will be able to accelerate and expand how we monitor these changes and develop solutions faster.”

As well, researchers are using new materials in optic photonics to build remote sensors with higher resolution to better understand the effects of a changing north on food chains, pollution, urbanization and infrastructures. One of the leaders in this space is Dr. Marcel Babin, who returned to Canada after working in France for 18 years.

Babin is a Canada Excellence Research Chair (CERC) in Arctic

remote sensing and one of three Laval-based CERCs involved in Sentinel North. His is currently developing an “Arctic-proof” drone that can plunge to depths of nearly 2 kilometres under the Arctic Ocean to collect data about marine organisms. The drones will fill an important gap in a global network of ocean-observing beacons.

Sentinel North is also led by Dr. Yves de Koninck, a Laval neuroscientist who will study the effects of a changing north and high-risk diets on people’s health. Research will also focus on brain diseases caused, for instance, by consuming seafood with trace amounts of heavy metals.

Two other key contributors are Drs. Younes Messaddeq and Pierre Marquet. Messaddeq left Brazil in 2010 to accept a CERC at Laval in optical materials, including new types of fibres and glass. He made headlines a year ago with his inven-

tion of “smart” clothes that monitor a wearer’s glucose levels, heart rhythm and brain activity and then transmit these data instantly to a doctor via wireless networks.

Marquet is an expert in the emerging science of neurophotonics, which uses photons – or quantum units of light – to study molecular processes in the brain.

Bourget stresses that Sentinel North’s research is designed to focus on solutions that detect and treat problems early.

“We’re talking about an investment that will have lasting and tangible benefits in areas including health, resource management and socioeconomic development,” he says.

LONG-TERM PARTNERSHIPS ARE KEY

Bourget credits Laval’s success in winning a CFREF grant to several factors: the establishment of dozens of new

research chairs; a growing number of researchers who work across disciplines; and a rapid rise in the number of partnerships with companies.

In 2008, Bourget embarked on an ambitious plan to more than double Laval’s 80+ research chairs. Today, the university has 84 federally funded Canada Research Chairs, more than 75 partnership research chairs and three prestigious CERCs.

“The biggest change we’ve seen from these partnerships is a switch from short-term research investments to longer-term partnerships with companies and organizations,” says Bourget. “It has fundamentally changed how many businesses think of university collaborations. Partnering over five or ten years gives companies a competitive edge well into the future.”

Debbie Lawes (Debbie@dovercourteditorial.ca) is an Ottawa-based science writer.

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How to change the world

It starts with inspiring new ways of thinking, connecting exceptional minds — across borders and disciplines — to solve complex challenges. That is what CIFAR has been doing for over 30 years. Our programs have transformed our understanding of disease, early child development, technology, society and more. We are generously supported by the governments of Canada, British Columbia, Alberta, Ontario and Quebec, Canadian and international partners, as well as individuals, foundations and corporations.

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- Fonds de recherche du Québec
- Genome British Columbia
- Genome Canada
- Inria, France
- Gordon and Betty Moore foundation, United States
- Western University

As one of Canada’s research-intensive universities, the University of Calgary is committed to conducting research that will have true impact and change the world. But what does that *really* mean?

Who cares about research, anyway?

› The woman whose lifelong partner has just survived a stroke because of groundbreaking new therapies

› The senior with osteoarthritis who regains quality of life because of biomedical engineering

› The high-potential teen who can test her leadership skills in a safe environment

› The farmer who uses satellite imagery and spatial positioning to do precision agriculture

› The young mother struggling with chronic disease who can now care for her children without pain

› The engineer reinventing an oil and gas company so that it positively contributes to the environment *and* generates profit

Every day, our scientists, researchers and students are making discoveries, creating new knowledge and tackling emerging and persistent global challenges in key areas where our particular strengths meet the world’s most pressing challenges: **energy; brain and mental health; biomedical engineering; infections, inflammations and chronic diseases; Earth-space technologies; and human dynamics in a changing world.**

In the end, research is really about improving quality of life, benefiting communities at home and around the world, and creating new understanding of our place in the world.

We should *all* care.

Learn more at ucalgary.ca/research



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CALGARY



SPOTLIGHT ON University Corporate and Non-Profit Research Partnerships 2010-2014

RESEARCH Infosource shines the spotlight on university research partnerships as measured by grants or contracts received from corporate and non-profit sources during the period FY2010-FY2014.

Corporate Research Income		
Rank	Medical/Doctoral	\$000
1	McMaster University	\$588,745
2	Université de Montréal*	\$382,267
3	University of Toronto	\$358,695
Tier Average (16)		\$189,709
Rank	Comprehensive	\$000
1	University of Guelph	\$98,630
2	University of Waterloo	\$71,188
3	Institut national de la recherche scientifique+ *	\$35,263
Tier Average (11)		\$30,582
Rank	Undergraduate	\$000
1	Université du Québec à Chicoutimi*	\$38,285
2	Laurentian University**	\$17,261
3	Ryerson University	\$16,994
Tier Average (15)		\$8,110
Overall universities average \$000 (42) = \$83,176		

Corporate Research Income as a % of Total University Research Income		
Rank	Medical/Doctoral	%
1	McMaster University	35.1
2	Dalhousie University	22.5
3	Queen's University	18.2
Tier Average (16)		11.3
Rank	Comprehensive	%
1	University of Regina	12.9
2	University of Guelph	12.8
3	Institut national de la recherche scientifique+ *	11.7
Tier Average (11)		8.3
Rank	Undergraduate	%
1	Université du Québec à Chicoutimi*	31.7
2	Laurentian University**	21.3
3	Ryerson University	11.0
Tier Average (15)		9.6
Overall universities average (42) = 10.8%		

Non-Profit Research Income		
Rank	Medical/Doctoral	\$000
1	University of Toronto	\$1,235,163
2	University of British Columbia	\$539,408
3	Université de Montréal*	\$320,584
Tier Average (16)		\$257,520
Rank	Comprehensive	\$000
1	University of Waterloo	\$98,819
2	Simon Fraser University	\$70,097
3	University of Guelph	\$56,920
Tier Average (9)		\$35,471
Rank	Undergraduate	\$000
1	Lakehead University**	\$18,325
2	University of Northern British Columbia	\$11,006
3	Université du Québec à Trois-Rivières*	\$10,391
Tier Average (15)		\$6,771
Overall universities average \$000 (40) = \$113,528		

Non-Profit Research Income as a % of Total University Research Income		
Rank	Medical/Doctoral	%
1	University of Toronto	24.8
2	University of Ottawa	20.5
3	University of British Columbia	19.2
Tier Average (16)		15.3
Rank	Comprehensive	%
1	Simon Fraser University	14.6
2	University of Waterloo	12.8
3	University of Guelph	7.4
Tier Average (9)		8.3
Rank	Undergraduate	%
1	Université de Moncton	21.3
2	University of Northern British Columbia	17.5
3	Lakehead University**	16.9
Tier Average (15)		8.1
Overall universities rate (40) = 14.2%		

Notes:

1. Based on universities on the 2015 Top 50 Research Universities list and reported research income from corporate or non-profit sources in the form of a grant or contract for all 5 years FY2010-FY2014.

2. Financial data were obtained from Statistics Canada.

3. See www.researchinfosource.com for details.

*In Fiscal 2011, Quebec universities reported data for only 11 months due to a fiscal year-end change

**Has a medical school

*Not a full-service university



BUILDING CAPACITY. BUILDING COMMUNITIES.

McMaster is research intensive to be sure. But we're also research infused: discovery is something we live and breathe. It shapes our teaching, inspires our collaborations, and commits us to sharing our knowledge throughout our communities – be they around the corner or across the globe. Our researchers, like **Abigail Payne**, director of MacDATA, are partnering with the private and public sectors to ensure our knowledge is placed directly into the hands of those who can use it best, driving social, cultural, and economic prosperity.

McMaster University

research.mcmaster.ca

The Next Generation of Entrepreneurs and Innovators



Dr. Martha Crago
Vice President Research
Dalhousie University

Looking ahead to Canada's future as an innovative nation means thinking about the next generation of entrepreneurs and innovators as well as the next generation of innovations. First let's consider the people involved in entrepreneurship and innovation from a few different perspectives: that of emerging and retiring professors and that of university students.

The abolition of mandatory retirement of university professors

combined with an unsteady economy may well have created a precarious science future for our country. The two together mean that there are many less young professors in our universities. This, in turn, over time will lead to a gap in experienced researchers, those at the associate and full professor level. At present, we have a number of senior professors who are not active in innovation and have not been a part of the culture that sees universities as places for innovation. This means that they are often unable to mentor their students or junior colleagues in this regard. The importance of keeping new researchers coming into Canadian universities is critical, and once they are in place, they will need adequate support to build their research and innovation capacity. They will also need a university culture that recognizes, builds and rewards the innovation and entrepreneurship side of their careers.

The students who may become the scientific and social innovators and entrepreneurs of tomorrow need similar support, opportunities and

motivators. Exposure to research experience, mentoring in innovation and entrepreneurship, co-located practice spaces, rewards, cross-disciplinary training, co-ops and experiential learning are all becoming increasingly important in today's university education.

Eric Grimson, a Canadian, is the Chancellor for Academic Advancement at MIT. He has been gracious enough to share with university, government and industry people in Nova Scotia many of the ideas that his university has put in place to meet the needs and encourage innovation and entrepreneurship for both students and professors. His talks have inspired ideas and optimism. He has described how MIT has worked to "interweave innovation and entrepreneurship with education to advance the capabilities of its students, postdocs, staff, faculty, and alumni to change the world through research, invention, innovation, leadership and intrapreneurship, entrepreneurship, service learning opportunities and research". In doing so, he said that

its goal is to demonstrate global leadership in innovation and entrepreneurship within an educational enterprise. Here are some of the elements for making that happen at MIT: educational programs (curricular and co-curricular activities at all levels), research projects at all levels, organizational collocation of activities, spaces to encourage innovation and team-building, linkages to the neighboring innovation ecosystem. This has led to 20 significant activities, spread across the institute, approximately 54 classes across multiple units, spaces for innovation spread across multiple locations, cross-disciplinary approaches, links across departments with no one unit "owning" entrepreneurship, direct connections with the research engine, incentives for inventors and policies to encourage student start-up activities, and student-run competitions all year long. The result is very impressive. Dr. Grimson reported that these initiatives have led to more than 130 companies with aggregate exit-values of \$2.5

billion captured and a market cap of over \$15 billion. Furthermore, these companies have generated more than 2,500 jobs and have received \$770 million in venture capital funding.

At the professorial level, according to Dr. Grimson, MIT has put in place a variety of incentives and supports such as a royalty policy with one third of royalty stream to inventors, a leave policy for the creation of a start-up of up to 2 years of unpaid leave. Professors are encouraged to spend up to one day a week in outside professional and consulting activities without the fees being counted against salary. MIT also provides ignition grants to provide seed funds for start-ups led by faculty and help in obtaining venture capital.

As Canada continues to build its innovation and entrepreneurship capacity into the future, there is much to learn from the MIT experience. In fact, many of our universities are already moving forward in similar directions.

Finally, but importantly, the next

generation of innovation needs to be developed with the sustainability of our planet clearly in sight. Science and technology take place in the context of society and must serve societies and their needs for many generations to come. As an example, many of the innovative products of today have life spans that far out live the product. Many such products are then discarded and end up in developing countries which do not have the capacity to recycle them. The manufacturers of products made from advanced energy-saving materials need to consider the energy resources needed to produce such materials. The latter may outweigh the former. Robotics and advanced information technologies have changed and will continue to change the labor market. Education of our youth must take these changes in employment possibilities into account. In a variety of ways, as we move forward to a next generation of innovation, the development of science, technology and society need to progress hand-in-hand toward a sustainable future.

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



The University of Waterloo is defining innovation in Canada with a unique blend of scholarship, real-world work experiences 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 Lakehead University, the strength of our research and innovation lies within our diversity of ideas. Lakehead takes pride in instilling a research culture into the curriculum from the undergraduate to the doctoral level. New questions require new ideas and we will continue to excel at generating these ideas through fundamental and applied research and meaningful partnerships. Global economic prosperity will depend upon innovation. Lakehead is well positioned to be the driver of that innovation through our strong focus on research and training.

*Andrew P. Dean, Ph.D.
Vice-President, Research & Innovation
Lakehead University*



Queen's distinguishes itself as one of the leading research-intensive institutions in Canada. The 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*



Solutions to daunting global challenges – food, water and energy security – will not come from any one government, university or industry but from all of us working together in multi-sectoral partnerships across national and disciplinary boundaries. That's the new paradigm needed to make Canada the most innovative country in the world.

*Peter Stoicheff
President
University of Saskatchewan*



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*



The complexity and magnitude of today's challenges – climate change, terrorism, social inclusivity, economic development, renewable energy, early child development, the genetics underlying human health and disease – demand the collective effort of the world's very best researchers, regardless of country or academic discipline. CIFAR currently draws on 400 researchers from Canada and 17 other countries in 115 institutions to create transformative knowledge and address questions of importance to the world. In so doing, CIFAR is helping to ensure that Canada is positioned to compete and contribute in today's globalized world.

*Alan Bernstein, O.C., Ph.D., FRSC
President and CEO
Canadian Institute for Advanced Research*



Your partner at the heart of innovation! R&D staff at Collège communautaire du Nouveau-Brunswick are on a mission to hone their skills to literally become a new economic development tool for the benefit of New Brunswick businesses, communities and government partners.

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



The scope of research questions and the necessary infrastructure to study these questions, require researchers to work collaboratively across scientific boundaries. Our researchers are pooling their expertise and resources to generate a new way of thinking and achieving excellence. Effective and bold research leadership, combined with imaginative ideas and partnerships, are key to turning challenges into successes.

*Edwin Bourget
Vice-President Research and Innovation
Université Laval*



Providing opportunities for students to engage in scholarship, research and creative activities with faculty and external partners is a guiding principle in our journey to become Sheridan University. Our dedication to hands-on learning is part of our tradition as an applied learning institution, and will remain a cornerstone of our future evolution.

*Dr. Jeff Zabudsky
President and CEO
Sheridan College*



Researchers working in Science, Technology, Engineering and Math (STEM) often make new discoveries and develop disruptive technologies and processes. However, if these are not adopted, there actually is no innovation. Interdisciplinary approaches including Social Sciences and Humanities scholars are critical to understanding the context, the users, and the organizational and political issues that drive and impede innovation.

*Wendy Cukier
Vice-President, Research & Innovation
Ryerson University*



At Niagara College, every Applied research project we do involves an industry partner. And the company is in on every aspect of the project: problem formulation, scoping, project execution, and knowledge transfer. By the time the intellectual property is transferred, they know it inside out and it is THEIR solution.

*Dr. Marc Nantel
Assoc. Vice President
Research & Innovation
Niagara College*



Our team of engineers in Canada are playing a key role in one of the most exciting transformation stories in history – the ongoing global journey towards the Networked Society. The advent of Mobility, Cloud and Broadband is driving transformation across all industry segments, and we are working to ensure our technology is a force for lasting, positive change.

*Mark Henderson
Chairman
Ericsson Canada Inc.*





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As a graduate student, **Braden Murphy** believed he could build a better engine - one that's more efficient, lighter and easier to maintain. With help from **Dr. Darrel Doman**, his Dalhousie University supervisor, he did just that. But Braden didn't stop there. He started a new company, signed a worldwide licensing agreement and now, his company is developing and building technology right here, right now. It's clear: Our Dalhousie students and professors are taking care of business.



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PARTNER PERSPECTIVE

PRACTICING WHAT WE TEACH: Innovative Universities for the 21st Century

Wendy Cukier
Vice President Research & Innovation
Ryerson University

Universities in Canada have been challenged as never before with new forms of competition, the erosion of funding, increasing demands for accountability, and questions about their very mission. Questions centre around value for money, the payback from investments in research, the quality of teaching, and their universities' contribution to innovation and economic and social development. Discussions on the innovation gap and Canada's descent in global innovation rankings, have driven widespread talk of strategies to build a "culture" of innovation and the role of the university. It's time to take a fresh look at what we do and how we do it.

Not only is Canada's Information and Communications Technology sector critical to our economic growth, but digital technologies also have the potential to transform virtually every sector. Evidence shows that under-investments in technology impede growth and productivity improvements – whether in advanced manufacturing, health care, or education. Among small and medium-sized enterprises (SMEs), recognized as the engines of economic growth in Canada, more than 40 per cent do not have even basic technology infrastructure. And our recent study of mobile technology shows that although Canada is a leader in consumer adoption of these tools, our companies, government, and educational

institutions are global laggards in the use of these technologies. As such, our efforts to drive innovation must not just focus on creating new technologies but must also recognize the factors that drive or impede their adoption. Entrepreneurship focuses on the creation of something new, a product or a service. Innovation, on the other hand, requires the adoption of something new – a new product or service – to fundamentally change the way we do things. While it is true that many transformative discoveries have emerged from labs and had impacts that could not have been planned or predicted, we also know that there is need for market-driven research with specific aims to solve real-world problems. The prevailing lab-to-market model of innovation, the assumptions that underlie it, and the programs aimed at accelerating it tend to focus primarily on the supply of new technologies without reference to the demand.

Consider this comment on e-health, which appeared in the Journal of the Medical Records Association: *The future of medical computing is bright. Obstacles to the practical use of the computerized medical record exist, but we may expect these to vanish within a few years. We have a golden opportunity to avoid a new round of escalating medical costs.* It was written in 1990 – 25 years ago! The technology needed to improve the management of health information has existed for decades. Technology is not the primary obstacle to moving forward. The critical challenges are human and organizational factors – politics and regulatory issues.

There is no doubt that strong grounding and investments in Science, Technology, Engineering and Math (STEM) are fundamental. However, a focus exclusively on the invention or creation of technologies, on the supply side, tends to obscure the critical importance

of the social sciences and humanities (SSH) and design disciplines in addressing the factors that actually drive and impede innovation. At Ryerson, researchers work closely with partners to develop next-generation technological solutions, but they also explore the strategic, organizational, and individual factors affecting the adoption of these technologies in order to inform approaches to innovation.

For example, Ryerson's Centre for Cloud and Context-Aware Computing (RC4) partners with industry to develop leading-edge technology and tools, but also examines the impediments and drivers of mobile technology adoption and develops evidence-based strategies to promote them. We know, for example, that short-term business priorities often prevent companies from investing in ICT solutions even though, over time, these investments improve growth and productivity. Our action-oriented research, with partners like the Ontario Chamber of Commerce and our new Innovation Portal, is designed to help SMEs develop the capacity to innovate.

In our Advanced Manufacturing, Design and 3D Printing Lab, researchers work with leading 3D augmented reality companies to develop applications that solve real world needs for both consumers and businesses. And we also have interior designers, social psychologists, and consumer behavior experts working with aerospace engineers to design aircraft interiors that will create outstanding user experiences.

In health care, our researchers have built a game-changing surgical navigation system and complementary surgical tools for use in spinal fusion surgeries. But we recognize that it is not a shortage of leading-edge technology that is impeding innovation in Canadian health care. To help drive transformation, we also examine patient-centered care,



In Ryerson's Advanced Manufacturing, Design and 3D Printing Lab, researchers work with leading 3D augmented reality companies to develop applications to solve real world needs for both consumers and businesses.

health innovation processes, organizational structures, and policies.

Too often, we talk about innovation as if it is a single process. We need to recognize that while innovation models have common features, there are enormous differences in the stakeholders, the investments, the processes, and the timelines between, for example, the search for a cure for cancer and the development of a new app. The implications for programs and supports are immense.

If we look at the programs currently in place to support commercializing university-based research and to incubate university-based start-ups, the underlying assumptions have tended to be predicated on lab-to-market models, and often the assumption that we need to turn researchers into entrepreneurs. Although some academics do become successful entrepreneurs, the mindset, personality traits, and interests that drive someone

to scholarship are not necessarily the same as those driving entrepreneurs. Too much of our innovation strategy has rested on a hope and a prayer that someone will discover something in a lab and take it to market. We need to recognize that there are many exciting and commercializable discoveries in labs and on benches around the country, but we currently lack the right kind of infrastructure to identify these opportunities and to successfully take them to market. While many rightly decry the erosion of funding for fundamental research, we also need more appropriate support for collaborative, research focused on solving real world problems.

There needs to be better alignment between the stated commitments to commercialization and innovation and the supports and incentives in place to promote them. The criteria, the adjudication processes, and the people making the decisions need to fit with the

goals. Today, professors are generally rewarded – hired, given tenure and promoted – for publishing articles and sometimes for teaching, but not for the impact of their work. Fundamentally, many of the old dichotomies that dominated universities in the past need to be eroded. This includes the medieval battles which pitted the "town versus the gown", more recent debates about a focus on theory and critical thinking, skills versus practical skills and employability. The relative importance of teaching versus research and the centrality of STEM versus SSH. And, most importantly, the tension between research excellence versus relevance. Universities for the 21st Century are critical to Canada's economic, social, and cultural development, and our place in the world. We need to rethink institutions that were designed for a very different time and very different challenges, retaining what is valuable while adapting to a new reality.

Growing our research strengths

As a university, we understand how important it is to face challenges of global importance.

Our recent growth in research funding is helping us do just that. In 2013-14, our research revenue grew \$37 million, the third highest growth of any university in Canada. And we didn't stop there.

We are proud to be one of five universities awarded major program funding by the Canada First Excellence Research Fund, and to be leading or co-leading four of Genome Canada's 11 recently awarded projects.

These investments will help us find new solutions to some of the world's most complex problems, such as how to feed a growing global population.

And when knowledge can be turned into real-world solutions, that is truly beautiful.

Knowledge is beautiful.

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York U Research Accelerates Scientific and Societal Solutions



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

York's researchers and trainees are actively changing the way we think about the world. York's faculty are a cohort of world-class leaders who work to advance research and innovation across a breadth of disciplines from the social sciences, to business, law health, science and engineering in

areas that range from biological and computational vision, to rehabilitation, big data, digital media, environmental sciences and transportation. As one of Canada's leading universities, with 24 active research centres and institutes, and a wide-ranging complement of Research Chairs, York's researchers are working together with industry, government, community groups, not-for-profits and international academic partners to create new knowledge and discoveries that accelerate the development of cutting-edge solutions to today's most pressing scientific questions and societal challenges.

York's researchers have played key roles in some of the most important research discoveries in the past half-century, including:

- ✓ Discovering a brainstem center that controls both 3D eye orientation and 3D head orientation, leading to the creation of models that have been used to guide neurosurgical


procedures and promise new treatments for movement disorders

- ✓ Actively contributing to an international team of researchers that discovered the Higgs Boson particle, which is the foundation upon which our current understanding of the material universe is built
- ✓ Detecting water on Mars, made possible by an instrument on the NASA Mars Phoenix Lander that was developed at York
- ✓ Leading research studies demonstrating that the lifelong use of two or more languages helps to prevent the onset of Alzheimer's and other forms of dementia

York University's commitment to excellence in research and scholarship reflects a world-class research university. Our vibrant community of researchers is central to driving discoveries, entrepreneurship and critical thinking required to make a difference in the world. This is innovation.

From Quantum Science to Quantum Technologies

Our scientific and knowledge mobilization strategy will provide a business friendly ecosystem that will boost discoveries, stimulate and increase collaboration with industry, foster entrepreneurship, competitiveness and productivity in strategic socio-economic sectors.

 **UNIVERSITÉ DE SHERBROOKE**

Prof. Alexandre Blais
Canada First Research Excellence Fund
Project Leader

PARTNER PERSPECTIVE

Mixed Campuses to Foster Inter-university and Industrial Partnerships



Daniel Coderre, PhD
Rector
INRS University

Competition amongst universities to attract both students and faculty can often give rise to a perception that it comes at the expense of limiting the return on the significant investments made by governments on behalf of society as a whole. Undeniably, the funding formulas which are weighted heavily on the number of registered

students do to a certain extent drive a numbers race in the delicate balance between financial viability and the preservation of academic excellence. Moreover, the environment in which researchers from different universities compete for government research dollars and private sector contracts contributes to this notion of inter-university competition. The fact that stringent criteria are applied in assessing the quality of proposals put forward and the strength of their proponent researchers, and are both measured against high standards of research excellence is however a desirable feature of the granting process for individuals and teams of researchers, and must remain the basis for attribution of funds.

For their part, university administrators have a role to play in balancing the above competitive forces through collaborative efforts between universities as a means of creating optimal conditions for conducting research, thus

maximizing public and private returns. In so doing, institutions can achieve their ultimate goals of formation of highly qualified personnel, the pursuit of knowledge and the socio-economic development of the country and welfare of its citizenry. The establishment of partnerships among universities is especially critical in periods of economic austerity as the demonstration of value for money spent becomes all the more important.

Hence, both governments and university officials must make efforts to instigate and support new groupings of researchers by embracing a multidisciplinary approach, building upon the best available research talent, regardless of their organizational affiliation. Gone are the days of private academic fiefdoms and the belief that research excellence must be concentrated only in a handful of prestigious universities. The future direction of research resides in developing new partnerships, clusters and

networks of outstanding researchers with complementary skillsets, dedicated to addressing emerging societal needs as well as the upcoming challenges of the twenty-first century.

Governments at both the federal and provincial levels have taken several measures to foster greater collaboration between researchers and promote partnerships with the private sector and other end-users of the resulting research knowledge. In this regard, the government of Quebec has been at the forefront of this activity through its significant investments in the creation of large research consortiums, focused on its key economic sectors, the upshot of which has been to yield major benefits and sustainable, long-term partnerships. Similarly, federal programs which require co-financing of research projects are also effective in promoting partnerships.

Without diminishing in any way the success the above measures

have achieved both in this country and abroad, there is however one approach which has barely been exploited in Canada and could work to enhancing the benefits of university and industrial research partnerships. It entails the creation and development of mixed campuses, combining various universities in a single location, along with governmental and industrial research centres, all targeting the same thematic fields. This form of collaborative model drastically changes the classical university paradigm; while remaining administratively attached to their home institutions, researchers nevertheless share the same physical surroundings, enabling daily contact with their university and industry colleagues involved in similar or complementary disciplines, all focused on common research endeavors.

The benefits of this physical proximity are several fold. Firstly, it offers the possibility of making available and therefore increasing the accessibility to large platforms of leading edge scientific research equipment. Through programs of the Canada Foundation for Innovation, Canada has invested considerable

sums over the past several years in major research infrastructure and expects to continue to do so in coming years. The sharing by many researchers of this world-class equipment would constitute an important gain by optimizing the level of Canadian research and its spin off transfer to industry. For researchers, availing themselves of this caliber of equipment which otherwise would be difficult to access, provides a clear advantage in areas of applied research and the economic benefits it produces for the country. The recently implemented Canada First Research Excellence Fund program would also be enriched by consortiums such as these.

The second positive outcome would be enhanced training of students, especially at the masters and doctorate levels. It would also facilitate the co-direction of inter-university activities, improve the interface with industry and its access to high performance technology parks, to name but a few examples of how the model would benefit the university sector and its partners. The support of governments for such innovative approaches should be favored in coming years.



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PARTNER PERSPECTIVE

The Power of Partnerships



Patrick Deane
President & Vice-Chancellor
McMaster University

Partnerships. They’re in our DNA. It was, after all, a partnership – a consortium of community and business leaders – that brought us from our original home in Toronto to Hamilton some 85 years ago.

Indeed, it was in these early days that we learned the true power of partnerships – partnerships that are

as much a part of our tradition as they are our current practice and our future plans.

Working with our partners, we’ve capitalized on our community’s inherent strengths – manufacturing and health – while diversifying our economy to build our collective capacity.

The McMaster Innovation Park is a case in point – a brownfield turned innovation hub, it is now home to world-class facilities like the CANMET-Materials Technology Laboratory, the United Nations University – Institute on Water, Environment and Health, and the McMaster Automotive Resource Centre. Each of these acts as a magnet for future partners.

We also learned early on that some of the most fruitful partnerships are those that occur, quite naturally, within the boundaries of our own campus – when researchers

from an array of disciplines come together to tackle a single issue from a variety of perspectives.

In fact, it may be our multidisciplinary approach to research that defines McMaster best.

In many cases, these cross-Faculty partnerships precipitated the creation of our 70-plus world-class research centres and institutes. While unique in their various themes – be it aging, infectious disease, population health, peace studies, big data, healthier environments, transportation and logistics, or materials research – they share a similar philosophy when it comes to solving problems: work collaboratively, leave no stone unturned and investigate the problem from every possible angle.

Our first place ranking in Research Infosource’s corporate sponsored research income category confirms that McMaster researchers are recognized leaders in their

fields. The ranking is a testament to the many ways in which their discoveries are contributing to the nation’s economic prosperity – a critical function of a research intensive university.

But beyond our contributions to building a stronger economy, we are committed to strengthening social and cultural prosperity – whether by engaging with local municipalities around policies to reduce poverty and improve living conditions, or working with developing countries to remediate and manage polluted ecosystems.

McMaster’s ability to attract sponsored research income has placed us among the top three research intensive universities in the country – a standing of which we are particularly proud, especially given our size. But we are not just research intensive, we are research infused: discovery is something we live and

breathe. It shapes our research and our teaching. And our students – both undergraduate and graduate – reap the rewards.

In true McMaster style, our researchers have a longstanding tradition of turning the process of discovery into a pedagogical tool. As a result, our students are nurtured in a culture of curiosity and inquiry, and continue to think critically when they enter the workplace and throughout their lives. They are, after all, our future leaders.

Our commitment to excellence ensures we continue to secure research grants across the disciplines, and our partnerships enable our research to be translated into practice. The income measure is certainly significant, but beyond our income, the true value of our research is best measured by its outcomes. It’s how our faculty and students use their research to advance and serve our broader society that really matters – whether that’s through the creation of new knowledge, policies, products, technologies or services. I am proud that the work of our researchers is making a huge difference and having

a profound impact on the lives of those in Canada and beyond.

The appeal and the value of partnerships – whether they’re with the private or public sector, around the block or around the globe – is that they allow us to put our knowledge directly into the hands of those who can use it best. From the way that we teach our students to the way we develop our partnerships, we are continually mobilizing our knowledge and transferring our technologies for the benefit of society.

And what’s best is that partnerships go both ways. The flow of information is by no means in one direction, rather we learn as much from our partners as they learn from us. Their insights, experience and challenges guide and inspire our research and inform the way we teach our students.

Together we are combining our human, financial, physical and intellectual capacity to create and support prosperity through research and innovation. Pooling our resources in this way truly means that the whole is greater than the sum of its parts.



Observatoire des sciences et des technologies

www.ost.qc.ca

Serving the Canadian research and innovation community since 1997

The *Observatoire des sciences et des technologies (OST)* was the first Canadian institution dedicated to the production and analysis of bibliometric and patent indicators.

Specialized in the evaluation of R&D activities, OST has met the needs of numerous organizations from all institutional sectors through rigorous, scientifically-proven methodologies, but also through novel approaches.

Rooted in academia, OST maintains its world class expertise through a sustained commitment in four key areas:

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FOCUS ON

Partnerships

RESEARCH

Partnerships a Cornerstone of Research With Impact

This year's *Canada's Innovation Leaders* theme is "Knowledge Transfer Through Research Partnerships" – focussing on how research partnerships are key to effective research, training and applications. Talk to research leaders across the country (see feature article page 1) and they'll inevitably speak of the power of research partnerships for facilitating and enriching research and moving ideas out of the laboratory into the marketplace and broader society. Whereas solid funding of basic academic research and applied industrial research are necessary conditions for success of Canada's research enterprise, partnerships can take the research to new levels. How?

In the first instance, partnerships can bring additional financial resources – cash and in-kind – to academic research in our universities, colleges and hospitals and expand its scope beyond available core funding. Many companies and charities, for example, are investing substantial sums to initiate or top-up research in our publicly-funded research institutions. Partnerships among the academic, industrial and government sectors can similarly expand the scale and scope of research conducted in industry.

But partnerships are about more than money. They are equally about expertise and know-how, and how expertise and know-how from different partners are brought together to address scientific and engineering challenges and opportunities. In these instances each partner brings its own capabilities to the table. Combining, say, the academic knowledge of a university researcher with the manufacturing knowledge of a medical device company can improve the chance

of commercial success of, for instance, a mobility device for people with disabilities.

Partnerships can also expand the reach and impact of publicly-funded research infrastructure – facilities and equipment that have been paid for with tax dollars. Many companies rely on the research infrastructure in university and government labs to gain access to facilities and equipment they cannot afford on their own, to develop or test technologies and products. Occasionally, academic researchers benefit from the research infrastructure in companies.

Most academic research is actually undertaken by graduate students or in the case of colleges, undergrads who are pursuing degrees or diplomas. Increasingly, students are fulfilling their research obligations by working in and with companies. This form of hands-on research training adds value to students' experience. It also constitutes a fast-track to employment as students and employers get a chance to assess one another during the research project. It's a real win-win scenario.

So, research partnerships add value to academic and industrial research in a variety of ways. How then to measure partnerships? RESEARCH Infosource is pleased to shine a spotlight on the universities, colleges and companies that stand out in their commitment to partnerships, on a variety of indicators.

Data from Statistics Canada have allowed us to determine which universities, in a 5-year period, have attracted the most research funding from the corporate and non-profit sectors; in total, and as a proportion of their total research income. This provides a useful surrogate for the level of partnerships being formed. This special university spotlight can be found on page 6.

Data from the Natural Sciences and Engineering Research Council of Canada (NSERC) awards database provided a similar perspective on corporate research partnerships with universities and colleges and the companies that are partnering with them.

Top 20 Companies Partnering with Universities and Colleges 2010-2014		
Rank	Company	Total Partnership Grants #
1	Hydro-Québec	313
2	Atomic Energy of Canada Limited	207
3	Bombardier Inc.	181
4	General Motors of Canada Limited (fs)	152
5	Suncor Energy Inc.	146
6	IBM Canada Ltd. (fs)	136
7	Vale Canada Limited (fs)	132
8	Shell Canada Limited (fs)	128
9	Pratt & Whitney Canada Corp. (fs)	126
10	BlackBerry Limited	125
11	Syncrude Canada Ltd.	110
12	BCE Inc.	103
13	Rio Tinto Group (fs)	94
14	Glencore Canada Corporation (fs)	90
14	Manitoba Hydro	90
16	Imperial Oil Limited	89
16	Resolute Forest Products Inc. (fs)	89
18	Teck Resources Limited	85
19	Tembec Inc.	83
20	Ericsson Canada Inc. (fs)	76

Notes:

1. Based on NSERC's award database and companies that partnered with universities and/or colleges during all 5 years between FY2010-FY2014.

2. Data are provided for the current parent company including any of its affiliated companies, divisions, subsidiaries and related companies involved in mergers/acquisitions during the period that partnered with an university and/or college directly, where applicable.

fs = Foreign subsidiary

Top Universities Partnering with Companies 2010-2014		
Rank	Medical/Doctoral	Total Partnership Grants \$000
1	University of British Columbia	\$76,506
2	University of Toronto	\$75,064
3	University of Alberta	\$66,292

Rank	Comprehensive	Total Partnership Grants \$000
1	University of Waterloo	\$56,553
2	University of Guelph	\$29,564
3	Simon Fraser University	\$25,103


Rank	Undergraduate	Total Partnership Grants \$000
1	École de technologie supérieure+	\$15,066
2	Ryerson University	\$9,658
3	Université du Québec à Chicoutimi	\$6,641

Note: 1. Based on NSERC awards database and universities that had one or more partnership grants with corporate partner(s) during all 5 years between FY2010-FY2014.

*Not full-service university


Top 10 Research Colleges Partnering with Companies 2010-2014		
Rank	College	Total Partnership Grants \$000
1	SAIT Polytechnic	\$6,800
2	Cégep de Saint-Hyacinthe	\$6,092
3	Cégep de l'Abitibi-Témiscamingue	\$5,750
4	Sheridan College	\$4,942
5	Cégep de La Pocatière	\$4,848
6	Cégep de Thetford	\$4,609
7	Algonquin College	\$4,550
8	Mohawk College	\$4,208
9	Seneca College	\$4,100
10	George Brown College	\$3,977

Note: 1. Based on NSERC awards database and colleges that had one or more partnership grants with corporate partner(s) during all 5 years between FY2010-FY2014.



Ontario Centres of Excellence

Where Next Happens



Investing in Ontario students and young entrepreneurs

Thousands of youth from across Ontario are drawn to OCE's campus entrepreneurship programs

Campus-Linked Accelerators (CLA) and OnCampus Entrepreneurship Activities (OCEA)

- Launched in spring of 2014
- Jobs created or retained: 1,321
- Start ups supported: 938

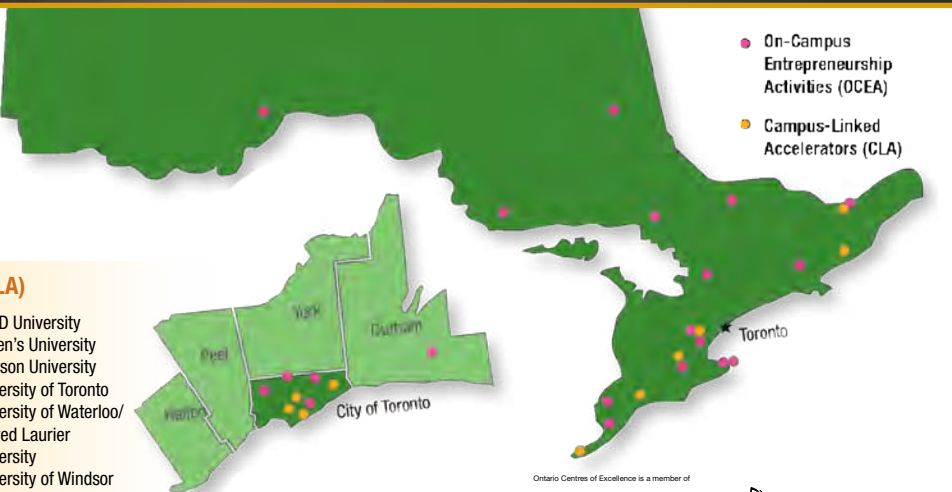
42 colleges and universities engaged in 30 communities across Ontario

On-Campus Entrepreneurship Activities (OCEA)

- Guelph University
- Georgian College
- Northern College
- Humber College
- St. Clair College
- Laurentian University/ Cambrian College/ Collège Boréal
- Conestoga College
- Lambton College
- Brock University
- Seneca College
- George Brown College
- Niagara College
- Mohawk College
- Algoma University/Sault College
- Loyalist College of Applied Arts and Technology
- York University
- Lakehead University/ Confederation College
- La Cité Collégiale
- Canadore College/ Nipissing University
- University of Ontario Institute of Technology/ Durham College/Trent University/Fleming College

Campus-Linked Accelerators (CLA)


- Ottawa: Carleton University, University of Ottawa, Algonquin College
- McMaster University
- Centennial College
- Western University/ Fanshawe College
- OCAD University
- Queen's University
- Ryerson University
- University of Toronto
- University of Waterloo/ Wilfred Laurier University
- University of Windsor




On-Campus Entrepreneurship Activities (OCEA)

Campus-Linked Accelerators (CLA)

Ontario Centres of Excellence is a member of



Ontario Network of Entrepreneurs



Wanted: Research Partnerships

Continued from page 1

Bombardier has also designated Centennial College in Toronto as the “trainer of choice” for its assembly plant in Downsview ON. “The average age of our shop floor workers is 53 years old,” says Hack. “We’re looking to retain those people but also train a generation of aircraft mechanics for our service organization as well.”

A PROVEN MODEL GOES NATIONAL

Canada's aerospace industry has pioneered a collaborative R&D approach that is attracting international attention. Modelled on the highly successful Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), the Consortium for Aerospace Research and Innovation in Canada (CARIC) brokers R&D partnerships between industry, universities, colleges and research institutions.

“Since OEMs (original equipment manufacturers) don't compete in Canada, that allows us to work together to develop technology that benefits the whole industry,” says Walter Di Bartolomeo, VP engineering at Pratt & Whitney Canada (P&WC). “And these partnerships extend to SMEs (small- and medium-sized enterprises) who can

develop materials, manufacturing and supply chain logistics – technologies they can offer not to just to P&WC but to any OEM.”

In one CARIC project, P&WC and partners are working to explore how additive manufacturing – also known as 3D printing – can optimize the design of metallic parts to develop more compact jet engines that make airplanes lighter and more fuel efficient.

Last December, P&WC announced that it would invest \$1 billion in R&D over the next four years to develop a new generation of lighter and quieter engines that use less fuel and produce fewer emissions.

“We will take some of the technologies that we have incubated with universities over the last 15 years and start to materialize them into commercial offerings,” including projects developed as part of CRIAQ and CARIC, says Di Bartolomeo.

Similar challenges face automotive companies. Fierce competition, growing consumer demands and tougher regulations put constant pressure on automakers to produce vehicles that are safer, more fuel efficient and less polluting. Brian Tossan, director of Canadian engineering at GM Canada, predicts the sector will see more changes in the

next five years than have occurred in the last 50, driven by technological advances like the “connected car”.

“We've been looking to our research partners, our university partners and our supply base to help us define what the connected car of the future will look like,” says Tossan.

Partnerships extend throughout the supply chain

Much of that research will happen at the company's engineering centre in Oshawa which is in the process of hiring 100 more software and control engineers. GM Canada's 20-year history of collaborating with Southern Ontario universities, and the skilled students these institutions produce, were key factors in the company's decision to expand its Oshawa operations.

To help identify top talent, GM Canada also works with universities to sponsor student competitions, like the EcoCAR, which challenges

competitors to build next-generation vehicles that use alternative fuels.

“By sponsoring these types of competitions we're able to give students and faculty real projects to work on with fundamental deliverables that will result in a working vehicle ... We find those types of interactions have been highly effective in us finding talent that comes to work for General Motors,” says Tossan.

It's not only universities and government labs partnering with industry. Increasingly, companies are turning to colleges and polytechnics when they need a fast solution to an immediate problem.

“We complement what universities do by taking lab-scale results and developing them to a demonstration scale technology or prototype for imminent commercial use,” explains Dr. John Fallavollita, director, Applied Research and Innovation Services (ARIS) at SAIT Polytechnic in Calgary. “If a company comes and says they need this done in four months we can help because we deliver products at the speed of industry.”

Over the past five years, more than 1,250 SAIT students have worked with 1,030 SMEs on 575 research projects to produce nearly 400 prototypes. The numbers are expected to rise with the launch this year of Kinetica Ventures. SAIT will provide the industry-led energy technology

accelerator with prototyping, design, testing and small-scale manufacturing services to help start-ups de-risk and accelerate technology in four areas: hydrocarbon recovery; energy transport; carbon capture, re-use and disposal; and renewable energy.

While low oil prices are driving down production in Alberta, Fallavollita said in a recent interview that this is a perfect time for companies to work with academia on innovations that will help the industry remain profitable and sustainable over the long term. “I'm meeting with COSIA (Canada's Oil Sands Innovation Alliance) this afternoon with one of our staff who leads environmental and energy technology. We're working with COSIA to help them and the companies they represent to cost effectively develop new technologies.”

There's a saying that “the best technology transfer walks on two feet”, referring to the students who learn job-ready skills by working directly with companies on real-world problems. This type of experiential learning is what today's employers need and what more universities and colleges are now offering.

“Part of the key to solving our innovation challenge is to ignite the fire of innovation in the next generation. You do this by giving them problems to solve and allowing them the leeway and opportunity to get creative,” says Dr. Darren Lawless, dean

of undergraduate research at Sheridan College in Oakville Ontario.

Increasingly, that means drawing on expertise from different faculties, including business, marketing and information technology.

“Instead of a company hiring five different people with different skill sets, our research group can pull together a team that looks at addressing a problem from different angles,” says Lawless. “Innovation is not just technology; it's a more holistic approach. What's going to entice someone to reach into their pocket and buy your product?”

IT'S NOT ABOUT THE MONEY

Public-private partnerships leverage more money for R&D, but everyone interviewed for this article insisted the larger cash pie is secondary to the on-the-ground impact such partnerships are having. The rationale is simple: if you want to produce a technology people will use, involve the people who will be responsible for making it, selling it and ultimately using it.

“We used to think we had all the answers,” says Dr. Alain Beaudet, president of the Canadian Institutes of Health Research (CIHR). “But working with partners made me realize we had a lot to learn: are you nimble, are you listening to patients and the people who actually use the

Continued on page 11

PARTNER PERSPECTIVE

Unleashing the Power of the Body's own Immune System to Fight off Deadly Cancers

Bristol-Myers Squibb Canada






With one in twelve Canadians being diagnosed with lung cancer in his or her lifetime, during this month's lung cancer awareness month many health care professionals and patient groups are focusing their attention on an innovative therapy that has the potential to bring long term survival to more Canadian patients.

“Immuno-oncology” or “Immunotherapy” represents an innovative approach to cancer research that seeks to harness the body's own immune system to fight tumor cells. Unlike the traditional approaches to cancer treatment that attack the cancer cell itself – surgery, radiation, chemotherapy and targeted therapy – immuno-therapies are drugs that release the natural brakes on the body's own immune system so it can fight and kill the cancer cells.

Aimed at patients with advanced or metastatic cancer, and acting on the patient's immune system to restore and eliminate cancer cells, immunotherapy is being tested in multiple tumor types. At the moment, immunotherapy

The Different Types of Cancer Treatment

Traditional cancer treatments are directed towards cancer cells.

Immuno-Oncology	Chemotherapy	Radiation	Surgery	Targeted therapy
				
Immuno-Oncology treatments use your body's own immune system to help fight cancer.	Chemotherapy is the use of medicines that kill cancer cells.	Radiation uses high-energy particles or waves to destroy cancer cells.	Surgery is an invasive procedure that is used to remove tumor tissue in an attempt to reduce cancer cells or improve symptoms in a patient.	Targeted therapy uses drugs or other treatments to more precisely identify and attack cancer cells directly.

treatment options are already available for patients with metastatic melanoma in Canada, with worldwide clinical trials also underway in other tumors such as lung, kidney, bladder, glioblastoma, and certain breast cancers.

Competition in the immunotherapy space is fast and fierce, with numerous pharmaceutical companies engaged in clinical trials in similar tumors. And while the potential of numerous therapies is good news for Canadians

fighting deadly cancers, the Canadian health system will face a challenge in managing and paying for the flow of new treatments the industry will continue to bring to patients.

“Research into innovative cancer therapies is moving very fast” said Dr. David Hogg, Professor, Department of Medicine, University of Toronto and Attending Physician, Princess Margaret Hospital. “When you consider the speed at which things are evolving, all the different

tumor types and all the possible combinations that can be tested, there are suddenly some really interesting opportunities. Through immunotherapy we may well be looking at a revolution in cancer care in Canada.”

Wanted: Research Partnerships

Continued from page 10

research? Can you do things more efficiently and less bureaucratically? Through our partnerships we learned on all these fronts.”

More than half of CIHR's funding still goes to early-stage discovery research where it could take decades for the discovery of a new gene, for example, to become a regulatory approved drug. The other half of its grants envelope goes to priority-driven research that addresses more immediate issues, like the health needs of an aging population.

Sometimes those partnerships are between CIHR and the provinces, or between federal agencies. Such was the case with the recent development of a vaccine for Ebola – the result of a collaboration between CIHR, the Public Health Agency of Canada, the International Development Research Centre and the Department of Foreign Affairs, Trade and Development.

“We focused our efforts, energy and funding collectively into a phase 1 trial for a vaccine in Canada using the talent and capacity we already had in the country, and the network for vaccine testing that we had developed a long time ago first dealing with SARS and then H1N1,” says Beaudet.

Based on the success of the phase 1 trial, human trials were launched in Guinea led by the World Health Organization, involving CIHR, PHAC, the governments of Guinea, Médecins Sans Frontières and Britain's Wellcome Trust charity. Early results this year showed the vaccine protected 100% of trial participants from getting the virus.

At the University Health Network (UHN) in Toronto, it was an expertise in engineering, physics and software that helped commercialize a non-invasive radiosurgery that treats brain disorders without scalpels and incisions. Most patients are in and out of the hospital that same day and back to their normal routines soon after treatment. The underlying software is now part of an imaging device marketed by a Swedish company.

“The device company knows about the marketplace – expertise we wouldn't necessarily have,” says Dr. Christopher Paige, VP research at UHN and senior scientist at Princess Margaret Cancer Centre.

UHN medical physicists also invented a sensor called an integral quality monitor, which ensures that the correct dose of radiation therapy is safely and precisely given to a tumour. UHN worked with a German company to refine the technology, which is now bringing the product to market.

“You can't expect to help patients unless at some time along the development of a new discovery you don't bring the private sector in,” adds Paige. “We're 100% in favour of merging the interests of the hospital with the interests of the private sector.”

Made-in-Canada

Ebola vaccine

a first

That view is echoed at Innovation York, launched three years ago to provide companies with a single point of entry for York University's 11 faculties and 24 research institutes and centres in the Greater Toronto Area.

“Innovation York connects people to everything that's being done at the university,” says Dr. Robert Haché, the university's VP of research and innovation. “As a result, our research agreements have been growing at about 20% a year over the last three years.”

One of York's biggest projects is Connected Health and Wellness, involving 19 university, health-care and industry partners, including heavyweights like BlackBerry, Rogers and NexJ Systems. The \$38-million project is integrating mobile, cloud-based computer technology to enable patients – for the first time ever – to access and share their health records with family, friends and care teams.

“York is a leader in what is often termed knowledge mobilization, or the transfer of knowledge from beyond technology-driven disciplines into productive users for society,” says Haché.

Of course, not all research ends up

in a new gadget, therapy or service. One example is communityBUILD, a partnership between York, the ventureLAB regional innovation centre, Seneca College and United Way York Region. Described as “grounded in community, guided by research and driven by entrepreneurship”, the program offers a system of supports to help for-profit social enterprises address regional challenges such as food security and youth employment.

SHARING BUSINESS EXPERTISE WITH SOCIAL ENTERPRISES

Another new project led by the University of Ottawa – Linking natural capital and productivity – is developing new approaches to measuring productivity that take into account the state of the environment. The goal is to examine the link between environmental and economic successes to help governments and industries optimize best practices and develop good policies. Partners include five universities, three federal departments, the Forest Protects Association of Canada and Shell Canada.

“Here you have all these partners working together to find ways to ensure profitability but in ways that are environmentally prudent,” says Dr. Ted Hewitt, president of the Social Sciences and Humanities Research Council of Canada, which funded the three-year study.

He adds that tech transfer needs both partnerships and participation from social scientists to be successful. “Technology has very little value until one contemplates how it will be used. That may include developing business plans or knowledge mobilization plans, or studying precisely how one intends to use a technology.”

As for the role of partners, Hewitt insists it's a no brainer. “If you want to do knowledge translation and have relevant research you have to have partners. It allows you to get at some of these more sophisticated, difficult and more complicated challenges – and ultimately have a bigger impact in the end.”

Debbie Lawes (Debbie@dover-courteditorial.ca) is an Ottawa-based science writer.

Our commitment to

research that has impact



Dr. Carrie Bourassa, a professor at the First Nations University of Canada, is looking to change the way health care is delivered to Indigenous women infected with HIV/ AIDS and Hepatitis C. Her approach may seem simple – she plans to ask them to share their experiences; it may also result in profound changes in health care delivery, and aid in developing a model for culturally-safe health care in Canada.

Bourassa, an inductee in the Royal Society of Canada, College of New Scholars, Artists and Scientists, in partnership with a community-based team, is leading a Canadian Institutes of Health Research funded initiative that will oversee more than 300 interviews with Indigenous women who have HIV/AIDS or Hepatitis C. The team includes co-principal investigator Margaret Poitras, executive director for All Nations Hope Network; two community-based navigators; and the involvement of groups such as the Canadian Aboriginal AIDS Network (CAAN).

“This is not research that is being done "on" or "to" a community," says Bourassa, who hopes this work will help educate health care providers about the issues, challenges and stories of the women who seek their services.

“The only way we are going to be able to change how care is delivered is if we ask," adds Bourassa. "They are the ones that know."

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Canada's TOP 40 RESEARCH HOSPITALS 2015

Rank		Hospital/Health Authority	Research Activity			Research Intensity		Prov	Research Institute(s)/Centre(s)
			FY2014 \$000	FY2013 \$000	% Change 2013-2014	Researcher** (\$ per Researcher \$000)	Institution (Research \$ as a % of Total Activity)		
2014	2013								
1	1	University Health Network	\$303,100	\$298,200	1.6	\$550.1	15.5	ON	Princess Margaret Cancer Centre, Toronto General Research Institute, Toronto Rehabilitation Institute, Toronto Western Research Institute, Techna Institute
2	2	Hamilton Health Sciences	\$212,017	\$182,101	16.4	\$441.7	16.5	ON	Population Health Research Institute, Thrombosis and Atherosclerosis Res. Institute, Escarpment Cancer Research Institute
3	3	The Hospital for Sick Children	\$199,927	\$174,916	14.3	\$331.6	25.6	ON	Peter Gilgan Centre for Research and Learning
4	4	McGill University Health Centre (MUHC)	\$190,309	\$175,554	8.4	\$530.1	17.8	QC	Research Institute of the MUHC
5	6	Provincial Health Services Authority*	\$142,381	\$128,101	11.1	\$193.5	5.2	BC	BC Cancer Research Centre, BC Children's Hospital - Child & Family Research Institute, BC Centre for Disease Control
6	7	Vancouver Coastal Health Authority*	\$124,057	\$117,971	5.2	\$298.2	3.9	BC	Vancouver Coastal Health Research Institute, Providence Health Care Research Institute
7	5	The Ottawa Hospital	\$123,691	\$129,800	-4.7	\$332.5	9.1	ON	The Ottawa Hospital Research Institute, The Ottawa Heart Institute Research Corporation
8	8	London Health Sciences Centre/St. Joseph's Health Care London ^(a)	\$113,381	\$114,211	-0.7	\$197.2	7.1	ON	Lawson Health Research Institute
9	11	Sunnybrook Health Sciences Centre	\$94,215	\$81,224	16.0	\$329.4	9.7	ON	Sunnybrook Research Institute, Sunnybrook Research Academy
10	9	Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex ⁺	\$88,296	\$103,493	-14.7	\$663.9	17.8	ON	Lunenfeld-Tanenbaum Research Institute
11	10	CHU de Québec - Université Laval*	\$85,457	\$84,113	1.6	\$240.0	6.9	QC	Centre de recherche du CHU de Québec - Université Laval
12	13	St. Michael's Hospital	\$69,342	\$62,688	10.6	\$335.0	10.9	ON	Keenan Research Centre for Biomedical Science, Li Ka Shing Knowledge Institute
13	12	Centre hospitalier de l'Université de Montréal (CHUM)	\$66,029	\$66,143	-0.2	\$181.4	6.9	QC	Centre de recherche du CHUM
14	14	Sir Mortimer B. Davis Jewish General Hospital ⁺	\$61,129	\$59,856	2.1	\$252.6	13.1	QC	Lady Davis Institute for Medical Research
15	15	Centre for Addiction and Mental Health	\$57,269	\$49,658	15.3	\$540.3	15.3	ON	Campbell Family Mental Health Research Institute, Research Imaging Centre, Temerty Centre for Therapeutic Brain Intervention
16	17	Institut de Cardiologie de Montréal	\$54,320	\$57,344	-5.3	\$705.5	26.0	QC	Centre de recherche de l'Institut de Cardiologie de Montréal
17	16	CHU Sainte-Justine	\$39,333	\$40,260	-2.3	\$193.8	9.1	QC	Centre de recherche du CHU Sainte-Justine
18	19	Institut universitaire de cardiologie et de pneumologie de Québec - Université Laval	\$33,924	\$33,347	1.7	\$230.8	11.9	QC	Centre de recherche de l'Institut universitaire de cardiologie et de pneumologie de Québec
19	21	St. Joseph's Healthcare Hamilton	\$27,952	\$26,406	5.9	\$188.9	5.2	ON	Firestone Institute for Respiratory Health, Programs for Assessment of Technology in Health (PATH) Research Institute, Peter Boris Centre for Additions Research, Boris Family Centre of Robotic Surgery, Hamilton Centre for Kidney Research
20	22	Winnipeg Regional Health Authority (WRHA) ^(b)	\$27,090	\$24,742	9.5	\$118.8	1.5	MB	Children's Hospital Research Institute of Manitoba
21	20	Children's Hospital of Eastern Ontario	\$24,209	\$27,627	-12.4	\$128.8	9.0	ON	CHEO Research Institute
22	23	Douglas Mental Health University Institute ⁺	\$22,522	\$21,358	5.4	\$417.1	15.6	QC	Douglas Hospital Research Centre
23	24	Institut universitaire en santé mentale de Québec ⁺	\$19,754	\$19,347	2.1	\$299.3	14.2	QC	Centre de recherche de l'Institut universitaire en santé mentale de Québec
24	28	Capital District Health Authority ⁺	\$19,049	\$17,368	9.7	\$76.2	1.9	NS	
25	18	Centre hospitalier universitaire de Sherbrooke (CHUS) ⁺	\$18,290	\$16,878	8.4	\$81.7	3.6	QC	Centre de recherche du CHUS (CRCHUS)
26	25	Hôpital Maisonneuve-Rosemont ⁺	\$16,891	\$14,122	19.6	\$203.5	4.0	QC	Centre de recherche de l'Hôpital Maisonneuve-Rosemont
27	26	Baycrest	\$16,855	\$18,975	-11.2	\$581.2	10.6	ON	Rotman Research Institute, Kunin-Lunenfeld Applied & Evaluative Research Unit
28	27	Kingston General Hospital	\$16,331	\$16,885	-3.3	\$89.2	3.7	ON	Kingston General Hospital Research Institute
29	30	St. Boniface Hospital	\$15,596	\$12,896	20.9	\$389.9	4.3	MB	St. Boniface Hospital Research Centre
30	29	IWK Health Centre	\$14,080	\$15,000	-6.1	\$140.8	5.2	NS	Biomedical Translational Imaging Centre, Canadian Center for Vaccinology, Centre for Pediatric Pain Research, Centre for Research in Family Health, Maritime Human Genetics Research Centre
31	31	Women's College Hospital	\$12,155	\$9,479	28.2	\$347.3	10.0	ON	Women's College Research Institute
32	32	Hôpital du Sacré-Coeur de Montréal ⁺	\$10,879	\$10,273	5.9	\$78.8	3.0	QC	Centre de recherche de l'Hôpital du Sacré-Coeur de Montréal
33	36	Holland Bloorview Kids Rehabilitation Hospital	\$9,038	\$7,079	27.7	\$430.4	11.2	ON	Bloorview Research Institute
34	34	Institut universitaire de gériatrie de Montréal ⁺	\$7,749	\$7,508	3.2	\$138.4	11.9	QC	Centre de recherche de l'Institut universitaire de gériatrie de Montréal
35	37	Thunder Bay Regional Health Sciences Centre	\$7,597	\$7,295	4.1	\$135.7	2.4	ON	Thunder Bay Regional Research Institute
36	40	Health Sciences North (HSN)	\$7,401	\$7,654	-3.3	\$92.5	1.7	ON	Advanced Medical Research Institute of Canada
37	35	Saskatoon Regional Health Authority*	\$7,157	\$7,433	-3.7	\$30.2	0.6	SK	Saskatoon Centre for Patient-Oriented Research, Cameco MS Neuroscience Research Center
38		Hôpital Montfort	\$6,626	\$5,899	12.3	\$147.2	3.1	ON	Institut de recherche de l'Hôpital Montfort
39	33	The Royal	\$6,319	\$5,773	9.5	\$92.9	4.0	ON	University of Ottawa Institute of Mental Health Research
40	38	Bruyère Continuing Care	\$6,071	\$6,439	-5.7	\$202.4	4.4	ON	Bruyère Research Institute

Notes:

- Data were obtained through a survey of research hospitals or from financial statements. Information for Alberta Health Services and Newfoundland was not available. Information for Ontario was coordinated in part through CAHO (Council of Academic Hospitals of Ontario).
- Research activity includes all income/expenditure (direct and indirect) received/spent from all sources (internal and external) to support research. Some hospitals (indicated with an asterisk *) provided research income data. Other institutions provided research expenditure data.
- FY2013 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.

*Reported research income data.

**Based on a head count of researchers/scientists/investigators/clinician-researchers conducting research. Does not include research fellows/post docs, technicians, students or support staff.

^(a) Not current name

^(b) Research expenditure amounts were combined as these hospitals have one research institute.

^(c) Data for St. Boniface Hospital are not included with WRHA.

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CANADA'S TOP 40 Research Hospitals

HOSPITAL RESEARCH RESOURCES GAIN

Research activity at Canada's Top 40 Research Hospitals rose by a combined 5.0% in Fiscal 2014. Hospitals, Hospital Networks and Health Authorities reported that their research expenditures (or in 4 instances, research income) increased to \$2.38 billion from \$2.27 billion in Fiscal 2013. (Detailed data for Alberta hospitals, which were not available in time for publication, would have added \$165 million to the total.) The number of hospital researchers increased by 4.5% to 8,572 from 8,205 the prior year. New to the Top 40 list this year is Ottawa's Hôpital Montfort.

The country's largest hospital research performer was Toronto's University Health Network, which reported \$303.1 million of spending on research, up 1.6% from Fiscal 2013. Hamilton Health Sciences occupies 2nd place with \$212.0 million of spending, an increase of 16.4%. The Hospital for Sick Children took third place with spending of \$199.9 million, up 14.3% on the year prior. With \$190.3 million of spending (up 8.4%) McGill University Health Centre captured 4th place on the Top 40 list, followed by B.C.'s Provincial Health Services Authority at \$142.4 million, up 11.1%. In total, 27 institutions reported activity gains against 13 where activity declined.

RESEARCH INTENSITY

Research Infosource measures research intensity in two ways: by researcher (research income/expenditure per researcher), and by institution (institution research activity as a percent of total institution income/expenditure). Institut de Cardiologie de Montréal (ICM) posted the highest level of researcher-intensity with \$705,500 of expenditure per researcher. Next was Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex (\$663,900), Baycrest (\$581,200), University Health Network (\$550,100), and Centre for Addiction and Mental Health (\$540,300).

Measured by institutional intensity (proportion of total activity that research comprises – i.e. institution budget), Institut de Cardiologie de Montréal ranked

The \$100 Million Club		
2014 Rank	Research Hospital	Research Activity \$000
1	University Health Network	\$303,100
2	Hamilton Health Sciences	\$212,017
3	The Hospital for Sick Children	\$199,927
4	McGill University Health Centre (MUHC)	\$190,309
5	Provincial Health Services Authority*	\$142,381
6	Vancouver Coastal Health Authority*	\$124,057
7	The Ottawa Hospital	\$123,691
8	London Health Sciences Centre/ St. Joseph's Health Care London ^(a)	\$113,381

highest among the Top 40, with research activity at 26.0% of total hospital expenditure. ICM narrowly displaced last year's leader, The Hospital for Sick Children (25.6% intensity). McGill University Health Centre and Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex were tied at 17.8% intensity.

THE \$100 MILLION CLUB

With activity topping \$100 million each, 8 hospitals gained membership in Research Infosource's \$100 Million Club, compared with 9 hospitals the year before. Combined activity among the 8 Club members expanded by 6.7%, to \$1.41 billion, slightly above the 5.0% all-institution increase. Club members accounted for 59.3% of the Top 40 total research activity.

PROVINCIAL PERFORMANCE

The province of Ontario had half the nation's total – 20 of the Top 40 Research Hospitals – and accounted for 59.0% of total national research activity, about the same as last year. Quebec's 13 institutions comprised 26.4%

Top 40 – Leading Provinces	
Province	% of Total
Ontario (20)	59.0
Quebec (13)	26.4
British Columbia (2)	11.2

of the total, followed by 2 British Columbia members of the Top 40, which accounted for 11.2% of total activity. From a provincial standpoint, growth was strongest in Manitoba, where activity at 2 reporting institutions increased by 13.4%. Gains were also stronger than the national trend in British Columbia (up 8.3%) and Ontario (up 4.9%).

PERFORMANCE BY TYPE

Research Infosource's Top 40 Research Hospitals list is in fact an amalgam of 3 types of institutions: stand-alone Hospitals, Hospital Networks and Health Authorities. There are 22 Hospitals on the Top 40 list, accounting for a combined \$759.9 million of research activity and a total 6.9% year-on-year increase. Hospital Networks include 13 organizations with \$1.3 billion of research, up 3.1% on Fiscal 2013. The Top 40 also includes 5 Health Authorities, which reported \$319.7 million of research, an increase of 8.2%.

RESOURCE GROWTH

Eleven of the Top 40 hospitals recorded research growth in double-digits. Research activity at Toronto's Women's College Hospital increased by 28.2%, followed by Holland Bloorview Kids Rehabilitation Hospital (up 27.7%), St. Boniface Hospital (up 20.9%), Hôpital Maisonneuve-Rosemont (up 19.6%), and Hamilton Health Sciences (up 16.4%).

THIS YEAR AND NEXT

Research activity among the Top 40 (expenditure or income) rose by 5.0% from last year, a substantial improvement over the 1.1% gain in Fiscal 2013. As with universities and colleges, a high portion of

Spotlight on Hospital Research Intensity			
TOP RESEARCHER-INTENSIVE ORGANIZATIONS			
Rank	Large Hospitals	Researcher Intensity (\$ per Researcher**) \$000	
1	University Health Network	\$550.1	
2	McGill University Health Centre (MUHC)	\$530.1	
3	Hamilton Health Sciences	\$441.7	
Rank	Mid-sized Hospitals	Researcher Intensity (\$ per Researcher**) \$000	
1	Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex [†]	\$663.9	
2	St. Michael's Hospital	\$335.0	
3	The Hospital for Sick Children	\$331.6	
Rank	Small Hospitals	Researcher Intensity (\$ per Researcher**) \$000	
1	Institut de Cardiologie de Montréal	\$705.5	
2	Baycrest	\$581.2	
3	Centre for Addiction and Mental Health	\$540.3	
TOP INSTITUTION-INTENSIVE ORGANIZATIONS			
Rank	Large Hospitals	Institution Intensity (Research \$ as % of Total Activity)	
1	McGill University Health Centre (MUHC)	17.8	
2	Hamilton Health Sciences	16.5	
3	University Health Network	15.5	
Rank	Mid-sized Hospitals	Institution Intensity (Research \$ as % of Total Activity)	
1	The Hospital for Sick Children	25.6	
2	Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex [†]	17.8	
3	Sir Mortimer B. Davis Jewish General Hospital [†]	13.1	
Rank	Small Hospitals	Institution Intensity (Research \$ as % of Total Activity)	
1	Institut de Cardiologie de Montréal	26.0	
2	Douglas Mental Health University Institute	15.6	
3	Centre for Addiction and Mental Health	15.3	

hospital research funding comes from public sector sources – primarily federal and provincial governments. However, hospitals typically receive more of their research resources from private sources – non-profit organizations and individual donors.

One is ever hopeful, but 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.

Notes:
1. Large hospitals = total income/expenditure of \$1 billion or more; Mid-sized = total income/expenditure between \$400 million and \$1 billion; Small = total income/expenditure of \$400 million or less.
2. Research activity includes all income/expenditure (direct and indirect) received/spent from all sources (internal and external) to support research.
*Reported research income data.
**Based on a head count of researchers/scientists/investigators/clinician-researchers conducting research. Does not include fellows/post docs, technicians, students or support staff.
†Not current name
(a) Research expenditure amounts were combined as these hospitals have one research institute.
(b) Data for St. Boniface Hospital are not included with WRHA.

Top 10 Research Hospitals by Growth			
2014 Rank			
Activity Growth	Overall	Research Hospital	% Change 2013-2014
1	31	Women's College Hospital	28.2
2	33	Holland Bloorview Kids Rehabilitation Hospital	27.7
3	29	St. Boniface Hospital	20.9
4	26	Hôpital Maisonneuve-Rosemont [†]	19.6
5	2	Hamilton Health Sciences	16.4
6	9	Sunnybrook Health Sciences Centre	16.0
7	15	Centre for Addiction and Mental Health	15.3
8	3	The Hospital for Sick Children	14.3
9	38	Hôpital Montfort	12.3
10	5	Provincial Health Services Authority*	11.1

Spotlight on Research Activity by Type

RESEARCH ACTIVITY BY TYPE OF HEALTH INSTITUTION

Rank	Hospitals	Research Activity \$000	Rank	Hospital Networks	Research Activity \$000	Rank	Health Authorities	Research Activity \$000
1	The Hospital for Sick Children	\$199,927	1	University Health Network	\$303,100	1	Provincial Health Services Authority*	\$142,381
2	Sunnybrook Health Sciences Centre	\$94,215	2	Hamilton Health Sciences	\$212,017	2	Vancouver Coastal Health Authority*	\$124,057
3	St. Michael’s Hospital	\$69,342	3	McGill University Health Centre (MUHC)	\$190,309	3	Winnipeg Regional Health Authority (WRHA) ^(b)	\$27,090

PARTNER PERSPECTIVE

Making Canada Healthier, Wealthier, Smarter



Karen Michell
Executive Director,
Council of Academic Hospitals of
Ontario (CAHO)

Congratulations to all the research hospitals named in the 2015 Top 40 list. The Council of Academic Hospitals of Ontario (CAHO) represents Ontario's 24 research hospitals. We see every day how our members make important contributions to our health care system, making Ontario – and Canada – healthier, wealthier and smarter. Core to their mission, research hospitals across the country strive for bolder ideas, bigger discoveries, better treatment and

faster cures, all while stimulating our country's economy and attracting and retaining the brightest and best minds from around the world. In the past year alone, CAHO members have brought 77 health technology commercializations from the lab bench to the patient bedside. By translating research into marketable health products, CAHO member hospitals are not only generating revenue and investment, they are expediting new treatments and delivering better quality care to patients who need it today. From stem cell basic science that is on the cusp of discoveries related to diabetes, heart disease and certain types of blindness, to clinical trials that has put a patient with Mantle Cell Lymphoma into remission after being told she had 2-5 years to live, to patient-informed research that has led to technological developments

for children with disabilities, health research is having a direct and real impact everyday. As Ontario and Canada strengthens our respective role as a global health leader, through the imperative work being done in Canada led by the research hospitals on the Top 40 list, we need a shared vision for health research. This requires a collaborative approach that brings together government, health care organizations, academic facilities and industry. We need to build partnerships that sustain Canada's health research enterprise. A healthy research ecosystem can only be sustained by a strong vision, investment, support and collaboration. When bright minds collaborate, even the unimaginable becomes deliverable. Learn more at www.healthier-wealthier-smarter.com and join the #onHWS dialogue on Twitter.

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November 6, 2015									
Canada's TOP 50 RESEARCH COLLEGES 2015									
Rank		College	Research Income			Faculty*	Research Intensity		
2014	2013		FY2014 \$000	FY2013 \$000	% Change 2013-2014	2013-2014 #	\$ per Faculty \$000	Prov	Main Research Institute/ Centre/Facility
1	3	George Brown College	\$14,227	\$9,269	53.5	138	\$103.1	ON	Food & Innovation Research Studio
2		Cégep de Saint-Hyacinthe	\$9,365	\$8,943	4.7	107	\$87.5	QC	Groupe CTT/CTT Group
3	5	SAIT Polytechnic	\$7,202	\$6,602	9.1	61	\$118.1	AB	Green Building Technology Access Centre
4	4	Cégep de la Gaspésie et des îles	\$7,090	\$6,665	6.4	47	\$150.9	QC	TechnoCentre éolien
5	1	British Columbia Institute of Technology	\$7,040	\$15,240	-53.8	120	\$58.7	BC	Building Science Centre of Excellence
6	7	Cégep Édouard-Montpetit	\$6,206	\$5,441	14.1	43	\$144.3	QC	Centre technologique en aérospatiale
7	35	Cégep de La Pocatière	\$5,622	\$1,513	271.6	35	\$160.6	QC	Solutions Novika
8	6	Red River College	\$5,581	\$5,821	-4.1	64	\$87.2	MB	Technology Access Centre - Aerospace & Manufacturing
9	9	Sheridan College	\$5,497	\$4,270	28.7	57	\$96.4	ON	Screen Industries Research & Training Centre (SIRT)
10	12	Niagara College	\$5,340	\$4,036	32.3	75	\$71.2	ON	Canadian Food & Wine Institute Innovation Centre
11	17	Lambton College	\$5,292	\$3,108	70.3	29	\$182.5	ON	Centre of Excellence in Energy and Bio-Industrial Technologies
12	13	Centennial College	\$5,234	\$3,941	32.8	83	\$63.1	ON	Applied Research, Innovation and Entrepreneurship Services (ARIES)
13	11	Cégep de Trois-Rivières	\$4,256	\$4,057	4.9	42	\$101.3	QC	Centre de métallurgie du Québec
14	10	Yukon College	\$4,184	\$4,256	-1.7	10	\$418.4	YT	Yukon Research Centre
15	14	Cégep André-Laurendeau	\$3,976	\$3,563	11.6	13	\$305.8	QC	OPTECH
16	16	Cégep de Thetford	\$3,787	\$3,211	17.9	40	\$94.7	QC	OLEOTEK and Centre de Technologie Minérale et de Plasturgie
17	22	Mohawk College	\$3,492	\$2,434	43.5	25	\$139.7	ON	iDeaWORKS
18	15	Cégep de Lévis-Lauzon	\$3,453	\$3,401	1.5	33	\$104.6	QC	TransBIOTech
19	28	Nova Scotia Community College	\$3,438	\$2,013	70.8	52	\$66.1	NS	Applied Geomatics Research Centre
20	33	Collège communautaire du Nouveau-Brunswick	\$2,892	\$1,723	67.8	23	\$125.7	NB	Centre pré-commercial de technologies en bioprocédés
21	27	Olds College	\$2,812	\$2,018	39.3	29	\$97.0	AB	Olds College Centre for Innovation
22	21	Cégep de Saint-Jérôme	\$2,811	\$2,515	11.8	24	\$117.1	QC	Centre de développement des composites du Québec
23	8	Seneca College	\$2,745	\$4,356	-37.0	68	\$40.4	ON	Centre for Development of Open Technology
24	31	Algonquin College	\$2,379	\$1,881	26.5	71	\$33.5	ON	Design Centre
25	32	Collège Shawinigan	\$2,337	\$1,842	26.9	15	\$155.8	QC	Centre National en Électrochimie et en Technologies Environnementales
26	26	Collège de Maisonneuve	\$1,964	\$2,150	-8.7	10	\$196.4	QC	Centre d'études des procédés chimiques du Québec
27	34	Cégep de Sainte-Foy	\$1,926	\$1,549	24.3	30	\$64.2	QC	Centre d'enseignement et de recherché en foresterie de Sainte-Foy
28	23	Justice Institute of British Columbia	\$1,792	\$2,413	-25.7	22	\$81.5	BC	Centre for Resilient Communities
29	38	Red Deer College	\$1,753	\$1,388	26.3	90	\$19.5	AB	Centre for Innovation in Manufacturing
30	18	La Cité ^(a)	\$1,704	\$3,034	-43.8	20	\$85.2	ON	Centre d'accès à la technologie en bio-innovation
31	24	Humber College	\$1,676	\$2,393	-30.0	73	\$23.0	ON	Centre for Urban Ecology
32	19	Grande Prairie Regional College	\$1,649	\$2,962	-44.3	19	\$86.8	AB	National Bee Diagnostic Centre - Technology Access Centre
33	37	Camosun College	\$1,612	\$1,397	15.4	17	\$94.8	BC	Camosun Technology Access Centre
34	36	Cambrian College	\$1,564	\$1,490	5.0	33	\$47.4	ON	Glencore Centre for Innovation
35	29	Fleming College	\$1,492	\$1,934	-22.9	33	\$45.2	ON	Centre for Alternative Wastewater Treatment
36	25	Durham College	\$1,455	\$2,282	-36.2	31	\$46.9	ON	Applied Minerology Lab
37	41	College of the North Atlantic	\$1,293	\$1,107	16.8	23	\$56.2	NL	
38	20	Lakeland College	\$1,178	\$2,613	-54.9	8	\$147.3	AB	
39	46	Holland College	\$1,140	\$969	17.6	26	\$43.8	PE	
40	40	Saskatchewan Polytechnic	\$1,121	\$1,281	-12.5	65	\$17.2	SK	Saskatchewan Polytechnic BioScience Applied Research Centre
41	44	Cégep de Sherbrooke	\$1,088	\$1,073	1.4	40	\$27.2	QC	Centre de productique intégrée du Québec
42	45	Lethbridge College	\$970	\$1,026	-5.5	15	\$64.7	AB	Centre for Applied Research and Innovation
43	48	Cégep de Sept-Îles	\$964	\$878	9.8	22	\$43.8	QC	Institut technologique de maintenance industrielle
44	39	Cégep de Rimouski	\$955	\$1,293	-26.1	16	\$59.7	QC	Service de recherche et d'expertise en transformation des produits forestiers
45	30	Conestoga College	\$939	\$1,903	-50.7	92	\$10.2	ON	Centre for Smart Manufacturing
46	47	Dawson College	\$912	\$957	-4.7	22	\$41.5	QC	Centre de recherche pour l'inclusion scolaire et professionnelle des étudiants en situation de handicap
47	43	St. Lawrence College	\$695	\$1,080	-35.6	15	\$46.3	ON	Sustainable Energy Applied Research Centre
48		College of New Caledonia	\$660	\$348	89.7	12	\$55.0	BC	CNC Research Forest
49	50	Fanshawe College	\$617	\$768	-19.7	42	\$14.7	ON	Centre for Sustainable Energy & Environments
50		Cégep régional de Lanaudière	\$611	\$422	44.8	25	\$24.4	QC	Centre d'expertise et de formation en design industriel
<div>Notes:</div> <div>1. Research income includes all funds (direct and indirect) to support applied and scholarly research received from all sources (internal and external).</div> <div>2. Data were obtained through a survey of publicly-funded colleges and from financial statements.</div> <div>3. Data are provided for the main college including affiliated research institutes/centres, where applicable.</div> <div>4. FY2013 figures may have been adjusted as more accurate information became available.</div> <div>*Head count of faculty/teaching staff and/or dedicated researchers conducting research. Does not include support staff or student researchers.</div> <div>^(a) Formerly named La Cité collégiale</div> <div>RESEARCH Infosource Inc. is Canada's source of R&D intelligence. For further information visit www.researchinfosource.com or call (647) 345-3434 ext 22.</div> <div>© RESEARCH Infosource Inc. 2015. Unauthorized reproduction prohibited.</div>									

CANADA'S TOP
50
RESEARCH
COLLEGES



CANADA'S
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CANADA’S TOP 50 Research Colleges

RESEARCH TRAJECTORY SLOWING

Growth in research activity at Canada’s Top 50 Research Colleges cooled substantially in Fiscal 2014, posting a 4.7% increase compared with a 38.8% expansion in Fiscal 2013. Combined research income reached \$158.0 million, compared with \$150.8 million the previous year. In total 31 colleges reported gains in research income while 19 colleges reported declines. Because the number of college faculty engaged in research increased by 14.3%, year-on-year research intensity (income per faculty) declined by -8.3%, to \$75,054 from \$81,883.

George Brown College headed the Top 50 list, attracting \$14.2 million of research income last year, with year-on-year growth reaching 53.5%. Cégep de Saint-Hyacinthe recorded about \$9.4 million of income, followed by SAIT Polytechnic at \$7.2 million. Rounding out the top 10 were Cégep de la Gaspésie et des Îles (\$7.1 million), British Columbia Institute of Technology (\$7.0 million), Cégep Édouard-Montpetit (\$6.2 million), Cégep de La Pocatière (\$5.6 million), Red River

College (\$5.6 million), Sheridan College (\$5.5 million), and Niagara College (\$5.3 million).

PROVINCIAL PERFORMANCE

Provincially, Québec’s 17 colleges accounted for a total of \$57.3 million of research income and 36.3% of total Top 50 activity. With 16 colleges, Ontario posted income of \$54.3 million and accounted for 34.4% of national activity. Colleges in all other provinces/territories combined accounted for 29.2% of national income.

Among the 4 leading provinces with more than 1 college reporting, average per-college income was highest in Ontario (\$3.40 million), Québec (\$3.37 million), British Columbia (\$2.78 million) and Alberta (\$2.59 million). (Note that Alberta’s results were affected because NAIT and Bow Valley College did not participate in this year’s survey.)

INCOME GROWTH LEADERS

In spite of the modest national result (4.7% increase) many colleges exhibited very strong rates of growth in income last year. Income grew by 271.6% at Cégep de La Pocatière, 89.7% at College of New Caledonia, 70.8% at Nova Scotia Community College, 70.3% at Lambton College and 67.8% at Collège communautaire du Nouveau-Brunswick.

RESEARCH INTENSITY

Average Top 50 research intensity – research income per faculty – declined by -8.3% last year, to \$75,054. Research intensity was highest at Yukon College (\$418,400 per faculty), followed by Cégep André-Laurendeau (\$305,800 per faculty) and Collège de Maisonneuve (\$196,400 per faculty). Overall, 25 of the 50 research colleges posted research intensities higher than the national average.

RESEARCH PARTNERSHIPS AND PROJECTS

A key metric for college research is the number of active and completed formal research partnerships and projects that colleges have with external organizations. This year the Top 50 Research Colleges reported a total of 2,093 active research partnerships, compared with 1,810 in Fiscal 2013. Similarly, they tallied 2,021 completed projects compared with 1,782 the year before.

THIS YEAR AND NEXT

This is the third year in which Research Infosource has reported on college research activity. We thank all the participating colleges for their cooperation in providing the data that help us to track national trends. As previously indicated, total Fiscal 2014 research income expanded by 4.7%, which was well below the 38.8% growth seen in Fiscal 2013 and the 35.4% growth in Fiscal 2012. On the positive side, the number of college faculty engaged in research expanded by 14.3%. Active research partnerships grew by 15.6% and completed projects expanded by 13.4%.

Why the reduced rate of income growth, which admittedly is only one measure of research activity? It is possible (though not likely) that external funders – primarily governments and the private sector – reduced the amounts of money available for college research.

Spotlight on College Research Activity

TOP COLLEGES BY # OF PARTNERSHIPS*

Partnerships			Partnerships			Partnerships		
Rank	Large Colleges	#	Rank	Mid-sized Colleges	#	Rank	Small Colleges	#
1	George Brown College	159	1	Cégep de Trois-Rivières	137	1	Cégep de La Pocatière	125
2	Algonquin College	135	2	Cégep de Saint-Hyacinthe	75	2	Cégep de Thetford	98
3	Sheridan College	122	3	Cégep Édouard-Montpetit	60	3	Collège Shawinigan	57

TOP COLLEGES BY # OF COMPLETED PROJECTS*

Completed Projects			Completed Projects			Completed Projects		
Rank	Large Colleges	Projects #	Rank	Mid-sized Colleges	Projects #	Rank	Small Colleges	Projects #
1	Sheridan College	225	1	Cégep de Trois-Rivières	133	1	Cégep de La Pocatière	173
2	George Brown College	182	2	Cégep Édouard-Montpetit	71	2	Cégep de Thetford	92
3	Algonquin College	170	3	Collège communautaire du Nouveau-Brunswick	58	3	Cégep de la Gaspésie et des Îles	61

Notes: Large college = total income of \$100 million or more; Mid-sized = total income between \$50 million and \$100 million; Small = total income of \$50 million or less.
*Research partnerships and completed projects with external organizations in FY2013-2014 that were governed by formal written agreements. Includes research contracts and collaborative research agreements. Does not include research grants.

Or perhaps the college research model has harvested the low hanging fruit and may need to evolve in the future in order to sustain prior levels of growth. Unlike their university counterparts, college faculty generally do not have a research mandate; they are hired primarily to teach. Colleges are thus required to hire additional teaching personnel to fill in for college staff who secure research funds, a situation that creates program delivery inefficiencies. Another barrier is that colleges do not have a cadre of graduate students to do the research legwork in a sustained way. College students do an admirable job, but their time is limited compared with that of a university graduate student. Another factor might be the relative

absence of infrastructure to support additional research. Other considerations may also be at play. This year’s Top 50 Research Colleges results should encourage colleges and funders to consider future prospects and examine barriers and opportunities to growing college research.

There is no doubt that college research – typically applied in nature – fills an important space in Canada’s national research agenda. Colleges and funders are both eager to expand their role. There is a willing group of companies, government departments, community groups and others interested in working with colleges. The coming year is a good time to establish a new action plan to move the sector forward.



Pride in Partnership

Red River College is proud to lead the nation in partnership growth for 2015. Here, we understand that partnerships open doors, and innovation impacts return on investment.

Partner with us today at rrc.ca/appliedresearch

 RED RIVER COLLEGE

THE DIFFERENCE IS HERE

Barn Raising the Innovation Economy



Robert Luke, Ph.D.
Vice President, Research and Innovation
George Brown College

Of the many useful things I learned growing up in Saskatchewan, two in particular stand out as relevant to Canada’s research and innovation ecosystem. The first is the importance of cooperation. The second is the weather.

Cooperation is the cornerstone of community building on the prairies, as anywhere really. I learned from a young age that when your neighbour is building a barn, everyone

pitches in to help. “Collaborating to compete together” has real meaning: working together we create vibrant communities and resilient regional economies that amplify complementary strengths and common goals.

This form of “cooperation” defines how various actors in the research and innovation ecosystem work together. Where once we might have seen these actors try to upstage each other in a scramble for money and attention, we now see cooperation to achieve increased academic and industrial innovation and productivity.

There can be little debate about the need to increase business investment in research and development (R&D). We have too little firm spending on R&D (and new equipment and training for that matter). This translates into poor industrial productivity and innovation capacity.

For academic productivity, we are excellent in our ability to perform basic science. We need to start focusing more on leveraging and translating our basic research into practical

applications for social and economic good. Successive expert panels have all identified a systematic failure in this country to capitalize on the basic research capacity of our world leading research institutions.

Countries like Canada, with economies dependent on resource extraction industries, need to start adding value to the raw resources we extract. Basic research with little or no focus on application or commercialization becomes just one more example of how Canada exports raw commodities (in this case ideas) without adding value (commercialization of these ideas).

Polytechnics and Colleges like George Brown work with many university scientists. We help them produce PhDs, patents, publications and products, just as easily as we work with industry to get new products and services to market. Here are some examples.

In 2012, the GBC Food Innovation & Research Studio (FIRS) collaborated with scientists at Mount Sinai

Hospital / University of Toronto and Ryerson University to help test whether eating cheese fortified with Vitamin D could affect the levels of the vitamin in the body. Over the course of the study we recruited 120 students, staff, and faculty who volunteered to eat pizza – topped with Vitamin D fortified mozzarella – once a week for 8 weeks in a double-blind randomized trial. Our food scientists and chefs were able to design an optimal and delicious Italian style pizza and produce over 100 pizzas every week for 8 weeks. Leaving aside the difficulty we may or may not have had in recruiting volunteers, we were approached to participate in the study because we offered these scientists complementary expertise to help them test their hypothesis.

This project showcases a unique recipe that blended basic and applied research. The findings provide scientific support for commercialization of vitamin D fortified cheese, showing that Vitamin D3 is safe and metabolically available from

fortified mozzarella cheese, even after being cooked.

Applied research at George Brown supports firms in a range of industries from construction and Building Information Modeling through to prototyping and food product development. Companies often access more than one academic partner in their engagement with industry-academic partnerships. One such company is Clear Blue Technologies. Their “smart off-grid” street light uses solar panels and wind turbines to power street lights, networked through wireless technologies to provide cost effective and green power solutions for lights, traffic cameras and signs. The company received support from MaRS and Centennial College; at George Brown our Advanced Prototyping Lab helped take the product from prototype to production manufacturing. A graduate student from Ryerson University was also employed on the project. By working together and leveraging complementary strengths we have collectively helped propel the company from idea to invoice.

And so the weather.

Talking about the weather is a national past time, but it very nearly passes for religion on the prairies. Perhaps this is because so much of the growing season is determined by the whims of nature. Being able to talk about the weather is what is most important – predicting it, observing and commenting on it, lamenting it. The weather is something we all have in common. In this sense, weather talk is an important social lubricant, an expression of our commonality and shared experience in place.

And this is the point. Like the weather, innovation is a social activity. While innovation may involve a technical challenge, it requires us to recognize common goals and to socialize and realize we are stronger when we work together.

Place matters when it comes to innovation. By integrating the harmonizing strength of regional college, polytechnic, and university capacity, and linking this with industry, we can evolve the Canadian economy. Together we can ensure graduates from across the credential spectrum understand innovation, and can work together to stand up the innovation economy.



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for industry.

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Ranked #1 in College Research 2015*

Discover Innovation at
georgebrown.ca/research



*Ranking by RESEARCH Infosource, 2015

PARTNER PERSPECTIVE

Sheridan Takes Research Partnerships to New Heights



Dr. Darren Lawless
Dean of Undergraduate Research
Sheridan

Sheridan has embraced a distinctive approach to furthering creativity and innovation, which involves the integration of creative engagement campus-wide, including a unique approach to Scholarship, Research and Creative Activities (SRCA). Integral to Sheridan's SRCA activities is the engagement of our students and professors, and the communities we serve.

Research partnerships at Sheridan are beginning to take a bold new form – one where projects go beyond contract research and become part of long-term public/private partnerships with industry and community. At our Centres of Expertise, the roles of our external partners are increasingly shifting from clients to collaborators and champions on major initiatives that bring benefits to both parties. These synergies have been bolstered by our ability to effectively match small and medium-sized businesses with the right research teams, and help them tackle the right problems – leading to our ranking by Research Infosource this year as the #1 college for number of research projects completed.

Our philosophy is to identify and nurture partnerships that not only help our industry and community partners solve a technical or business challenge, but also create the best possible learning opportunities for

the students who drive the project forward.

We work closely with our partners to strategically define the right problem to solve, and then use tools such as creative problem-solving methodology and multidisciplinary teams to tackle the challenge. At each stage, our partner provides feedback and input. The outcome is an enriched experiential learning opportunity for students and professors that adds value for our partners.

This approach has allowed us to grow dynamic, multifaceted partnerships with organizations of all sizes that feed back into the curriculum and enhance our students' professional education as our partners become more involved.

As an example of this synergy at work, Sheridan's Centre for Advanced Manufacturing and Design Technologies (CAMDT) has built a unique technology playground for its local manufacturers and engineering students, enriched

by the support of leading industry partners and an engineering team that truly understands how to make the most of collaboration. Long-term partnerships have been established with leaders in the manufacturing field who are invested in seeing the Centre succeed, and have enhanced CAMDT's preparation of the next generation of engineers and the local manufacturing community. Through rich partnerships with industry leaders like Cimetrix and ABB, who share a commitment to supporting the local manufacturing sector, CAMDT offers a suite of advanced additive manufacturing, robotics and integrated energy management technology that is accessible to its SME research partners as a way of furthering technology adoption. These partnerships often involve multiple research projects with CAMDT's engineering students, as well as skills training and technology adoption initiatives for local industry. CAMDT's unique facilities are a

testament to the commitment and active role of its industry partners in the Centre's success.

Sheridan recently reached new milestones in our partnerships with Siemens Canada and Hatch that will significantly enhance our ability to deliver a premiere undergraduate engineering education through applied research at CAMDT and the School of Mechanical and Electrical Engineering and Technology's curriculum. Earlier this year, we signed Memoranda of Understanding with both companies that will promote further collaborations to foster innovation through research and enhance our engineering students' learning experience.

Dynamic social innovation partnerships are flourishing at Sheridan, too. This year, our Centre for Elder Research was thrilled to see the launch of Spirit50, an initiative developed with partner Vintage Fitness over the course of multiple projects. Spirit50 allows older adults to work with a trainer virtually to

design customized workout plans and receive support for their health and fitness goals. The launch of Spirit50 represents the hard work of 15 Sheridan students from multiple disciplines, who helped Vintage Fitness bring it to life over a span of four years.

Through the dedicated participation, leadership and support of our industry and community partners, Sheridan is taking SRCA to a new level for our students, professors, and communities. As our industry partners take a seat at the planning table to help us move forward with our innovative approach to invigorating SRCA, their involvement is helping us mature as drivers of impactful change in our communities, and as providers of high-quality learning opportunities that inspire our students to become innovation catalysts themselves. We are excited and optimistic that this will help improve Canada's innovation performance, and bring economic benefit to the country.

Turn ideas into innovations

Undergraduate Research

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



Research & Innovation

Solutions for Industry

With funding support from various regional, provincial and federal agencies, students and graduates are hired to work alongside faculty researchers to assist industry partners leap forward in the marketplace. We conduct many projects in collaboration with small- and medium-sized businesses.

For example, in recent months we have:

CREATED

10

NEW RECIPES for a fine meats company

1,500+

acres of grain managed with our **PRECISION AGRICULTURE ALGORITHM**

DOUBLED production capacity for **VIJ'S AT HOME** to expand sales across Canada



DESIGNED the first-ever aluminum

10 tonne

GANTRY CRANE

AGRICULTURE & ENVIRONMENT

ADVANCED MANUFACTURING

FOOD & BEVERAGE INNOVATION

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should contact us directly.

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November 6, 2015

Canada's TOP 100 CORPORATE R&D SPENDERS 2015

Rank		Company	R&D Spending			Revenue	Research Intensity	Industry
2014	2013		FY2014 \$000	FY2013 \$000	% Change 2013-2014	FY2014 \$000	R&D as % of Revenue**	
1	1	Bombardier Inc.*	\$2,022,340	\$2,193,719	-7.8	\$22,212,600	9.1	Aerospace
2	2	BlackBerry Limited* ++	\$785,300	\$1,324,470	-40.7	\$3,683,508	21.3	Comm/Telecom Equipment
3	3	Magna International Inc.*	\$585,385	\$576,752	1.5	\$40,469,985	1.4	Automotive
4	4	BCE Inc.	\$546,000	\$575,400	-5.1	\$21,000,000	2.6	Telecommunications Services
5	5	Pratt & Whitney Canada Corp. (fs)	\$542,000	\$544,782	-0.5	nd		Aerospace
6	6	IBM Canada Ltd. (fs)	\$466,000	\$492,000	-5.3	nd		Software & Computer Services
7	8	Canadian Natural Resources Limited	\$450,000	\$390,000	15.4	\$18,863,000	2.4	Energy/Oil & Gas
8	7	Rogers Communications Inc.	\$418,000	\$394,000	6.1	\$12,850,000	3.3	Telecommunications Services
9	9	Atomic Energy of Canada Limited+	\$346,900	\$353,600	-1.9	\$129,977	266.9	Engineering Services
10	10	Ericsson Canada Inc. (fs)	\$315,000	\$318,000	-0.9	nd		Comm/Telecom Equipment
11	12	Apotex Inc.	\$311,105	\$222,439	39.9	\$1,924,956	16.2	Pharmaceuticals/Biotechnology
12	16	Constellation Software Inc.*	\$287,518	\$190,554	50.9	\$1,843,790	15.6	Software & Computer Services
13	20	Valeant Pharmaceuticals International, Inc.*	\$271,707	\$161,473	68.3	\$9,127,036	3.0	Pharmaceuticals/Biotechnology
14	11	CGI Group Inc.	\$262,492	\$252,116	4.1	\$10,499,692	2.5	Software & Computer Services
15	14	AMD Canada (fs)	\$206,000	\$211,000	-2.4	\$432,000	47.7	Electronic Systems & Parts
16	19	Open Text Corporation*	\$195,313	\$168,916	15.6	\$1,794,480	10.9	Software & Computer Services
17	21	TELUS Corporation	\$194,000	\$161,000	20.5	\$12,002,000	1.6	Telecommunications Services
18	18	General Motors of Canada Limited (fs)	\$190,000	\$182,089	4.3	nd		Automotive
19	15	Imperial Oil Limited	\$175,000	\$199,000	-12.1	\$36,231,000	0.5	Energy/Oil & Gas
20	22	BRP Inc.**	\$158,200	\$144,900	9.2	\$3,524,700	4.5	Transportation
21		Suncor Energy Inc.	\$150,000	\$150,000	0.0	\$41,516,000	0.4	Energy/Oil & Gas
22	23	CAE Inc.	\$149,000	\$144,096	3.4	\$2,114,900	7.0	Aerospace
23	27	MDA	\$138,951	\$116,602	19.2	\$2,098,837	6.6	Software & Computer Services
24	37	Mitel Networks Corporation*	\$130,662	\$57,366	127.8	\$1,219,368	10.7	Comm/Telecom Equipment
25	24	Sanofi (fs) (a)	\$130,471	\$129,100	1.1	\$677,946	19.2	Pharmaceuticals/Biotechnology
26	13	Cenovus Energy Inc.	\$124,000	\$213,000	-41.8	\$19,642,000	0.6	Energy/Oil & Gas
27	17	Syncrude Canada Ltd.	\$112,094	\$185,165	-39.5	nd		Energy/Oil & Gas
28	25	GlaxoSmithKline Inc. (fs)	\$110,125	\$118,224	-6.9	\$868,951	12.7	Pharmaceuticals/Biotechnology
29	28	Hydro-Québec	\$106,000	\$100,000	6.0	\$13,638,000	0.8	Electrical Power & Utilities
30	29	Cisco Canada (fs)	\$104,156	\$94,554	10.2	nd		Comm/Telecom Equipment
31	34	Sierra Wireless, Inc.*	\$91,286	\$78,253	16.7	\$605,844	15.1	Comm/Telecom Equipment
32	30	Westport Innovations Inc.*	\$85,568	\$94,517	-9.5	\$144,213	59.3	Transportation
33	26	Ontario Power Generation Inc.	\$84,000	\$117,000	-28.2	\$4,963,000	1.7	Electrical Power & Utilities
34	31	PMC-Sierra Ltd.* (fs)	\$78,003	\$82,278	-5.2	\$129,928	60.0	Electronic Systems & Parts
35	35	Janssen Inc. (fs)	\$73,916	\$67,430	9.6	\$1,614,490	4.6	Pharmaceuticals/Biotechnology
36	32	Amgen Canada Inc. (fs)	\$73,900	\$79,963	-7.6	nd		Pharmaceuticals/Biotechnology
37	36	Linamar Corporation	\$70,004	\$64,274	8.9	\$4,171,561	1.7	Automotive
38	52	Redknee Solutions Inc.*	\$68,715	\$35,452	93.8	\$284,626	24.1	Software & Computer Services
39	33	Pfizer Canada Inc. (fs)	\$68,302	\$78,324	-12.8	\$1,483,463	4.6	Pharmaceuticals/Biotechnology
40	40	Evertz Technologies Limited	\$60,196	\$52,851	13.9	\$325,524	18.5	Comm/Telecom Equipment
41	38	EXFO Inc.*	\$57,901	\$55,959	3.5	\$254,925	22.7	Medical Devices & Instrumentation
42	53	Bayer Inc. (fs)	\$57,089	\$33,897	68.4	\$726,265	7.9	Pharmaceuticals/Biotechnology
43	42	NOVA Chemicals Corporation* (fs)	\$53,016	\$50,466	5.1	\$5,698,116	0.9	Chemicals & Materials
44	51	Huawei Canada (fs)	\$52,800	\$35,900	47.1	\$335,200	15.8	Comm/Telecom Equipment
45		Shell Canada Limited	\$50,000	\$100,000	-50.0	\$9,250,000	0.5	Energy/Oil & Gas
46	45	Novelis Inc.* (fs)	\$49,703	\$47,376	4.9	\$10,787,652	0.5	Mining & Metals
47	48	Pharmascience Inc.	\$45,821	\$42,455	7.9	\$725,350	6.3	Pharmaceuticals/Biotechnology
48	43	SMART Technologies Inc.*	\$45,564	\$50,271	-9.4	\$650,773	7.0	Computer Equipment
49	44	Trican Well Service Ltd.	\$45,100	\$48,700	-7.4	\$2,703,858	1.7	Energy/Oil & Gas
50	67	Tekmira Pharmaceuticals Corporation* +	\$42,759	\$22,100	93.5	\$16,516	258.9	Pharmaceuticals/Biotechnology
51		Servier Canada Inc. (fs)	\$40,245	\$35,808	12.4	\$274,996	14.6	Pharmaceuticals/Biotechnology
52	54	Dorel Industries Inc.*	\$39,885	\$33,889	17.7	\$2,957,358	1.3	Other Manufacturing
53	57	Martinrea International Inc.	\$38,835	\$31,449	23.5	\$3,598,645	1.1	Automotive
54	64	TransCanada Corporation	\$38,809	\$23,911	62.3	\$10,185,000	0.4	Energy/Oil & Gas
55	58	Enghouse Systems Limited	\$38,147	\$31,149	22.5	\$219,987	17.3	Software & Computer Services
56	70	ProMetic Life Sciences Inc.	\$36,635	\$19,520	87.7	\$23,010	159.2	Pharmaceuticals/Biotechnology
57	50	Cascades Inc.	\$36,526	\$39,213	-6.9	\$3,561,000	1.0	Forest & Paper Products
58	61	Pason Systems Inc.	\$35,427	\$27,252	30.0	\$499,272	7.1	Software & Computer Services
59	60	Monsanto Canada Inc. (fs)	\$32,309	\$27,451	17.7	\$697,196	4.6	Agriculture & Food
60	63	Descartes Systems Group Inc.* ++	\$31,011	\$26,655	16.3	\$188,715	16.4	Software & Computer Services
61		Shopify Inc.*	\$30,053	\$15,009	100.2	\$115,992	25.9	Software & Computer Services
62	49	SNC-Lavalin Group Inc.	\$28,629	\$39,900	-28.2	\$8,238,762	0.3	Engineering Services
63	62	Thales Canada Inc. (fs)	\$26,399	\$26,951	-2.0	\$349,902	7.5	Electronic Systems & Parts
64	66	AEterna Zentaris Inc.*	\$26,367	\$22,461	17.4	\$1,158		Pharmaceuticals/Biotechnology
65	96	Avigilon Corporation	\$24,689	\$11,770	109.8	\$271,411	9.1	Computer Equipment
66	75	Celstica Inc.*	\$21,759	\$17,921	21.4	\$6,219,771	0.3	Electronic Systems & Parts
67	76	Sandvine Corporation*	\$21,595	\$17,781	21.4	\$136,289	15.8	Comm/Telecom Equipment
68		Lockheed Martin Canada (fs)	\$21,032	\$19,898	5.7	\$385,355	5.5	Aerospace
69	80	Northland Power Inc.	\$21,024	\$17,512	20.1	\$760,071	2.8	Electrical Power & Utilities
70		Héroux-Devtek Inc.	\$20,982	\$12,762	64.4	\$272,034	7.7	Aerospace
71	83	Performance Sports Group Ltd.*	\$20,382	\$16,536	23.3	\$492,805	4.1	Other Manufacturing
72	78	Tembec Inc.	\$20,200	\$17,692	14.2	\$1,491,000	1.4	Forest & Paper Products
73	74	Teck Resources Limited	\$20,000	\$18,000	11.1	\$8,599,000	0.2	Mining & Metals
74	87	AstraZeneca Canada Inc. (fs)	\$19,235	\$15,116	27.2	\$640,588	3.0	Pharmaceuticals/Biotechnology
75	77	ViXS Systems Inc.* ++	\$19,206	\$17,715	8.4	\$42,430	45.3	Electronic Systems & Parts
76	68	DragonWave Inc.* ++	\$18,569	\$20,545	-9.6	\$174,253	10.7	Comm/Telecom Equipment
77	86	IMAX Corporation*	\$17,778	\$15,213	16.9	\$320,903	5.5	Other Services
78		Transition Therapeutics Inc.	\$17,614	\$9,156	92.4	\$0		Pharmaceuticals/Biotechnology
79	97	Rio Tinto Iron & Titanium Inc. (fs)	\$17,057	\$11,744	45.2	\$1,193,000	1.4	Mining & Metals
80		Kinaxis Inc.*	\$17,034	\$10,729	58.8	\$77,375	22.0	Software & Computer Services
81	89	Computer Modelling Group Ltd.	\$16,439	\$14,364	14.4	\$74,503	22.1	Software & Computer Services
82	79	Ballard Power Systems Inc.*	\$15,788	\$17,629	-10.4	\$75,902	20.8	Machinery
83	91	Winpak Ltd.*	\$15,767	\$13,487	16.9	\$868,970	1.8	Rubber & Plastics
84	71	QLT Inc.*	\$15,245	\$19,063	-20.0	\$0		Pharmaceuticals/Biotechnology
85	69	Resolute Forest Products Inc. (fs)	\$14,500	\$20,400	-28.9	\$3,168,000	0.5	Forest & Paper Products
86	93	Mediagrif Interactive Technologies Inc.	\$14,381	\$12,267	17.2	\$65,376	22.0	Software & Computer Services
87	94	Canadian Solar Inc.*	\$14,356	\$12,035	19.3	\$1,430,139	1.0	Energy/Oil & Gas
88	72	Oncolytics Biotech Inc.	\$13,824	\$18,506	-25.3	\$0		Pharmaceuticals/Biotechnology
89	98	Halogen Software Inc.*	\$13,511	\$11,226	20.4	\$62,580	21.6	Software & Computer Services
90	85	ShawCor Ltd.	\$13,053	\$15,687	-16.8	\$1,890,029	0.7	Other Manufacturing
91	95	Absolute Software Corporation*	\$12,177	\$11,771	3.4	\$100,486	12.1	Software & Computer Services
92		Novadaq Technologies Inc.*	\$11,909	\$8,213	45.0	\$51,470	23.1	Medical Devices & Instrumentation
93		Titan Medical Inc.*	\$11,795	\$5,515	113.9	\$0		Medical Devices & Instrumentation
94		Neptune Technologies & Bioresources Inc. ++	\$11,026	\$8,526	29.3	\$15,070	73.2	Pharmaceuticals/Biotechnology
95		Trillium Therapeutics Inc.	\$10,919	\$3,571	205.8	\$0		Pharmaceuticals/Biotechnology
96	59	Resverlogix Corp.*	\$10,855	\$29,668	-63.4	\$0		Pharmaceuticals/Biotechnology
97		Tesco Corporation*	\$10,574	\$8,835	19.7	\$599,734	1.8	Energy/Oil & Gas
98		Concordia Healthcare Corp.*	\$10,273	\$1,989	416.5	\$134,960	7.6	Pharmaceuticals/Biotechnology
99		Velan Inc.* ++	\$10,196	\$9,109	11.9	\$503,376	2.0	Other Manufacturing
100		Aurinia Pharmaceuticals Inc.*	\$10,106	\$2,249	349.4	\$307		Pharmaceuticals/Biotechnology

Notes:

- Data were obtained through annual reports, financial statements, securities commission filings, or through a survey.
- We have attempted, wherever possible, to provide gross R&D spending before deduction of investment tax credits or government grants.
- We have attempted, wherever possible, to provide revenue net of interest and investment income.
- FY2013 R&D spending figures may have been adjusted as more accurate information became available.
- Canadian-owned company results include worldwide revenue and R&D spending; foreign subsidiaries (fs) include revenue and R&D spending for their Canadian operations only.

*Converted to CDN\$ at annual average 2014 = 1.1045, 2013 = 1.0299 (Bank of Canada)

**Based on companies with \$2 million or more of revenue

+Not current name/acquired/merged

++Fiscal 2015 results were used for year-ended January or February

fs = Foreign subsidiary (includes revenue and R&D spending for Canadian operations only)

nd = Not disclosed

(a) Sanofi Pasteur Limited and Sanofi-aventis Canada Inc. (including Genzyme Canada).

CANADA'S TOP 100 Corporate R&D Spenders

CORPORATE R&D SPENDING HEADS SOUTH

Canada's Top 100 Corporate R&D Spenders reduced their spending on research and development by -1.6% in Fiscal 2014, as total outlays fell to \$12.3 billion from \$12.5 billion the previous year. This compares with a 4.1% rise in R&D spending among last year's Top 100 grouping. The reduced R&D flies in the face of a 7.3% rise in revenues for the 87 companies that provided revenue data.

For a third year Bombardier Inc. held on to 1st place among the Top 100, even though R&D spending fell by -7.8% to \$2.0 billion. While it managed to hold on to

second place in the ranking, R&D outlay dropped by -40.7% at BlackBerry Limited, to \$785.3 million. Auto parts manufacturer Magna International Inc. posted a small 1.5% increase in spending, to \$585.4 million, to hold on to 3rd position and narrowly edge 4th place finisher BCE Inc., where R&D levels fell by -5.1%, to \$546.0 million. Pratt & Whitney Canada Corp.'s R&D spending fell by -0.5% to \$542.0 million as the firm held on to 5th position.

The divergence between increased revenues and reduced R&D spending led to a sharp -8.0% drop in research intensity (R&D spending as a portion of revenues) for the 87 companies that reported in full. Intensity fell to 2.7% of revenues from 2.9% last year. Paradoxically, while total Top 100 R&D fell, spending did rise at 69 companies, but fell at 30 others (spending was flat at 1 company).

THE \$100 MILLION CLUB

Research Infosource is pleased to showcase 30 companies (up from 28 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 22 Canadian companies and 8 foreign subsidiaries.

New to the \$100 Million Club are Suncor Energy Inc. (#21 overall), Mitel Networks Corporation (#24) and Cisco Canada (#30).

On a discordant note, \$100 Million Club members' Fiscal 2014 spending on research fell by -3.7% to \$10.0 billion, from \$10.4 billion the prior year. Club members accounted for 81.2% of total Top 100 spending, which is nearly the same as in Fiscal 2013.

INDUSTRY PERFORMANCE

Even though their total R&D declined by -5.5%, 5 Aerospace companies still accounted for 22.4% of total Top 100 spending, down slightly from 23.3% the year before. By growing their spending by 14.9% the 15 Software and Computer Services companies on the list accounted for 13.2% of the Top 100 total, up from 11.3% in Fiscal 2013. In contrast, 9 Communications/Telecom Equipment manufacturers saw their share of total industry spending fall to 12.9% of the total from 16.0% the prior year, as a result of a -21.0% reduction in R&D. A bright spot was the Pharmaceuticals/Biotechnology sector, where 22 firms increased their R&D levels by 23.4% and raised their share of Top 100 spending to 11.5% of the total, from 9.1% last year. Spending by 10 Energy/Oil & Gas firms fell by -12.1%, which dropped their share of the Top 100 total to 9.5% from 10.6% in Fiscal 2013. Taking all its sub-industries into account (including Medical Devices and Instrumentation) the Information

and Communications Technology sector still dominates the R&D scene, accounting for a total of 39.6% of all-industry spending.

R&D SPENDING GROWTH

While the overall Top 100 picture was weak, a number of individual firms posted strong gains in R&D spending. Heading the list was Concordia Healthcare Corp., which expanded its spending by 416.5% to \$10.3 million. At Aurinia Pharmaceuticals Inc. R&D investment grew by 349.4% to \$10.1 million. R&D spending at Trillium Therapeutics Inc. rose by 205.8% to \$10.9 million. Mitel Networks Corporation grew its R&D by 127.8% to \$130.7 million. Titan Medical Inc. expanded R&D by 113.9% to \$11.8 million.

THE TOP 10 R&D INTENSIVE FIRMS

Available data allowed Research Infosource to calculate the R&D intensity of 85 of the Top 100 firms – research spending as a percent of revenues. An eclectic mix of companies and industry sectors are represented. The 5 leading firms are AECL (now Canadian Nuclear Laboratories – up 266.9%), Tekmira Pharmaceuticals Corporation (258.9%), ProMetic Life Sciences Inc. (159.2%), Neptune Technologies & Bioresources Inc. (73.2%), and PMC-Sierra Ltd. (60.0%).

LOOKING AHEAD

This year's Top 100 results were a disappointment overall. However, analysts can take heart that spending rose at 69 of the Top 100 against a decline at 30 others (1 company was even). Total R&D expenditure was down by -1.6%. This compares with a 4.1% increase in spending among last year's Top 100 grouping. (Note that the Top 100 composition changes from year to year and results are not strictly comparable.)

The Top 100 result is heavily influenced by the performance of the leading R&D firms. Disappointingly, spending declined – often substantially – at 7 of the country's 10 largest R&D firms. With some notable exceptions – e.g. BlackBerry Inc., AECL – overall revenues increased, so revenue shortfalls cannot be blamed for the decline in research spending at most firms.

It seems to us that R&D activity is broadly holding up among most R&D firms, but suffering at the largest companies, many of which are facing well-known product or market headwinds. Last year we suggested that a declining Canadian dollar and a shift in federal research tax policy would be the primary influences on corporate R&D spending. This year resource company revenues will be a primary driver. Overall, expect next year's corporate R&D performance to mirror this year's. Also prepare for some further significant declines among the leading firms.

Top 100 – Leading Industries	
Industry	R&D Spending (% of Total)
Aerospace (5)	22.4
Software & Computer Services (15)	13.2
Communications/Telecom Equipment (9)	12.9
Pharmaceuticals/Biotechnology (22)	11.5
Energy/Oil & Gas (10)	9.5
Telecommunications Services (3)	9.4
Automotive (4)	7.2

The \$100 Million Club		
2014 Rank	Company	R&D Spending \$000
1	Bombardier Inc.*	\$2,022,340
2	BlackBerry Limited* ++	\$785,300
3	Magna International Inc.*	\$585,385
4	BCE Inc.	\$546,000
5	Pratt & Whitney Canada Corp. (fs)	\$542,000
6	IBM Canada Ltd. (fs)	\$466,000
7	Canadian Natural Resources Limited	\$450,000
8	Rogers Communications Inc.	\$418,000
9	Atomic Energy of Canada Limited+	\$346,900
10	Ericsson Canada Inc. (fs)	\$315,000
11	Apotex Inc.	\$311,105
12	Constellation Software Inc.*	\$287,518
13	Valeant Pharmaceuticals International, Inc.*	\$271,707
14	CGI Group Inc.	\$262,492
15	AMD Canada (fs)	\$206,000
16	Open Text Corporation*	\$195,313
17	TELUS Corporation	\$194,000
18	General Motors of Canada Limited (fs)	\$190,000
19	Imperial Oil Limited	\$175,000
20	BRP Inc.++	\$158,200
21	Suncor Energy Inc.	\$150,000
22	CAE Inc.	\$149,000
23	MDA	\$138,951
24	Mitel Networks Corporation*	\$130,662
25	Sanofi (fs) (a)	\$130,471
26	Cenovus Energy Inc.	\$124,000
27	Syncrude Canada Ltd.	\$112,094
28	GlaxoSmithKline Inc. (fs)	\$110,125
29	Hydro-Québec	\$106,000
30	Cisco Canada (fs)	\$104,156

Notes:
*Converted to CDN\$ at annual average 2014 = 1.1045, 2013 = 1.0299 (Bank of Canada)
**Based on companies with \$2 million or more of revenue
+Not current name/acquired/merged
++Fiscal 2015 results were used for year-ended January or February
fs = Foreign subsidiary (includes R&D spending for Canadian operations only)
(a) Sanofi Pasteur Limited and sanofi-aventis Canada Inc. (including Genzyme Canada).



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PARTNER PERSPECTIVE

Intellectual Capital is Vital to Our Innovation Ecosystem



Ian McWalter
President & CEO
CMC Microsystems

It also provides training and experience to professors, students, and industrial innovators.

Training is the value-add that gives our NDN innovators their competitive edge. Academics and students who take our courses, workshops and webinars don't just learn how to use commercial tools or processes; those learnings become jumping-off points for exploring limitations or pushing the boundaries of tools and processes. Sometimes those investigations trigger industrial collaborations, leading to graduate hirings; and sometimes they lead to startup companies, headed by entrepreneurial faculty or students. But a particularly valuable outcome is when NDN trainees become academics themselves, because they pass on this learning and experience to their students, ensuring a new generation of micro-nano innovators.

We saw a wonderful example of this "continuity effect" recently at our annual TEXPO student research competition and exposition.

Amin Rasouli, a graduate student at Simon Fraser University, won the Huawei Microsystems Design Award for his novel resonance sensing technique. Ten years ago, the same award went to a University of Manitoba graduate student, Behraad Bahreyni. Today Dr. Bahreyni is Professor of Mechanical Engineering at SFU, a leading MEMS researcher – and Mr. Rasouli's graduate supervisor.

Another example is our past board chair and longtime member, Dr. Yvon Savaria. A TEXPO winner in 2000, today he is Professor of Electrical Engineering, Polytechnique Montréal, where he has supervised more than 130 graduate students, a large number of whom have benefited from the NDN's resources.

There are many more examples from the NDN, but they share a common lesson: that intellectual capital is a vital piece of the innovation ecosystem, and that it makes sense to continue to invest in this knowledge asset.



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PARTNER PERSPECTIVE

R&D Drives Oil Sands Reclamation at Syncrude

Canada’s oil sands industry has come a long way since a household washing machine first successfully demonstrated hot water extraction of heavy bitumen from the sand. In the decades that followed, conscious investments in research and development have transformed the oil sands into a viable and responsible industry.

At the fore of innovation is industry pioneer Syncrude Canada Ltd. It has always maintained a leadership role in creating and developing technologies to responsibly mine, extract and upgrade high quality crude oil from the oil sands, and to reclaim the land it uses.

When Syncrude was first established in 1964, it was really a research project designed to prove that oil could be produced economically from the oil sands deposits in Northern Alberta. It was an industry in its infancy where solutions to unlocking the mysteries of the oil

sands needed to be imagined, tested and implemented because they simply didn’t exist.

“There isn’t a lot of off-the-shelf technology for this industry. It was all invented here,” says Glen Rovang, Manager of Syncrude’s Research & Development Centre, in Edmonton.

Today, R&D continues to open doors to new and better ways to manage the oil sands resource.

In 2014, Syncrude invested \$107 million towards technologies and processes to improve the reliability of its operation, reduce costs and address environmental issues. In fact, over half of its research expenditures are directed to environmental projects including a reclamation research program that focuses on landscape creation and performance, with emphasis on watersheds.

The Sandhill Fen Watershed research project, located in a portion of Syncrude’s former East mine, is a unique example. Not only is it the

industry’s first and largest example of fen watershed re-establishment, it is also the first reclaimed landform in the oil sands built on a foundation of mine tailings. After just four growing seasons, it is on a trajectory toward success. “It can take a very long time for a fen to evolve naturally, and we’re trying to speed that up through reclamation,” said Jessica Piercey, Project Leader. “The lessons we learn here will help us develop future wetland areas equal in productivity to what was here before mining occurred.”

Eight multi-year research programs involving a number of universities are collecting data on hydrology, wetland and terrestrial plant response, carbon dynamics and climate conditions associated with the fen. The information being gathered will improve wetland reclamation and best practices for Syncrude and the oil sands industry.

One of the participating researchers,

University of Alberta professor Lee Foote, says that “the Sandhill Fen continues to develop as a template on which natural processes and time are hard at work. Colonizing plant communities are sorting themselves out along soil gradients; hydrologic connections are evident, and; wildlife populations are re-establishing.”

Based on the success of the Sandhill Fen, Syncrude is now constructing another fen nearby.

Syncrude openly shares its research and technologies through collaborative industry groups such as Canada’s Oil Sands Innovation Alliance (COSIA).

Sharing knowledge makes Syncrude a better performer operationally and environmentally, and advances the oil sands industry in general. A dedicated effort to research and development both financially and collaboratively, ensures the oil sands industry remains at the forefront of innovation.



Syncrude’s Sandhill Fen watershed research project was built on a foundation of mine tailings in a 54-hectare section of a former oil sands mine. It was re-vegetated in 2012 with more than 40 types of native plants and an additional 80 types of native plants are growing without having been planted. Birds are now visiting and nesting in the fen. Fens are an important Boreal forest peat land and this large-scale reconstruction effort underscores Syncrude’s commitment to returning the land it uses to a condition similar to that prior to disturbance.

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INNOVATION: It’s a Constant Process



Russell Williams
President
Canada’s Research-Based
Pharmaceutical Companies (Rx&D)

Innovation drives Canada’s pharmaceutical sector. It’s a constant process and it’s what propels us to find the next generation of treatments that save lives. Innovation is our ultimate goal – we are always striving to find healthcare solutions that help Canadians live longer and healthier lives.

Canada has world-class research facilities, scientists and researchers who have contributed to the numerous ground-breaking discoveries influencing global health. Canada is also a cost-competitive place to conduct research amongst developed countries.

We have a great cluster of life sciences companies and sources of investment capital in Canada. While Canada faces some hurdles with regards to intellectual property, regulatory and market access, the business environment in Canada is ripe to welcome more life sciences research.

Canada’s pharmaceutical industry contributes to over \$6-billion in global exports. Here at home, Canada’s innovative pharmaceutical sector directly employs over 12,000 people and creates over 21,000 indirect jobs.

For example, Sanofi Pasteur Limited has invested \$100-million to open a new vaccine manufacturing facility in Canada, which will serve as its North American

Centre of Excellence in global analytical and bioprocessing R&D. In addition, Hoffmann-La Roche Limited invested over \$190-million to establish a global Pharmaceutical Development in Canada, creating more than 260 jobs. This site is one of six the company has established around the world, and manages operations for all stages of global clinical trial research.

While we’re making these great contributions to intramural R&D and manufacturing, our industry is moving towards newer types of R&D investment models, such as targeted financing and virtual research and open innovation models.

By partnering with academic/clinical research institutes, commercialization centres and virtual research centres, our industry is expanding its capacity to conduct R&D work in Canada. These numerous groups are powered by approximately \$10-billion in total funding to work with industry to drive innovation.

With targeted financing, our industry contributes, along with other public and private investments, to create “risk” capital funds, allowing the industry to gain access to promising technologies while sharing the financial risk. These funds offer \$1.5-billion dedicated to life sciences companies looking to partner with larger biopharmaceutical companies.

For example, our industry has sponsored \$6.7-billion in research funding to academic and clinical research institutes. We’ve made significant contributions to universities like the University of Toronto, McGill University and the University of British Columbia to partner on research discoveries.

Two of Rx&D’s member companies, Hoffmann-La Roche Limited and Merck Canada Inc., are partnering with the Montreal Heart Institute to fund basic and translational research into cardiometabolic disease. Another two member companies, Janssen Inc. and

Pfizer Canada Inc., have partnered with the Ontario Institute for Cancer Research (OICR) to fund innovation, technology and translational research. This partnership is paying off – between 2009 and 2013, the OICR has filed for 31 licences on research discoveries.

We’re also partnering with organizations to encourage commercialization of discovered-in-Canada therapies. Across the country, the NEOMED Institute, MaRS Innovation and the Centre for Drug Research and Development benefit from industry partnerships to work on commercializing new, potentially life-saving and life-changing therapies.

Industry is also stimulating R&D through venture capital funds that provide support for the advancement and development of promising technologies, while minimizing risk. Examples include in-house, corporate venture arms, such as those like the Novartis Venture Fund (NVF) or Lilly Ventures, and partnerships

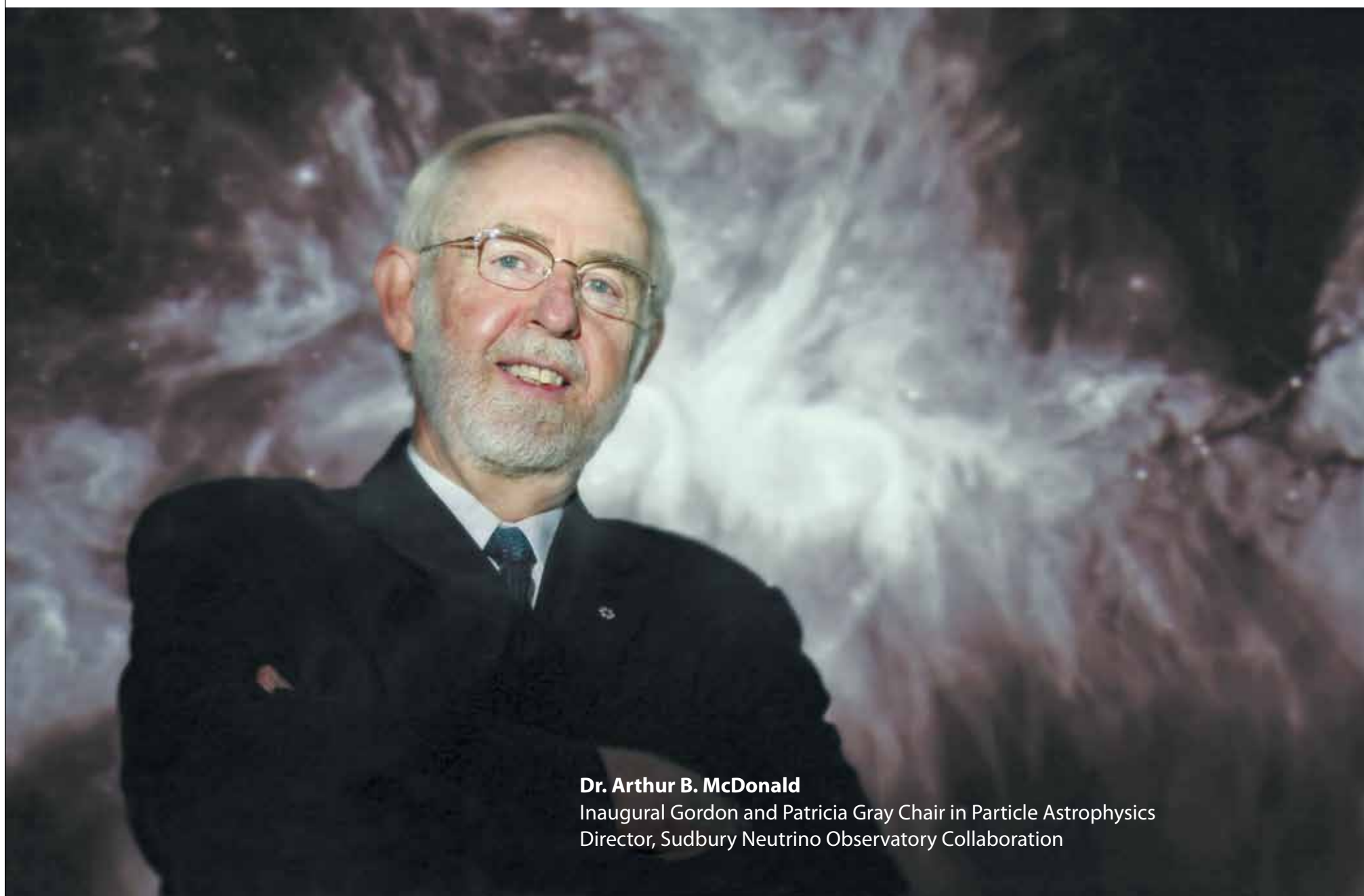
such as GSK’s venture capital firm SR One and the Life Sciences Innovation Fund in Canada.

But these new models of innovation in research and development aren’t being recognized by Canada’s Patented Medicines Prices Review Board (PMPRB). While over 28 years ago, Ottawa strengthened protection on new discoveries, our members committed to invest ten percent of annual sales revenues in pharmaceutical R&D. We’ve met that commitment over and over again, but these new models of research described above do not fit into the limited definition of what counts as scientific R&D.

It’s clear the model for life sciences research and innovation in the twenty-first century has changed. We are investing in new, more collaborative initiatives with Canadian universities, hospitals, centres of excellence, early stage biopharmaceutical companies, and health charities.

We can do more to promote Canada’s capacity for life sciences research. We must act urgently so that we can attract more global dollars and keep this high-quality research here at home.

Tiny particles Big prize



Dr. Arthur B. McDonald
Inaugural Gordon and Patricia Gray Chair in Particle Astrophysics
Director, Sudbury Neutrino Observatory Collaboration

2015 Nobel Prize in Physics

Congratulations Professor Arthur B. McDonald

Queen's University professor Arthur B. McDonald, along with Takaaki Kajita of the University of Tokyo, has been awarded the 2015 Nobel Prize in Physics. Dr. McDonald and a team of Canadian and international scientists worked deep underground unlocking the mysteries of neutrinos, fundamental building blocks of nature. Their revolutionary work redefined the basic laws of particle physics and confirmed the detailed understanding of how the sun burns. This exemplifies research at Queen's: leading-edge ideas, advances and discoveries that address the world's greatest challenges.

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