NOVEMBER 2, 2012























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# Canada's University

PREPARED BY RE\$EARCH INFOSOURCE INC., AN IMPACT GROUP COMPANY

**RESEARCH INCOME GROWTH STALLS** — Canada's Top 50 Research Universities recorded a 2.2% gain in combined research income in Fiscal 2011, down from 3.6% in Fiscal 2010. Total research income reached

### **Canada's Top 50 Research Universities 2012**

University of	rsity of Rank		Sponsored Research Income			Full-time Faculty**	Research Intensity		
Lethbridge	2011	2010	University	FY2011 \$000	FY2010 \$000	% Change 2010- 2011	2010- 2011 #	\$ per Full-time Faculty \$000	Province
	1	1	University of Toronto* ++	\$915,661	\$878,725	4.2	2,427	\$377.3	Ontario
AT LUKS	2	2	University of British Columbia*	\$575,155	\$538,398	6.8	2,346	\$245.2	British Columbia
	3	4	University of Alberta*	\$536,063	\$513,473	4.4	1,629	\$329.1	Alberta
	4	3	Université de Montréal* <sup>(a), (b)</sup>	\$525,705	\$524,133	0.3	1,869	\$281.3	Quebec
	5	5	McGill University* <sup>(a)</sup>	\$522,913	\$469,729	11.3	1,578	\$331.4	Quebec
	6	6	McMaster University*	\$325,946	\$395,364	-17.6	1,311	\$248.6	Ontario
CALGARY	7	7	Université Laval* <sup>(a)</sup>	\$299,362	\$307,928	-2.8	1,323	\$226.3	Quebec
	8	8	University of Calgary*	\$286,420	\$282,752	1.3	1,539	\$186.1	Alberta
	9	9	University of Ottawa*	\$276,220	\$273,278	1.1	1,296	\$213.1	Ontario
	10	10	Western University*	\$218,729	\$221,236	-1.1	1,422	\$153.8	Ontario
JNIVERSITY #GUELPH	11	12	University of Saskatchewan*	\$203,179	\$184,756	10.0	1,131	\$179.6	Saskatchewan
	12	13	University of Manitoba*	\$166,303	\$164,695	1.0	1,212	\$137.2	Manitoba
CHANGING LIVES	13	11	Queen's University*	\$163,280	\$197,016	-17.1	816	\$200.1	Ontario
IMPROVING LIFE	14	14	University of Guelph	\$153,068	\$148,905	2.8	795	\$192.5	Ontario
	15	15	University of Waterloo	\$146,779	\$144,299	1.7	1,014	\$144.8	Ontario
	16	18	Université de Sherbrooke* <sup>(a), (c)</sup>	\$145,493	\$111,898	30.0	1,050	\$138.6	Quebec
	17	16	Dalhousie University*	\$132,461	\$125,147	5.8	1,017	\$130.2	Nova Scotia
	18	17	University of Victoria	\$103,249	\$98,481	4.8	696	\$148.3	British Columbia
UNIVERSITY	19	19	Simon Fraser University	\$89,894	\$87,374	2.9	819	\$109.8	British Columbia
<u>of</u> Manitoba	20	20	Memorial University of Newfoundland*	\$70,181	\$74,499	-5.8	930	\$75.5	Newfoundland
	21	21	Université du Québec à Montréal <sup>(a)</sup>	\$65,470	\$70,942	-7.7	1,026	\$63.8	Quebec
	22	23	York University	\$65,427	\$69,379	-5.7	1,371	\$47.7	Ontario
	23	22	Carleton University	\$59,343	\$70,456	-15.8	741	\$80.1	Ontario
Universite d'avant-garde	24	24	Institut national de la recherche scientifique <sup>+ (a)</sup>	\$59,132	\$64,998	-9.0	153	\$386.5	Quebec
a a a	25	25	University of New Brunswick	\$48,244	\$53,919	-10.5	471	\$102.4	New Brunswick
- <b>-</b>	26	26		\$42,018	\$39,126	/.4	912	\$46.1	Quebec
	2/	38		\$33,966	\$16,087	111.1	216	\$157.3	Quebec
Olieen's	28	2/	University of Windsor	\$32,129 \$30,519	\$28,348	13.3	513	\$62.6	Ontario
UNIVERSITY	29	20 20	Ryerson University	\$29,310 \$25,494	\$22,324 \$22,949	21.1 11.5	109	\$40.0 \$1.20.7	Ouchos
	21	29		\$23,400	\$22,040	0.0	190	\$120.7	Quebec
	37	35		\$24,447 \$24,101	\$22, <del>4</del> 20 \$17 377	38.7	345	\$69.9	Alberta
UNIVERSITY	33	33	Université du Québec à Trois-Rivières (a)	\$22 552	\$18,296	23.3	381	\$59.2	Quebec
Everyone Makes a Mark	34	32	Royal Military College of Canada	\$22,332 \$22,461	\$20,661	87	195	\$115.2	Ontario
	35	36	Lakehead University*	\$22.263	\$17.359	28.3	306	\$72.8	Ontario
UNIVERSITY OF	36	28	University of Regina	\$22,038	\$23,822	-7.5	381	\$57.8	Saskatchewan
WATERLOO	37	34	École de technologie supérieure <sup>+ (a)</sup>	\$19,090	\$17,884	6.7	159	\$120.1	Quebec
	38	37	University of Prince Edward Island	\$18,216	\$17,026	7.0	243	\$75.0	Prince Edward Island
	39	43	Université du Québec en Abitibi-Témiscamingue <sup>(a)</sup>	\$16,052	\$11,153	43.9	99	\$162.1	Quebec
	40	39	Brock University	\$14,831	\$15,655	-5.3	537	\$27.6	Ontario
	41	41	Trent University	\$14,263	\$13,641	4.6	237	\$60.2	Ontario
canacio 📖	42	42	Nova Scotia Agricultural College <sup>+</sup>	\$13,923	\$11,444	21.7	63	\$221.0	Nova Scotia
	43	40	University of Northern British Columbia	\$13,583	\$15,042	-9.7	183	\$74.2	British Columbia
	44	44	Wilfrid Laurier University	\$12,613	\$9,997	26.2	498	\$25.3	Ontario
McMaster	45	48	University of Ontario Institute of Technology	\$10,037	\$8,312	20.8	159	\$63.1	Ontario
University 🔛	46	49	Université du Québec en Outaouais <sup>(a)</sup>	\$8,800	\$8,173	7.7	186	\$47.3	Quebec
	47	45	Université de Moncton	\$8,483	\$9,396	-9.7	342	\$24.8	New Brunswick
Inspiring Innovation and Discovery	48	46	Saint Mary's University	\$7,703	\$9,005	-14.5	240	\$32.1	Nova Scotia
	49	47	St. Francis Xavier University	\$7,271	\$8,393	-13.4	243	\$29.9	Nova Scotia
	50	50	University of Winnipeg	\$6,774	\$5,335	27.0	267	\$25.4	Manitoba



### SHERBROOKE









- Notes: 1. Sponsored research income: includes all funds to support research received in the form of
- a grant, contribution or contract from all sources (internal and external) to the institution. 2. Financial data were obtained from Statistics Canada and the RE\$EARCH Infosource Canadian University R&D Database, except where noted.
- 3. Faculty data were obtained from Statistics Canada, Conférence des recteurs et des principaux des universités du Québec (CREPUQ) and the RE\$EARCH Infosource Canadian University R&D Database. For confidentiality reasons, Statistics Canada randomly rounds faculty numbers either up or down by a multiple of "3". Δ
  - All data are provided for the main university/college including its affiliated institutions, where applicable.
- 5. All institutions are members of the Canadian Association of University Business Officers (CAUBO)

\*Has a medical school \*\*Includes full, associate and assistant faculty only + Not a full-service university

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

(a) Fiscal 2010-2011 and Fiscal 2009-2010 research income figures were obtained directly from the university and have not been validated by CAUBO.

(b) The Fiscal 2010-2011 research income figure reported includes Fiscal 2009-2010 research income for HEC Montréal.

(c) Fiscal 2009-2010 research income figure has been revised.

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### **Research Universities of the Year 2012**

Three universities gain RE\$EARCH Infosource's designation of Research University of the Year in their category for their performance on a balanced set of input, output and impact measures for FY2011. These full-service universities demonstrated superior achievement both in earning research income and in publishing research in leading scientific journals.

Rank	Medical/Doctoral	Score*	Rank	Comprehensive	Score*	Rank	Undergraduate	Score*
1	University of Toronto	100.0	1	University of Waterloo	92.7	1	University of Lethbridge	78.1
2	McGill University	72.5	2	University of Guelph	88.2	2	Ryerson University	77.8
3	University of British Columbia	69.2	3	University of Victoria	72.6	3	Université du Québec à Rimouski	74.8

\*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 (20%) and publication intensity in leading journals (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 ranking institution. To be eligible to be included in the Research Universities of the Year Tier Group ranking, universities must rank in the top 50% in their respective tier group for at least 3 out of the 5 measures. See www.researchinfosource.com for details.

\$192.5

#### Continued on page 1

\$6.63 billion from \$6.48 billion in Fiscal 2010. The 2011 research income growth result was the worst showing since RE\$EARCH Infosource began tracking the Top 50 in 2001. The previous lowest growth result recorded (3.0%) was between Fiscal 2008 and Fiscal 2009. The highest research income gain in the past dozen years (23.9%) was between Fiscal 2000 and Fiscal 2001.

#### THE \$100 MILLION CLUB HOLDS FIRM

Eighteen universities - up from 16 last year gained membership in RE\$EARCH Infosource's \$100 Million Club - an elite group that attracted at least \$100 million of research income in Fiscal 2011. Club members garnered a total of nearly \$5.7 billion of research income, an increase of 3.9% from the previous year. As such, they accounted for 86% of total university research income, slightly up from 85% in Fiscal 2010. All but 3 universities (Guelph, Waterloo and Victoria) are Medical/Doctoral institutions - universities with medical schools. Fourteen of the 18 Club members posted gains in research income and 4 saw their research income decline over the period.

#### The \$100 Million Club

2011 Rank	R University	esearch Income \$000
1	University of Toronto*	\$915,661
2	University of British Columbia	* \$575,155
3	University of Alberta*	\$536,063
4	Université de Montréal*	\$525,705
5	McGill University*	\$522,913
6	McMaster University*	\$325,946
7	Université Laval*	\$299,362
8	University of Calgary*	\$286,420
9	University of Ottawa*	\$276,220
10	Western University*	\$218,729
11	University of Saskatchewan*	\$203,179
12	University of Manitoba*	\$166,303
13	Queen's University*	\$163,280
14	University of Guelph	\$153,068
15	University of Waterloo	\$146,779
16	Université de Sherbrooke*	\$145,493
17	Dalhousie University*	\$132,461
18	University of Victoria	\$103,249
*Has a me	edical school	

#### **NOTABLE CHANGES IN PROVINCIAL PERFORMANCE**

Examining provincial performance, university research income rose in 7 provinces and declined in 3. Gains were strongest in Saskatchewan where 2 universities posted a total increase of 8.0% in research income. UPEI boosted Prince Edward Island's total by 7.0%, while 13 Quebec

institutions posted a combined gain of 6.1% and 4 British Columbia universities upped provincial research income by 5.8%. Provincial research income totals fell over the period in New Brunswick (-10.4%), Newfoundland (-5.8%) and Ontario (-2.0%). Research income growth in Manitoba (1.8%) also lagged the national increase of 2.2%

Ontario universities' 18 institutions captured 38% of the national total, down from 39% in Fiscal 2010. Quebec's 13 institutions increased their share to 27% of the total from 26% in Fiscal 2010. Over the period share was steady in Alberta (13% of the total) and increased 1% in British Columbia (12% of the total).

Top 50 – Leading Provinces	
Province	% of Total
Ontario (18)	38
Quebec (13)	27
Alberta (3)	13
British Columbia (4)	12

#### **GAINERS AND LOSERS**

Overall, the proportion of universities that reported gains and declines in their research income remained the same this year. In Fiscal 2011, 34 universities posted gains in research income compared with 16 universities reporting declines, versus 33 gainers and 17 decliners last year. However, this year all but one of the top gainers were from Undergraduate universities. The top gainers were Université du Québec a Chicoutimi (111.1%), Université du Québec en Abitibi-Témiscamingue (43.9%), University of Lethbridge (38.7%), Ryerson University (31.1%) and Université de Sherbrooke (30.0%). In total, 29 institutions had research income growth in excess of the 2.2% national average.

As in past years, a number of institutions saw their research income decline; however, year-on-year changes are not uncommon.

#### **SLOW GROWTH IN RESEARCH INTENSITY**

Research intensity - research income per full-time faculty position - eked out a small 1.7% gain in Fiscal 2011, one of the smallest increases over the decade. The sub-par 2.2% income increase combined with a 0.6% rise in faculty to lower the research intensity increase from 2.3% the previous year. On average the Top 50 Research Universities each attracted \$174,200 per faculty compared with \$171,400 last year. A total of 14 universities posted research intensity that was higher than the national average. University of Toronto (\$377,300 per full-time faculty position) led the pack McGill University (\$331,400), University of Alberta (\$329,100), Université de Montréal (\$281,300) and McMaster University (\$248,600) rounded up the top 5.

#### **TIER SHARES STEADY**

Sixteen Medical/Doctoral universities accounted for 81% of total research income in Fiscal 2011, the same share as in Fiscal 2010. However, the share of total research income of the 12 Comprehensive institutions fell to 13% of total research income from 14% in Fiscal 2010, and the share of 22 Undergraduate universities rose to 6% of the total from 5% last year. In Fiscal 2011, Medical/ Doctoral institutions gained 1.9% in combined research income compared with a 4.3% increase in Fiscal 2010. Research income rose by a combined 18.4% at 22 Undergraduate institutions in Fiscal 2011 compared to a growth of 2.8% recorded in Fiscal 2010.

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

RE\$EARCH Infosource highlights the achievements of 3 Research Universities of the Year - the leading institutions that excel on a balanced scorecard of research input and output/impact indicators (see our website for details www.researchinfosource.com/top50.shtml).

This year's winners are: University of Toronto in the Medical/Doctoral category, University of Waterloo in the Comprehensive category and University of Lethbridge in the Undergraduate category.

#### THIS YEAR AND NEXT

This year's meagre 2.2% increase in research income makes last year's 3.6% gain seem positively bountiful in comparison. But research income growth has in any event been slowing in recent years from the heady days of double-digit increases in the early years of the 2000s. In the context of declining federal government spending and with public sector job layoffs accelerating the research community has, for now, dodged a fiscal bullet. Deteriorating public sector circumstances mean that the 2013 Top 50 results are likely to disappoint. Gloomy business conditions will mean that the private sector will likely be unable to pick up the slack. In any event, government sources typically account for over two-thirds of total research income versus less than 15% for corporate sources (Non-government, non-corporate income accounts for the rest.)

What are the implications for the university research community? First off, it is important to recognize that faculty researcher salaries are not affected by the research income totals; faculty salaries are mostly paid for by provincial government grants to universities. That means that pressures will be felt more in the funds available for student research assistants, technicians, minor equipment, materials, and ancillary expenses. As government resources come under continuing strain politicians will be forced to balance spending for potential future improvements to national competitiveness through university research with current spending priorities in health, social services, education, etc. Two years ago we forecast "In a best case scenario the 'new normal' will be research income growth that keeps pace with inflation". This year's results confirm that view.

Top 10 Research Intensive Universities**						
201 Researc Intensit	1 Rank h y Overall	Research Intensity (\$ per full-time faculty) University \$000				
1	1	University of Toronto*	\$377.3			
2	5	McGill University*	\$331.4			
3	3	University of Alberta*	\$329.1			
4	4	Université de Montréal*	\$281.3			
5	6	McMaster University*	\$248.6			
6	2	University of British Columbia*	\$245.2			
7	7	Université Laval*	\$226.3			
8	9	University of Ottawa*	\$213.1			
9	13	Queen's University*	\$200.1			
10	14	University of Guelph	\$192.5			

#### Top 10 Universities by Growth\*\*

\*Has a medical school \*\*Includes full-service institutions only

2011	Rank		
ncome Growth	Overall	University	% Change 2010-2011
1	27	Université du Québec à Chicoutimi	111.1
2	39	Université du Québec en Abitibi-Témiscamingue	43.9
3	32	University of Lethbridge	38.7
4	29	Ryerson University	31.1
5	16	Université de Sherbrooke*	30.0
6	35	Lakehead University*	28.3
7	50	University of Winnipeg	27.0
8	44	Wilfrid Laurier University	26.2
9	33	Université du Québec à Trois-Rivières	23.3
10	45	University of Ontario Instit of Technology	ute 20.8
Has a med	ical school	**Includes full-service institutions	only

#### Bottom 10 Universities by Growth\*\*

2011	Rank	% (	hango
Growth	Overall	University 2010	)-2011
1	6	McMaster University*	-17.6
2	13	Queen's University*	-17.1
3	23	Carleton University	-15.8
4	48	Saint Mary's University	-14.5
5	49	St. Francis Xavier University	-13.4
6	25	University of New Brunswick	-10.5
7	47	Université de Moncton	-9.7
8	43	University of Northern British Columbia	-9.7
9	21	Université du Québec à Montré	al -7.7
10	36	University of Regina	-7.5
*Has a med Apparent tie	ical school es due to ro	**Includes full-service institutions only unding	

I want to lift this rock and study what's underneath. I want to climb this fence and explore the other side. But I cannot do it alone. I am still a child, but I understand that the more help I have, the further I can go.

Since before my days as a Medical student here, I have enjoyed working with others towards a common goal. Now I travel around the world and collaborate with local experts to study issues such as HIV/AIDS and maternal and child health firsthand. We are bringing public health programs and science together to improve the lives of the most vulnerable. What we learn in these communities helps create more effective global health policies. Building and sharing our knowledge has helped us do more than we ever thought possible.

The University of Manitoba has been a constant partner from the beginning, understanding that the road to new discoveries is best



### I AM NINE YEARS OLD.

I AM NOT AFRAID TO HELP.

#### I AM AN EXPLORER.

James Blanchard is a professor of community health sciences and medical microbiology, a Canada Research Chair in Epidemiology & Global Public Health, and the director of the Centre for Global Public Health at the University of Manitoba.





UNIVERSITY OF MANITOBA

University



# **Growing our community**

Great research builds strong communities. It's a powerful resource that drives economic growth and social well-being. It's a vital engine that stimulates prosperity on the local, national and international levels. McMaster researchers are fully engaged with business, industry and government in addressing the challenges we all face living and working in a global environment. They are connected to their communities – providing solutions and mentoring the next generation of leaders. Their ideas, knowledge and discoveries will continue to fuel Canada's long-term economic health and development. Visit: www.mcmaster.ca/research

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# UNDERGRADUATE CATEGORY

## Exemplary Research + Engaged Students = Extraordinary Results

Over the last 45 years, students have worked alongside professors at the University of Lethbridge, engaging in research, discovery and creativity. Today, the U of L is recognized as a researchintensive university with a focus on both undergraduate and graduate education. In less than half a century, we have built an outstanding record of research performance that has consistently placed us among the top ranks of competition within our cohort.

Congratulations to our faculty and students who have made the University of Lethbridge Canada's Research University of the Year 2012 (Undergraduate Category).

We are proud to foster the next generation of researchers. Alberta's Destination University. Make it yours.





University of

www.ulethbridge.ca



Dr. Feridun Hamdullahpur President and Vice-Chancellor University of Waterloo

nnovation is key to economic growth, scientific achievement and rising living standards. And a main driver of innovation is partnership.

Universities and industry have enormous partnership potential, and in North America and Europe, we are already experiencing a profound and deliberate enmeshment of educational and business activities.

Opening Universities to Business Several factors support this trend, including the high-tech and highend education advantages in developed economies; the outsourcing of research activities by large-scale businesses; and the increase in public pressure placed on universities to measure their societal contribution through the

lens of economic impact. This overlap of economic and educational activity represents a profound shift for some post-secondary institutions. The classic university traces its roots to the Middle Ages, and that legacy of doing scholarship for its own sake is as valuable and vital as it is an incomplete picture of what modern post-secondary education should be.

The University of Waterloo, for example, is predicated upon the mutual reinforcement of industry and education. Canada needed new sources of engineering and scientific talent to fuel its postwar expansion, so the University of Waterloo was founded to meet this need in 1957.

**NOVEL APPROACHES:** 

To this day, the experiential education program established in our first years remains integral to Waterloo's identity and value proposition, and it remains firmly rooted in academic excellence and world-class scholarship. Our 16,000 co-operative education students are employed in 60 countries around the world, bringing cutting-edge talent and innovation to enterprise. In exchange, our co-op students gain business expertise and our course curricula is verified against our students' industry experience.

The links between post-secondary education institutions and industry run deeper today than they did when Waterloo's co-operative education system was established in 1957 and in some well-defined areas there is deliberately little daylight between them. Universities can avail themselves of a range of innovation instruments that either deepen industry ties, or catalyze innovation and enterprise right on campus.

Intellectual property policy is a key area that can either incent or disincent innovation and commercialization. IP policies that favour the creator can help universities support applied research and monetization, bringing value to the local community and commercial opportunity to business. IP represents a significant measure of the value of successful enterprises, and private sector demand for useful IP is high. Favourable IP conditions not only generate economic activity, but also can assist universities seeking to attract top research talent.

On-campus entrepreneurialism and enterprise incubation is another area where universities can convene a powerful combination of research talent, business savvy, and investment capital to foster innovation and create jobs.

At Waterloo we have a residence community named VeloCity that is specifically designated for entrepreneurial students. These student entrepreneurs feed off one another's enthusiasm and attract first-class mentorship from local, national and international innovators. We've provided a workshop facility, or entrepreneurial "garage", to help them develop their ideas. If they need to dedicate a sustained amount of time to their

enterprise, they can take an extended entrepreneurial co-op term so they can both innovate and educate during their time with our university.

With major international enterprises such as Google, 3M and Electronic Arts coming to Waterloo Region, it's clear that the business community sees the value our region's deep instinct for innovation.

The ties that bind universities and industry are not geared only toward monetizing research, developing student-professionals and generating start-ups. They also link our efforts to address the major public challenges of the 21st century.

Aging, for example, is a major economic challenge for advanced economies. In North America, Europe and Asia, national demographics are beginning to challenge public finances and the capacity of political systems to implement solutions.

Waterloo has convened private, public and educational partners to found the Schlegel-University of Waterloo Research Institute for Aging,

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### **IDEAS THAT ENLIGHTEN**

#### Leading research that changes lives

Melanie Campbell and her team have received a substantial Canadian research grant supporting their work in the early diagnosis of Alzheimer's disease. This innovative research will image neural tissue in the retina in order to detect amyloid beta, a protein found in the brain in initial stages of the disease. This less expensive, non-invasive method would enable improved diagnosis and treatment, as well as better quality of life for patients.

Whether discovering diagnostic breakthroughs, building business leadership skills, or developing sustainable energy solutions, you'll find it all at the University of Waterloo. uwaterloo.ca

#### UNIVERSITY OF WATERLOO

#### IDEAS START HERE - IDEAS THAT CHANGE THE WORLD



**Pioneering the Quantum Frontier** 



to rephrase it. The smallest packages - atoms, electrons, and other quantum particles - will bring about the next big thing in scientific innovation. By harnessing the laws of quantum mechanics, we can pioneer incredible new technologies that will forever change the ways we work, communicate, play and live. The Institute for Quantum Computing (IQC) at the University of Waterloo is the world's largest concentration of quantum information research, and growing every day. Nearly 200 scientists - a multidisciplinary team of faculty, students and postdoctoral fellows spanning physics, computer science, mathematics, chemistry and engineering - pursue research at the highest international level. Just weeks ago, the institute celebrated the grand opening of its state-of-the-art new headquarters, the Mike & Ophelia Lazaridis Quantum-Nano Centre. This new facility is - quite literally - the next

big thing in enabling cutting-edge science. The 285,000-square-foot building, shared between IOC and the Waterloo Institute for Nanotechnology, is unique in the world, from its stringent technical specifications to its collaborative spaces and inspiring architecture. The facility is shielded from even the tiniest disturbances that can disrupt experiments at the quantum scale, and designed to attract top researchers from around the globe. Within a week of the grand opening, more than 5,000 visitors toured the facility, exemplifying IQC's mission to share its discoveries with those who support it and will benefit from it. Mike and Ophelia Lazaridis, whose visionary philanthropy launched IQC a decade ago and made possible the new Quantum-Nano Centre, foresee Waterloo becoming the world's "Quantum Valley of the 21st Century." At the grand opening of the facility in September, Mike Lazaridis described how the Quantum-Nano Centre will become the future equivalent of Bell Labs (the birthplace of the computing revolution that defined the 20th century).

Prof. Stephen Hawking - my former PhD mentor and longtime friend

tum concept called "entanglement," which he described as "spooky").

A century of quantum research has led us to a pivotal point in history. Quantum phenomena that once puzzled us are now within our control, and the technological implications are enormous. Take quantum "superposition," which holds that a particle can be in multiple states simultaneously. If we use such particles as "bits" for computation, those bits could not only be ascribed the conventional binary values of zero or one, but could also be in a "superposition" of both zero and one simultaneously. The resulting speed-up to computing power is enormous, and could allow us to solve problems too taxing for even today's most advanced supercomputers.

Just as exciting as the research itself is where it's happening; Canada is already a recognized leader in the quantum race and our research efforts are continually growing. IQC is a shining example of partnerships between the public sector, private philanthropy and academia. Canada's continued position at the forefront of quantum science is the direct result of this teamwork. I can't think of a better place than Waterloo - with its bustling high-tech ecosystem, entrepreneurial spirit and history of excellence in computer science and engineering to have launched this effort. We're already seeing the first practical technologies and startup companies emerging from our research - and we're just getting started. The next generation of students will take for granted ideas their professors could only imagine. While we have charted a path toward a full-scale quantum computer, the unexpected breakthroughs and spinoff technologies emerging along that path are equally as exciting. The revolution is well under way. Welcome to the quantum frontier.

Prof. Raymond Laflamme Executive Director Institute for Quantum Computing at the University of Waterloo

e are on the cusp of a technological revolution the quantum information revolution - and Canada is poised to become the world's "Quantum Valley."

It's often said that big things come in small packages, but I prefer

- joined us for the grand opening of the building. He said "what's happening in Waterloo is truly special, from theory to experiment and beyond, (and) such dedication to deep, fundamental science will benefit generations to come."

Quantum information research is about much more than creating the next gadget or "killer app." It is a dramatic transformation of the ways we manipulate, store and transmit information, building upon an entirely different set of physical principles. IQC scientists aim to control phenomena of the quantum world, which often behave in ways contrary to our everyday intuition (even Einstein struggled with the quan-

Beyond computing, quantum information science promises breakthroughs in other important areas, such as information technologies or new sensors of unprecedented precision. These breakthroughs will have applications in medicine, oil exploration, materials design and more. We've only begun to imagine the possibilities.

**CANARIE** provides researchers with

tomorrow's digital tools TODAY.





NETWORK

**CLOUD COMPUTING** 

#### INNOVATION THAT CAN CHANGE OUR LIVES

SOFTWARE TOOLS

#### CANARIE is more than the network.

CANARIE is much more than the coast-to-coast, ultra-high-speed network that connects universities, colleges, government and private sector research labs across the country. We develop research software tools and provide cloud-computing services to support today's data- and compute-intensive research, education, and innovation.

#### CANARIE enables cutting-edge research.

Much of today's research has moved off the lab bench - it is global, collaborative, and highly data-intensive. Researchers simply can't use a typical residential Internet connection to access a genome sequence or a climate model; it's too much data. That's why the Government of Canada first invested in the CANARIE network almost 20 years ago, and continues to invest in this fundamental infrastructure today.

The research community developed the Internet and many of the web tools we use today. With CANARIE delivering a robust toolkit of software, computing services, and an ultra-fast network, who knows what transformations lie ahead?

#### CANARIE looks to the future.

CANARIE stands at the nexus of two rapidly changing environments: technology and research. We focus on the technology, so Canada's innovators can focus on the future.

#### We're proud to support Canadian leadership in research, education, and innovation.



Want to know more about tomorrow's digital research tools? Check our website at www.canarie.ca



# How Research Organizations Such as University of Calgary are Opening their Doors to Business



Dr. Elizabeth Cannon President and Vice-Chancellor University of Calgary

everal recent studies have examined the innovation system in Canada and documented the need for business to enhance its investment and focus on R&D. It is well known that Canada is lagging in terms of Business Expenditure on R&D (BERD) with the latest OECD data (2011) showing that only 0.91% of GDP is invested, which ranks Canada well below the OECD median. Our lagging BERD intensity is linked to Canada's declining productivity which further emphasizes the need for the innovation ecosystem to be recalibrated.

Industry needs a stronger motivation and an environment for research and innovation, and universities need to play a significant role in providing the necessary talent and ideas. The challenge is in building an effective interface between these providers of talent and ideas with the business community so university-led discovery, creativity and innovation can be harnessed for economic growth and societal wellbeing.

There are many advantages to universities and industry working together, including the focusing of research on problems relevant to the economy and society at large. The grand challenges – be they in healthcare, the environment, or elsewhere – need the best minds at the table and these are rarely found within one organization or sector.

University-industry collaborations furthermore ensure that student training will be more pertinent, and that a broad range of skills will be developed so graduates can hit the ground running. This will keep more graduates in Canada since they will be more adaptable and desirable to business – a critical issue given the expected labour shortages in some sectors. And with the anticipated growth in the number of international students studying here, we want those who are educated in Canada to stay in Canada to contribute to our country's growth and prosperity.

So how can research organizations open their doors to business to build a constructive interface for collaboration? Here are some avenues that we are pursuing at the University of Calgary:

### Matching Strengths with Opportunities

Identifying priority research themes to match areas of strength ("push") with areas of unmet need in society for new knowledge, creative expression, and innovation ("pull") allows universities to better focus industry collaborations. Using research catalysts and "prospectors" to match strengths with opportunities and embedding commercialization and technology transfer experts throughout the university to promote opportunities are two initiatives that can accelerate industry partnerships.

#### Building Industrial Consortium Models

Using an industrial consortium model – which brings multiple com-

panies to the table together- creates an environment to tackle problems that are major barriers to progress in a particular sector. This model spreads the risk and increases the value-add by getting input from many different companies around technology development. Grand challenges such as reducing the use of water in the oil sands work well using this model.

#### Clearly Articulating Leveraging Opportunities

Using provincial, federal, and international programs to leverage industrial investments is an effective approach to scale up the size and scope of research programs at universities. Many CEOs do not realize that seed funding for major R&D projects can be leveraged two to three times if the expectations around timing and deliverables are well planned. The bang for the industrial buck in Canada is tremendous.

### Simplifying the Rules of Engagement

Creating simple rules of engagement with industry helps to streamline their investment in people and research at the university. Standard templates for contracts as well as clear policies on overhead and intellectual property are a few examples. When not done right, these can be major hurdles for effective and efficient industry engagement. The majority of time spent with industry should be focused on exciting challenges and opportunities, not trying to paper the deal.

#### Enhancing Commercialization and Knowledge Translation Savvy

Developing focused professional development and training programs for faculty and graduate students around commercialization and knowledge translation reaps dividends in terms of their confidence and know-how to interface with industry effectively. Graduate students in particular, will be better prepared and better able to transfer their experience to diverse career paths upon graduation and they will gain valuable leadership skills which will set them apart from their peers.

#### Building the

**Commercialization Pipelines** Partnering universities with government agencies and industry to test new models for building the pipeline from discovery to application is showing promising results. By creating the structures and focusing in sector-specific areas, the speed of commercialization can be accelerated. Two examples with significant involvement of the University of Calgary are Biovantage to support the biomedical engineering sector and Tecterra in support of the geomatics industry. These models, in concert with the university's technology transfer arm Innovate Calgary, bring together researchers, industry players and sector-specific technology transfer leaders to create a dynamic and nimble 'idea to innovation' pipeline.

These are just a few of the many examples that increase the opportunities and maximize the potential for success of universitybusiness collaborations. With the growing urgency to mine, develop and implement university-led discovery, creativity and innovation, it is expected that these collaborations will only grow in size and impact.



To become one of Canada's top 5 research-intensive universities, we need more of the best minds in our labs and classrooms, and in our partnerships with industry.

That's why over the next year, we're increasing our research and teaching staff by hiring 50 new assistant professors and 60 new postdoctoral scholars.

We're investing in people who want to change the world.

Trailblazers like chemical engineer Nashaat Nassar. He chose the University of Calgary in the energy capital of Canada because of the industry partnerships open to further his research in nanotechnology. He's reducing the environmental footprint of the oil sands through research in heavy oil recovery and upgrading, waste water treatment,

solid waste management, and air pollution control. Protecting our environment for future generations is research changing the world.

We're increasing our research capacity and exploring new frontiers to achieve our Eyes High goals — to become of one of Canada's top 5 research-intensive universities, grounded in innovative learning and teaching, and fully integrated with the community.

### WE'RE INVESTING IN A WORLD OF CHANGE.

LEARN MORE UCALGARY.CA/REPORT



John McDougall President National Research Council

RC's mandate is to be agent of economic development for Canada. In 2010, the National Research Council began a process to transform the organiza-

### OPENING NATIONAL RESEARCH ORGANIZATIONS TO BUSINESS

tion to help bridge Canada's innovation gap. In late 2011, the Jenkins Expert Panel confirmed the need for "collaborative R&D and innovation projects that are large scale, industry facing, demand driven and outcome oriented. Such projects can result in breakthroughs and can build capacity in existing and emerging industry sectors."

Budget 2012 reinforced NRC's agenda by allocating \$67M in 2012-

13 to "refocus the National Research Council on research that helps Canadian businesses develop innovative products and services."

Rebuilding NRC has three fundamental planks – focus, sustainability and strengthened communications. • Focus – fewer areas of work with more impact in areas important to Canada

 Avoiding duplication and overlap • Sustainability – living within our means, generating value

More effective and efficient use of resourcesCommunication – Simple, easy to

understand brand and image – A collaborative value-adding partner

NRC will focus on technology development to facilitate industrial R&D and support Canadian industry. We will be more market-oriented and business-like and will focus on bridging the gap between university based discovery and industry. Five key values underpin the culture we need to drive such a business – making a difference for Canada, being accountable, maintaining a leadership position, integrity and transparency, and collaboration with industry, academia and others.

We are moving from an institute model built around individuals and bricks and mortar to a program model built on outcomes, multi-disciplinary teams, rigorous management and partnerships. Six critical priorities aligned with the federal S&T Strategy guide NRC's programmatic decisions:

- economic competitiveness;
- natural resources supply chains;

- mitigating environmental impacts;health care costs:
- complex security challenges; and
- sustainability of communities.

NRC's transformation will promote sustainable growth of Canada's business sectors, reduce early-stage technology development risk and strengthen the ability of Canadian firms to address areas of major public concern. NRC will also continue to deliver the NRC-Industrial Research Assistance Program (NRC-IRAP).

NRC programs will be designed around customer needs within a framework aligned with national innovation strategy. Some will be large multi-disciplinary, multi-year efforts with multiple partners and

# STILL NUMBER ONE!

Again this year, INRS University ranks first in Canada in terms of research intensity thanks to the excellence of its professors.

Taking a multidisciplinary approach to fundamental and applied research, INRS research teams play a critical role in finding solutions to the problems facing our society, as well as in the training of highly qualified students and researchers.

Congratulations to all our researchers!



INRS Université d'avant-garde

**INRS.CA** 



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

t was not a likely partnership. But when Montréal-based Bombardier Inc. teamed up with researchers at a McGill University music lab, the end result was a quieter cabin for the company's new line of luxury jets.

Using a system of highly sensitive microphones and sophisticated computers, researchers in the lab were able to simulate the true acoustic experience a passenger would have in the jet, and then apply their knowledge to minimize the noise.

### PUBLICLY FUNDED RESEARCH AND DEVELOPMENT IS HELPING BOOST CANADA'S ECONOMY

As a leader in Canada's aerospace industry – an industry that employs some 85,000 people and had revenues of \$22.4 billion in 2011 – Bombardier plans to use the research results from McGill University as part of its sales strategy for the new aircraft. It is one of many companies turning to Canadian universities and colleges in an effort to build a research-driven business model that improves products and processes.

More than ever before, executives realize that they need to invest in research and development to remain globally competitive and maintain a healthy bottom line. Increasingly, this means turning to post-secondary institutions. Companies across the economic spectrum are partnering with academic institutions for research and development that will help them innovate and adapt to the demands of a globalized world. This is even happening in the most traditional of industries.

The forestry sector, for example, recognized the need to innovate and adapt after the global recession, slumping U.S. housing market and high Canadian dollar led to significant revenue and job losses. Since 2007, it has been boosting its investments in value-added pulp and paper products and wood manufacturing. New, innovative products such as nanocellulose, which can be used as additives in pharmaceuticals and cosmetics, are ensuring that the industry gets the most out of waste wood and makes its processes more environmentally friendly.

The mining industry is no different. Internationally recognized as top producers of some 60 minerals and metals, mining companies are looking for ways to become more efficient and sustainable. Universities and colleges are helping them head in this direction by developing mineral analysis labs that can be transported to remote exploration sites; building low-emission vehicles that operate deep inside mines; and creating computer models that lead to more accurate risk assessments.

Canadian researchers are also building relationships with companies in the oil and gas, communications and agriculture sectors. These relationships are made possible because the research capacity – the right people with the right equipment – exist at academic institutions to support industry-driven research. Recognizing that research and innovation is necessary to secure a strong economic future, the Government of Canada has made strategic investments with public funds that have created a vibrant research ecosystem in this country. Funding for federal granting councils, centres of excellence, scholarship programs and organizations such as the Canada Foundation for Innovation have provided Canadian universities and colleges with the labs, equipment and facilities needed to attract new talent, train the next generation of innovators, and generate interest from international research institutes and businesses.

Federal investments to bolster research capacity at Canadian universities and colleges are having an impact and helping the business community and national economy grow and adapt. But more needs to be done. Sustained, long-term investments are needed to further grow Canada's innovation system and keep this country competitive and prosperous.

Public opinion is on the federal government's side. A Nanos poll published last year indicated that three out of four Canadians agree that research and development are important to Canada's future prosperity. And eight out of ten Canadians support government-funded research support programs such as the Canada Research Chairs and other investments in universities.

By continuing to invest in research and innovation, the Government of Canada is betting on bright minds to make discoveries that help private enterprise stay ahead of the curve and lead to advances that benefit all Canadians. I'd say it's a pretty good bet.

Dr. Gilles G. Patry is the President and CEO of the Canada Foundation for Innovation, the country's only funding organization dedicated solely to supporting research infrastructure at Canadian universities, colleges and research hospitals.



## At the University of Guelph ...

#### CHANGING LIVES IMPROVING LIFE

# Ingenuity Matters!

### **Best Return on Investment in Canada**

The University of Guelph is Canada's most inventive university.

Guelph ranks No. 1 both in the number of inventions per faculty and in the number of inventions in proportion to research funding, according to a new survey by The Impact Group.

In fact, Guelph's invention disclosure rate is twice the national average.

Our researchers produce one invention disclosure for every 1 million of research funding — 50 per cent more than the next-closest university.

This is possible because of our worldclass researchers, infrastructure and visionary partners, including the provincial and federal governments.

Investing in the University of Guelph makes sense for your business future and your bottom line.



### The Future of Canadian **Innovation is in Recognizing** the Power of Partnership



Dr. Daniel Woolf Principal and Vice-Chancellor at Queen's University and a professor in the Department of History

sounds like simple technology: a restraint system designed to keep wheelchair users safe while riding on public transit. Though such systems are now a common sight on transit vehicles around the world, there was a time when they weren't.

That's why a team of pioneering mechanical engineers at Queen's decided to take on the challenge of coming up with an uncomplicated system that could save lives by keeping wheelchairs and their users locked in place while travelling. They devised a retractable and adjustable four-point system which has since been implemented in vehicles across North America, as well as in Europe, Asia and beyond. As a result of their innovation, more than 10 billion wheelchair transit trips have been completed more safely.

If the idea had remained a prototype within the walls of the academy, however, that might not have been the case. Instead, Professor Henk Wevers and his Clinical Mechanics Group at Queen's saw their idea translated into Q'Straint Systems Inc., a company which is now considered the world leader when it comes to wheelchair securement.

Though that idea first arose more than a quarter-century ago, I'm using it to highlight an important point. If Canada is going to become a world leader in innovation, we must find ways to nurture emerging talent, foster new ideas, and support discovery research. One way to do that is by developing mutually ben-

eficial relationships that meet both the changing needs of the academy and the demands of industry.

Let's go back to wheelchair restraints for a moment. Q'Straint Systems Inc. was one of the first successes to come out of PARTEQ Innovations, a not-for-profit company first established at Queen's in 1987. Our goal back then was simple: to commercialize university research, even at a time when many universities were shying away from the idea. What we saw, however, was an opportunity to advance knowledge and to translate researchers' discoveries into products and processes with wide-reaching benefits for the wider world.

In the last 25 years, PARTEQ has returned more than \$30 million to both Queen's and its inventors, and has formed or helped to form 47 companies which have attracted more than \$1.2 billion dollars in investment. It's not surprising that other institutions have since emulated our model. Alongside other Queen's industry-minded endeavours - such as Tech Value Net, which brings together 40 researchers from across Canada to improve the care of seriously ill, elderly patients and their families - what it demonstrates is our commitment to fostering innovation in a way that has helped distinguish Queen's as one of the top ten research-intensive universities in Canada. In fact, "Guiding and Supporting the Research Enterprise" is one of the pillars of our new Strategic Research Plan, an initiative that lays out our goals through 2017. From an increased focus on global engagement and internationalization, to creating an academic environment that will nurture research initiative and leadership, we now know what we need to do as we move into the future. We live in challenging times. Uni-

versities are under increasing fiscal constraint, and as an institution, we are continually striving to maintain a balance between meeting the needs of our students and remaining mindful of our economic realities. And it's no secret that today's students worry about finding jobs. Increasingly, they're looking for relevance

in their learning as they prepare for the next phase in their lives.

That's why we are more focused than ever on producing entrepreneurial students, working across disciplines, who are not only independent thinkers, but who have the skills to become the next generation of innovators. In fact, earlier this month one of our own PhD students was the recipient of the \$50,000 Martin Walmsley Fellowship for Technological Entrepreneurship from the Ontario Centres of Excellence - an award that supports a graduate student's business founded on university research. In addition, the Queen's Summer Innovation Institute began this year, pulling undergraduate engineering and commerce students together in a dynamic environment where they worked together to bring original ideas to life as a business venture.

We know that the future will depend on collaboration - between researchers and institutions, between business and academia, and across international borders. At Queen's, more than 50 per cent of our researchers are already publishing articles or books in conjunction with collaborators in other countries - a rate that's double the national average. It's a statistic that will inevitably increase.

It's no longer enough for universities to rest comfortably on their academic laurels. From conquering global poverty and eradicating the stigma of mental illness, to tackling on the challenges of climate change, we all need to be invested in making this world a better place. Rather than keeping research confined to the ivory tower, let's all be motivated by the impulse to develop viable solutions. Forging connections with the private sector will help bring more of that research to light.

As we move into the future at Oueen's, we have a clear roadmap that will allow us to unleash the full potential of our thinkers and doers. And thanks to innovative research and fruitful industry partnerships, we even have a way to make sure everyone's strapped in - no matter how they're travelling.

# Unleashing the potential of our thinkers anddoers

Since 1987, PARTEQ Innovations has advanced academic research discoveries to the marketplace, making a difference in people's lives.

> 419 patents 1,065 disclosures of invention **47**<sub>companies created</sub>

> > \$1.2 billion invested

800+ jobs created

\$30+ million returned to institutions and inventors

queensu.ca



## COMPANIES, UNIVERSITIES & HOSPITALS: **Pioneer New Partnership Models**



term liabilities associated with maintaining and running sophisticated research facilities. "If we can make this work, we will have sustained investment in the necessary infrastructure and intellectual capacity to drive an innovation agenda for research that will create jobs, wealth and make the sector more competitive - and without trading our soul as a university to pursue the academic and scholarly freedom which researchers need to be creative," he says.

before any research begins.

and mortar costs, but also the longer rounding intellectual property (IP) on the notion that there are people as ries some exciting developments are combustion, instead of chemicals, to smart, or smarter, than you who don't happening outside its radar. That's work for you. Eventually they're going to try to achieve a competitive advantage at your expense so it is in your interest to harness their talents and skills and work with them collaboratively," says Emechete Onuoha, V.P. Citizenship and Government Affairs for XRCC. XRCC holds a global mandate to develop the materials used by Xerox Corp. globally. Onuoha says this makes partnering with academic and government research labs a necessity. At any given time, it has active projects with more than a dozen Canadian universities. "Some of the collateral insights that are associated with scientific inquiry are lost or end up being trapped on the shelves of the corporate lab," he says. "With NINT, we're allowing very talented postdoc researchers in material science to work with our data and our materials to see if they can gain any insights that might ultimately lead to a commercially viable product." Ericsson Canada is another major player in Canada's research landscape. Its Canadian R&D Centres are some of the largest outside of Sweden and fulfill worldwide mandates in development, testing and support of wireless networks and advanced end-user multimedia services. In addition to joint research, Ericsson works with universities to build a critical mass of wireless technology expertise aimed at addressing practical industry issues. "Ericsson was the first company to establish a centre for wireless research at the University of Waterloo," says Dragan Nerandzic, Ericsson Canada's Chief Technology Officer. "Now you see how much research is happening in that area resulting in the establishment of some of the most successful and advanced Canadian companies in that space."

capture CO2 emissions from boilers. "Academia is involved in a lot of

the things we do where we're trying

to solve the fundamental problems

about how to make something work,"

says Mark Bilozir, Director of Tech-

nology Development at Cenovus. "In

other cases like Western Kentucky

University and Chalmers we went

there because they have working

models that allow us to test things

that we couldn't test anywhere else

in the world. We are searching the

Companies that are interested in

longer term research - as opposed to

one-off projects - will often sponsor

academic research chairs. Industrial

partners and the Natural Sciences

and Engineering Research Council

(NSERC), for example, currently

support 170 Industrial Research

Chairs across Canada, including Dr.

Peter McVetty at the University of

Since the chair was established

world for answers."

Manitoba.

Debbie Lawes Consulting Editor **RE\$EARCH MONEY** 

ometimes the brightest ideas come from the most unlikely of places. Let's start with the cows. They (well, to be fair, the Dairy Farmers of Ontario) needed access to state-of-the-art research facilities to test new approaches to sustainable animal agriculture.

To do this on their own would cost a hefty \$25 million - and that's just for the buildings and equipment. Tack on tens of millions more over the long term for scientists' salaries, pensions, maintenance costs, overhead and inflation. Even the hay isn't cheap these days.

With one of the largest agriculture research farms in Canada, the University of Guelph was a logical partner. But its' nearly half a century old Elora Research Station was in dire need of upgrading and money is scarce. A new approach was needed.

"Universities do about 80% of new agricultural research and development (R&D) and bear all the costs of maintaining a research enterprise. The old model wasn't working anymore so we came up with something that's pretty unique worldwide," says Prof. Rich Moccia, the university's Associate V.P. (strategic partnerships).

The new model will see the University of Guelph, the Dairy Farmers of Ontario and the Ontario Ministry of Agriculture, Food and Rural Affairs share not only the bricks

#### **Embracing "Open Innovation"**

Across Canada, and around the world, academic institutions are stepping out of their comfort zones to better align their research agendas with the needs of industry and society.

One popular model is not-forprofit consortia that pool the collective R&D strengths of industry, academia and government. This "open innovation" approach combines a company's internal resources with the best external capabilities to identify new ideas, reduce risk, increase speed to market and leverage scarce resources.

The Consortium for Research and Innovation in Aerospace in Québec (CRIAQ) is one such example. It brings together some 50 companies and 30 universities and research centres to give Canada's aerospace companies a technological edge in this fiercely competitive sector.

Prior to CRIAQ's founding in 2002, bilateral collaboration was the norm with one company partnering with one university on one project. Under CRIAQ, each project must involve at least two universities and two industry partners. Industry decides the topic and the research is done at universities.

Dr. Fassi Kafyeke, Director Strategic Technology at Bombardier Aerospace, says this approach leads to faster technology commercialization, partly because members resolve the most contentious issues sur-

"Some discussions can take upwards of two years to conclude, which can kill a project before it ever gets started," he notes.

**66** There's a common misconception that working on an industry problem isn't something that requires basic research. **99** 

Digvir Jayas, V.P. Research, University of Manitoba

One successful technology to emerge from CRIAQ is "out of autoclave" - a new manufacturing method for composite materials that is faster and less costly than traditional processes. It is used to build the Bombardier Learjet 85.

"Some European and Asian countries have come here to study the CRIAQ model and see how they could apply it in their home countries. It gives us a great competitive advantage," says Kafyeke.

Xerox Canada includes open innovation in its R&D mix as well. The multinational launched its firstever open innovation program in 2007 at the National Institute of Nanotechnology (NINT), a partnership between Canada's National Research Council and the University of Alberta. The partners invest funds, human resources and infrastructure to study materials-based nanotechnologies at NINT in Edmonton and at the Xerox Research Centre Canada (XRCC) in Mississauga.

"Open innovation is predicated

The company collaborates with more than 20 universities, yet wor-

why it launched a new program this year that awards grants for academic projects across Canada that support Ericsson's business priorities.

"We wanted to have a more structured process that is open to more universities to make sure we have access to the best talent and capabilities," says Nerandzic.

#### From Oil Sands to Oil Seeds

Canada's oil sands companies also recognize the value of collaboration. They spend hundreds of millions of dollars annually to find technological solutions that can lower CO2 emissions, enhance productivity and reduce the industry's environmental footprint.

Cenovus Energy Inc. spends \$200 million to support more than 140 current R&D projects. At the University of Alberta, for example, Cenovus funds a graduate student to study biological methods for converting bitumen to natural gas and other hydrocarbon liquids that can

in 2003 with support from Bunge Canada and DL Seeds, Dr. McVetty's 66 Academia is involved in a lot of the

things we do where we're trying to solve the fundamental problems about how to make something work. ??

Mark Bilozir, Director of Technology Development, Cenovus Energy

be used as a biodiesel feedstock. The company also sponsored a new research chair at the University of Calgary to examine the mechanics of oil sands reservoirs.

Outside of Canada, Cenovus works with Western Kentucky University to understand the science behind turning bitumen into a new energy source, and with Chalmers University on a \$60-million project that would use chemical looping

team has developed oil seed crops with higher yields, shorter maturity, better disease resistance and premium prices.

"There's a common misconception that working on an industry problem isn't something that requires basic research. That's an artificial distinction since an applied component will often flow from a fundamental research

November 2, 2012

# 



York University researchers and trainees are actively engaged in research and critical discussions that lead to new knowledge, discoveries and innovative solutions to complex local and global societal challenges. The ability to contribute to a better world is part of our DNA and is the driving force behind our research.

> Robert Haché Vice-President Research & Innovation York University



ANARIE supports data-intensive research and innovation. With our ultra-fast network, research software tools and cloud computing services, CANARIE delivers the digital infrastructure Canadians need to engage in world-class research.



Jim Roche President and CEO CANARIE



hrough the Humber Research Department, Humber drives innovation and discovery for the new economy. Humber students with an entreprenurial vision are supported through the New Venture Seed Fund and the Innovation Humber Incubator. Other students, guided by faculty experts, work with local businesses to provide solutions to real problems. These opportunities to engage with industry and the community enrich the student experience and facilitate economic growth and development for Ontario.

Chris Whitaker, Ph.D. President and CEO Humber College Institute of Technology & Advanced Learning



There is no easy path to achieving There is no easy pair a the status of Canada's Research University of the Year 2012 (Undergraduate Category). A research portfolio must be built strategically, over time, and with support throughout the university. It is also dependent on the hard work of faculty members, who not only excel in teaching their students, but actively engage them in research opportunities that foster the next generation of researchers.

> Dr. Daniel J. Weeks Vice-President Research University of Lethbridge



oving research knowledge out **V** of our classrooms and laboratories and putting it to use to benefit people's daily lives is the overarching goal of University of Guelph research. Faculty, staff and students from across the disciplines work together to create a vibrant, unique research environment. Their efforts are advanced through partnerships with government, industry and other academic institutions, which help create value for society, domestically and globally, and accelerate the transformation of research knowledge.

> Dr. Kevin Hall Vice-President (Research) University of Guelph



 $S_{\rm power}^{\rm cience}$  and innovation has the power to help restore health or even to save lives. At Amgen Canada, we are committed to investing in, and using, science and innovation to serve patients. With the determination of our scientists, we will continue to discover new medicines that treat grievous illness and dramatically improve people's lives.

Dr. Clive Ward-Able Executive Director, R&D Amgen Canada Inc.



For over 40 years, INRS has played a critical role in the advancement of science in Canada and around the world, and in the training of highly qualified researchers. We are very proud to rank firts again this year in research intensity thanks to the outstanding performance of our professors, our many partnerships in various strategic sectors, and our state

of the art research facilities. Daniel Coderre, Ph.D. Director General INRS



anadian universities have the talented researchers to create knowledge and advances that enable humanity to move forward on a diversity of fronts - climate change, the economy, human rights, stem cells, cities, the arts, green technology, new media and so many others. Enabling our people to realize their full potential, however, demands that universities build upon traditional disciplinary strengths and work with a variety of partners in both the public and private sectors. Real progress relies on collaboration. As a nation and through partnership in research and innovation, we will transform our future.

> Dr. R. Paul Young, FRSC Vice President, Research and Innovation University of Toronto



Innovation and entrepreneurship are Lembedded in all that we do. Building on leading edge research, we collaborate with industry and community partners to find real-world solutions to real-world problems. Ryerson's unique zones of innovation harness the imagination of our researchers and students to help drive Canada's prosperity and quality of life.

> Wendy Cukier Vice President, Research and Innovation Ryerson University

# Real-world research for real-world problems.

Innovation is the lifeblood of Ryerson University. Partnering with industry, government and community groups, our research meets and anticipates the needs of society. Ryerson researchers build and apply knowledge in critical areas such as digital media, biomedical engineering, aerospace, creative industries and design, energy and sustainability and civil society.

With over 150 advanced research centres, institutes and labs in a wide range of disciplines, our research enriches communities at home and abroad. Internationally recognized, Ryerson's unique innovation zones develop student entrepreneurs who create companies and jobs.

#### Learn more at www.ryerson.ca/research





tionships. Of the industrial partners a funding decision in "business" K&D PAKINEKSHIPS HELP

Suzanne Fortier President Natural Sciences and Engineering Research Council of Canada

n today's economy, a global innovation leader must be not only open for business, but also open to collaboration. Being the first to market requires flexibil-

ity, speed and access to the right resources that must be available at the right time. Companies of all sizes are recognizing this and turning to collaborative research activities undertaken together with higher education institutions, research hospitals, and government labs to meet their innovation goals. At the Natural Sciences and

Engineering Research Council of Canada (NSERC), we are committed to helping connect Canadian businesses with the research talent in our post-secondary institutions. Every year, we fund more than 12,000 professors and 30,000 students in Canadian universities, as well as expert researchers and students at over 70 colleges, to tackle research challenges in the natural sciences and engineering. This represents a considerable reach, and a powerful pool of talented people with new ideas and expertise to bring to the business community. Today, NSERC invests one-third of our \$1.1 billion budget every year in connecting businesses to academic institutions to accelerate the delivery of the ideas, solutions, and people businesses need for their continued success.

**BUSINESSES SUCCEED** 

To further facilitate research and development (R&D) collaborations between academics and businesses, NSERC has focussed on understanding the needs of business and responding to them. In 2009, NSERC launched a new Strategy for Partnerships and Innovation, introducing new flexible granting options to bring companies and researchers together. For example, to help kick-start new relationships, we have a sixmonth, \$25,000 Engage grant that lets researchers work directly with companies to solve an important R&D challenge. NSERC provides

## Harnessing a Climate of Change



Pierre Meulien, Ph.D. President and CEO Genome Canada

anada along with much of developed world is being thrust into an era of renewed industrial growth powered by the knowledge and application of the comparatively young science of genomics.

Since the completion of the DNA

sequencing of the human genome a decade ago, the influence of genomics has surged across all aspects of the life sciences. Nowhere is this more true than in Canada where abundant natural resources and vast areas of food production provide the fuel for rich scientific activity, which will lead to increased productivity in these key industries.

Genomics is the study of all biological information contained in an organism from the DNA coding to the biochemical activity at the cellular level. Already this research is yielding applications in areas as diverse as food safety, security and surveillance; environmental monitoring; tree breeding, and ,of course, significant inroads into the development of new diagnostic tools and therapies in health care.

Over the past decade, through support from the Government of Canada, provinces and many other research partners from both the private and public sectors, Canadians have developed a world-class capacity in the genome sciences. We are now poised to reap some of the economic benefits including highvalue job creation and industrial growth that the genome sciences have promised.

Today Canadian researchers and industrialists are using genomics to develop a large array of tools that have the potential solve real world problems.

The following examples illustrate how the genome sciences are equipping Canada to meet that challenge:

· Energy systems are gradually shifting to make use of biomass resources as a sustainable contribution to energy needs while improvements to efficiencies of bitumen extraction using biological means are developed. Microbial processes informed by genomics are making

all of this possible. A new science called "metagenomics" which looks at the biochemical functions of microbial communities is a driving force in this regard.

· Food production techniques are evolving to ensure the security of livestock, cereals, other food sources - even honey bees that are so crucial to the pollination of Canada's multibillion-dollar fruit and canola crops. The dairy cow breeding industry has embraced the results of the Bovine Genome Project, where Canadian scientists played a leading role.

• Technologies are being applied to assure safer foods with advanced means of analysis and surveillance of pathogens that threaten the health of consumers

· Wild fisheries and the aquaculture industry are employing genomics-based evidence to help safeguard an important food source

• Environmental management

time - within six weeks.

In talking to industry and academic researchers, another key challenge mentioned was how to find the right partner and how to start a research relationship that is productive and will generate results. In response, NSERC re-oriented our regional offices to help connect more businesses with researchers. The offices offer targeted networking events at which researchers, with the expertise and desire to form a partnership, can meet with interested companies.

This new approach is not only building new research relationships, but is garnering concrete results for businesses. The results speak for themselves. Today, NSERC works with over 2,400 companies. Since 2009. NSERC has facilitated over 1,700 new business-academic rela-

and better mining practices through development of natural biochemical processes are helping to remediate toxic waste sites. Small companies are being created around some of these new applications

· Transforming the forestry sector from a pulp, paper and lumber focus to a bioproduct industry will require the integration of new technologies into the traditional landscape

· Diagnostic tools are being developed and commercialized so that cancer and heart disease patients can benefit from more targeted treatments that show increased clinical benefits while at the same time reducing harmful side effects.

Along with this genomics technology comes the challenge related to the capture, storage and analysis of a massive influx of data coming from genome sequencing and analyses. All of this underscores the need for new computational tools and information hardware in studying modern biology.

These will be essential for analyzing and integrating complex data

who have participated in a research project through NSERC for the first time, 94 percent reported that they are applying, or intend to apply, the knowledge gained from the relationship. Seventy-five percent said the project contributed to new business opportunities and twothirds plan to work with the same researcher again.

Innovation is a national priority, and it will shape our future. NSERC's goal is to help more Canadian businesses see their names in the top 100 "Innovation Leaders." Our strong suite of funding options helps any business leverage the incredible expertise of Canada's research community to meet their corporate R&D needs. In the global innovation race, working together will benefit all Canadians.

sets and to better understand the underlying biology.

To fully exploit this research, Canada requires investment mechanisms for technology to move more efficiently from the academic laboratory into industry. Only through these mechanisms and other policy changes will Canada occupy the place it deserves in the new world bio-economy, which is expected to reach over 4% of OECD country GDP by 2030.

Canada should have a disproportionally large piece of that pie given its substantial footprint in the life sciences.

For all these reasons, Canada is forging a path towards future economic prosperity with a strong foundation of research in the genome sciences.

Now, with our best foot forward, there is much work ahead yet as Canada builds a solid new scientific platform upon which to expand industry, enhance development and production, and exploit the knowledge-based economy to the benefit of all Canadians.

NOVEMBER 2, 2012



# Canada's Hospital Innovation Leaders

PREPARED BY RE\$EARCH INFOSOURCE INC., AN IMPACT GROUP COMPANY

HOSPITAL RESEARCH INCOME SLOWS DRAMATICALLY — Canada's Top 40 Research Hospitals reported \$2.195 billion in research income in Fiscal 2011, up from \$2.179 billion in Fiscal 2010 – a meagre 0.7% year-over-year increase.

Canada's Top 40 Research Hospitals 2012

#### RESEARCH Infosource Inc.







Rai	ιk		Res	earch Inco	ome	Researchers*	Research Intensity		
11	2010	Hospital	FY2011 \$000	FY2010 \$000	% Change 2010- 2011	2010- 2011 #	\$ per Researcher \$000	Province	Main Affiliated Research Institute(s)/Centre(s)
1	1	University Health Network	\$253,245	\$267,654	-5.4	539	\$469.8	Ontario	Ontario Cancer Institute, Toronto General Research Institute,
2	3	Hospital for Sick Children	\$167,815	\$172,213	-2.6	538	\$311.9	Ontario	Toronto Western Research Institute Hospital for Sick Children Research Institute
3	4	McGill University Health Centre (MUHC)	\$153,008	\$131,147	16.7	628	\$243.6	Quebec	Research Institute of the MUHC
4	2	Hamilton Health Sciences	\$152,545	\$180,435	-15.5	286	\$533.4	Ontario	Population Health Research Inst., Thrombosis/Atherosclerosis Research Institute, Escarpment Cancer Research Institute
5		Provincial Health Services Authority	\$138,722	\$151,677	-8.5	633	\$219.2	British Columbia	BC Cancer Research Centre, Child & Family Research Institute, BC Mental Health & Addictions Research Institute
6	6	Ottawa Hospital	\$129,929	\$138,350	-6.1	305	\$426.0	Ontario	Ottawa Hospital Research Institute, Ottawa Heart Institute Research Corporation
7	5	Sunnybrook Health Sciences	\$122,100	\$106,000	15.2	236	\$517.4	Ontario	Sunnybrook Research Institute
8		Vancouver Coastal Health Authority	\$120,261	\$115,098	4.5	364	\$330.4	British Columbia	Vancouver Coastal Health Research Institute, Providence Health Care Research Institute
9		London Health Sciences Centre/ St. Joseph's Health Care London <sup>(a)</sup>	\$102,000	\$105,000	-2.9	640	\$159.4	Ontario	Lawson Health Research Institute
10	8	Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex	\$84,000	\$81,000	3.7	53	\$1,584.9	Ontario	Samuel Lunenfeld Research Institute
11	10	Centre hospitalier universitaire de Québec (CHUQ)	\$75,573	\$75,735	-0.2	249	\$303.5	Quebec	Centre de recherche du CHUQ
12	11	Centre hospitalier de l'Université de Montréal (CHUM)	\$67,800	\$65,300	3.8	319	\$212.5	Quebec	Centre de recherche du CHUM
13	18	Centre for Addiction and Mental Health	\$54,393	\$42,933	26.7	110	\$494.5	Ontario	
14	14	Sir Mortimer B. Davis Jewish General Hospital	\$54,038	\$51,497	4.9	219	\$246.7	Quebec	Lady Davis Institute for Medical Research
15	15	St. Michael's Hospital	\$53,643	\$49,300	8.8	180	\$298.0	Ontario	Keenan Research Centre, Li Ka Shing Knowledge Institute
16	16	Institut de Cardiologie de Montréal	\$51,519	\$49,192	4.7	85	\$606.1	Quebec	Centre de recherche de l'Institut de Cardiologie de Montréal
17	17	CHU Sainte-Justine - Le centre hospitalier universitaire mère-enfant	\$49,004	\$49,000	0.0	201	\$243.8	Quebec	Centre de recherche du CHU Sainte-Justine
18	19	Centre hospitalier universitaire de Sherbrooke (CHUS)	\$34,462	\$36,270	-5.0	200	\$172.3	Quebec	Centre de recherche clinique Étienne-Le Bel du CHUS
19	21	St. Joseph's Healthcare Hamilton	\$30,600	\$30,100	1.7	110	\$278.2	Ontario	Firestone Inst. for Respiratory Health, Hamilton Centre for Kidney Research, Programs for Assessment of Technology in Health (PATH) Res. Inst.
20	22	Institut universitaire de cardiologie et de pneumologie de Québec	\$27,140	\$28,071	-3.3	119	\$228.1	Quebec	Centre de recherche de l'Institut universitaire de cardiologie et de pneumologie de Québec
21 22	24	IWK Health Centre Winnipeg Regional Health Authority	\$24,635 \$22,647	\$20,892 \$25,146	17.9 -9.9	235 372	\$104.8 \$60.9	Nova Scotia Manitoba	Manitoba Institute of Child Health
23	27 20	Kingston General Hospital	\$22,230 \$21,807	\$16,330 \$15,202	36.1	175	\$127.0 \$270.2	Ontario Ontario	iDADT Contro for Dobabilitation
24	29	Institute <sup>(b)</sup>	\$21,077	\$12,392	42.5	01	\$270.5	Ontano	Research
25	25	University Institute	\$17,5	\$10,024	0.4	20	\$299.0	Quebec	Centre
20 27	31	Children's Hospital of Eastern Ontario	\$17,239	\$13,768	25.2	169	\$102.0	Ontario	Children's Hospital of Eastern Ontario Research Institute
28 29		Capital District Health Authority Institut universitaire en santé mentale de Québec	\$17,218 \$16,877	\$17,153 \$17,258	0.4 -2.2	250 68	\$68.9 \$248.2	Nova Scotia Quebec	Centre de recherche de l'Institut universitaire en santé mentale de Québec
30	30	Centre hospitalier affilié universitaire de Québec (CHA)	\$13,509	\$15,093	-10.5	222	\$60.9	Quebec	Centre de recherche du CHA
31	33	Hôpital Maisonneuve-Rosemont	\$12,638	\$12,125	4.2	51	\$247.8	Quebec	Centre de recherche de l'Hôpital Maisonneuve-Rosemont
32	32	St. Boniface Hospital	\$12,200	\$12,935	-5.7	32	\$381.3	Manitoba	St. Boniface Hospital Research Centre
33 34	34	Women's College Hospital Holland Bloorview Kids	\$8,758 \$8,167	\$8,331 \$8.400	5.1 -2.8	47 21	\$186.3 \$388.9	Ontario Ontario	Women's College Research Institute Bloorview Research Institute
35	36	Rehabilitation Hospital Hôpital du Sacré-Coeur de Montréal	\$7,799	\$6,764	15.3	138	\$56.5	Quebec	Centre de recherche de l'Hôpital du Sacré-Coeur de Montréal
36	35	The Royal	\$7,400	\$8,100	-8.6	94	\$78.7	Ontario	University of Ottawa Institute of Mental Health Research
37	40	Thunder Bay Regional Health Sciences Centre	\$6,191	\$4,637	33.5	20	\$309.6	Ontario	Thunder Bay Regional Research Institute
38 39	38	Bruyère Continuing Care Centre de santé et de service sociaux Champlain - Charles-Le Mource	\$5,833 \$5,730	\$5,763 \$5,874	1.2 -2.5	56 38	\$104.2 \$150.8	Ontario Quebec	Bruyère Research Institute Centre de recherche du CSSS Champlain - Charles-Le Moyne
40	39	Institut universitaire de gériatrie de Montréal	\$5,696	\$5,461	4.3	40	\$142.4	Quebec	Centre de recherche de l'Institut universitaire de gériatrie de Montréal



## RESEARCH

#### **RE\$EARCH Infosource Inc.** is

Canada's source of R&D intelligence. Data used for this table were extracted from our Canadian Research Hospitals Database, a proprietary database. Hospitals wishing to be included in future editions of the Top 40 List should contact us directly.

The Top 40 List is available online at www.researchinfosource.com or by calling (416) 481-7070.

For advertising information, please contact Arlene Dwyer at (416) 481-7070 ext. 23 arlene@ impactg.com Notes:

- 1. Research income includes all funds to support research received in the form of a grant, contribution or contract from all sources (internal and external) to the organization.
- Data were obtained through a survey of research hospitals or from financial statements. Information for Alberta was not available.
- 3. FY2010 research income figures may have been adjusted, as more accurate information became available.
- Data are provided for the main hospital(s) including their affiliated hospitals and research institutes/centres, where applicable.

\*Head count of researchers/scientists/investigators/clinician-researchers.

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

(a) Research income amounts were combined as these hospitals have one research institute.

- (b) For FY2012 reporting, Toronto Rehabilitation Institute will be included with University Health Network.
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#### Canada's Innovation Leaders, a RE\$EARCH Infosource Inc. Publication

#### Continued from page 9

Toronto's University Health Network remains the country's largest destination for research funding, garnering \$253.2 million of research income. Hospital for Sick Children was next on the list (\$167.8 million) and McGill University Health Centre (\$153.0 million) rounded out the top 3 institutions in the country. These leaders were followed by Hamilton Health Sciences (\$152.5 million) and B.C.'s Provincial Health Services Authority (\$138.7 million). Four of these top 5 research hospitals reported declines in research income from Fiscal 2010. Overall, 23 research hospitals posted increases in research income in Fiscal 2011, compared with 17 hospitals where income declined or was flat.

#### THE \$100 MILLION CLUB

In Fiscal 2011, 9 hospitals reported research income of \$100 million or more, thereby gaining admission to RE\$EARCH Infosource's prestigious \$100 Million Club. Research income of these top research hospitals accounted for 61% of the total (\$1.340 billion), but combined research income dropped -2.0% over the period. Additions to the Club were Provincial Health Services Authority (\$138.7 million), Vancouver Coastal Health Authority (\$120.3 million) and London Health Sciences Centre/St. Joseph's Health Care London (\$102.0 million).

The \$100 Million Club							
2011 Rank	Researc Research Hospital	h Income: \$000					
1	University Health Network	\$253,245					
2	Hospital for Sick Children	\$167,815					
3	McGill University Health Centre						
	(MUHC)	\$153,008					
4	Hamilton Health Sciences	\$152,545					
5	Provincial Health Services Authority	\$138,722					
6	Ottawa Hospital	\$129,929					
7	Sunnybrook Health Sciences Centre	\$122,100					
8	Vancouver Coastal Health Authority	\$120,261					
9	London Health Sciences Centre/						
	St. Joseph's Health Care London	\$102,000					

#### **PROVINCIAL PERFORMANCE**

In Fiscal 2011, Ontario's 19 research hospitals accounted for 58% of all research income (\$1.266 billion), the same share as in Fiscal 2010. Quebec's 15 research hospitals garnered 27% of the national total (\$593.97 million), up from 26% in Fiscal 2010. British Columbia attracted 12% of the total, accounting for \$258.98 million of research income.

Research income gains in Fiscal 2011 were strongest Nova Scotia, where the province's 2 research hospitals expanded their combined research income by 10.0%. The other province where research income increased over the period was Quebec, posting combined research income growth of 4.8%. However, research income dropped in Ontario (-0.3%), British Columbia (-2.9%) and Manitoba (-8.5%).

Top 40 – By Province	
Province <sup>1</sup>	% of Total
Ontario (19)	58
Quebec (15)	27
British Columbia (2)	12
Nova Scotia (2)	2
Manitoba (2)	2

Again this year Ontario research hospitals led the list on the basis of research income received per-capita (per provincial resident). Ontario hospitals attracted an average of \$95 research dollars per capita, followed by Quebec hospitals (\$74), British Columbia (\$57), Nova Scotia (\$44) and Manitoba (\$28).

Top 40 – Research Income Per Capita				
Province <sup>1</sup>	Research Income Per Capita \$			
Ontario (19)	\$95			
Quebec (15)	\$74			
British Columbia (2)	\$57			
Nova Scotia (2)	\$44			
Manitoba (2)	\$28			

#### **RESEARCH INTENSITY**

In Fiscal 2011, average research intensity – research income per researcher<sup>2</sup> – was \$267,000. Eighteen hospitals posted intensity levels in excess of the average. Leading this group of high intensity hospitals was Mount Sinai Hospital with \$1,584,900 per researcher.

Institut de Cardiologie de Montréal (\$606,100), Baycrest (\$585,200), Hamilton Health Sciences (\$533,400) and Sunnybrook Health Sciences Centre (\$517,400) rounded out the top 5.

#### **GAINERS AND LOSERS**

Between Fiscal 2010 and Fiscal 2011, strong gains in research income were reported at Toronto Rehabilitation Institute (42.3%), Kingston General Hospital (36.1%), Thunder Bay Regional Health Sciences Centre (33.5%), Centre for Addiction and Mental Health (26.7%) and Children's Hospital of Eastern Ontario (25.2%). IWK Health Centre, McGill University Health Centre, Hôpital du Sacré Coeur de Montréal, Sunnybrook Health Sciences Centre and Baycrest also posted double-digit gains in research income over the period.

A number of other institutions were not as fortunate, reporting declines in research income in Fiscal 2011.

#### THIS YEAR AND NEXT

Fiscal 2011 was not kind to Canada's research hospitals. In real terms (constant dollars) the 0.7% overall gain in research income represented an actual decline in spending ability. Given the important role that Canada's Top 40 Research Hospitals play in the national system of health research and innovation, the 2011 result are disappointing. Research hospitals are important players; many of the leading institutions conduct as much or more research as our leading universities.

Because research costs – salaries, supplies, operating expenses – are essentially fixed, the flat hospital research



income growth in Fiscal 2011 (0.7%), will inevitably translate into less research being conducted. In normal times this might be expected to lead to a brain drain to better-funded jurisdictions. Fortunately for Canada, health jurisdictions in the US and Europe are equally or more distressed, which will minimize the actual migration of researchers.

Last year we reported that "Economic headwinds will make 2011 and beyond a difficult environment in which to attract research income. Government funders in particular will be looking to rein in deficits. The bottom line is that hospitals' research funding situation is clouded. The research community is anxiously awaiting forthcoming federal and provincial budgets for clues about research support". That prognostication indeed seems to have come true. And the situation could become more difficult in 2012 and beyond. The private sector is in no shape – or no mood – to significantly increase its support for public sector research and government sources are tapped out. The coming years look to be difficult ones for the hospital research community.

Top 10 Research Intensive Hospitals							
201 Researd Intensi	1 Rank ch ty Overall	Research Intensity ((\$ per researcher) Research Hospital \$000					
1	10	Mount Sinai Hospital, Joseph and Wolf Lebovic Health Complex	\$1,584.9				
2	16	Institut de Cardiologie de Montréal	\$606.1				
3	26	Baycrest	\$585.2				
4	4	Hamilton Health Sciences	\$533.4				
5	7	Sunnybrook Health Sciences Centre	\$517.4				
6	13	Centre for Addiction and Mental Health	\$494.5				
7	1	University Health Network	\$469.8				
8	6	Ottawa Hospital	\$426.0				
9	34	Holland Bloorview Kids Rehabilitation Hospital	\$388.9				
10	32	St. Boniface Hospital	\$381.3				

#### Top 10 Research Hospitals by Growth

2011	Rank		
Income		% Ch	ange
Growth	Overall	Research Hospital 2010-	2011
1	24	Toronto Rehabilitation Institute	42.3
2	23	Kingston General Hospital	36.1
3	37	Thunder Bay Regional Health Sciences Centre	33.5
4	13	Centre for Addiction and Mental Health	26.7
5	27	Children's Hospital of Eastern Ontario	25.2
6	21	IWK Health Centre	17.9
7	3	McGill University Health Centre (MUHC)	16.7
8	35	Hôpital du Sacré-Coeur de Montréal	15.3
9	7	Sunnybrook Health Sciences Centre	15.2
10	26	Baycrest	12.8

#### Bottom 5 Research Hospitals by Growth

2011 Income	Rank	9	% Change
Growth	Overall	Research Hospital 2	010-2011
1	4	Hamilton Health Sciences	-15.5
2	30	Centre hospitalier affilié universitaire de Québec (Ch	HA) -10.5
3	22	Winnipeg Regional Health Authority	-9.9
4	36	The Royal	-8.6
5	5	Provincial Health Services Authority	-8.5

<sup>1</sup> Information for Alberta was not available

<sup>2</sup> Head count of researchers/scientists/investigators/ clinician-researchers. (Not included were research fellows/ post docs, technicians, students or support staff.)

# LUNENFELD: Always Open for Business



Dr. Jim Woodgett Director of Research Samuel Lunenfeld Research Inst. Mount Sinai Hospital Joseph and Wolf Lebovic Health Complex



Terry Donaghue Director, Technology Transfer & Industry Liaison Samuel Lunenfeld Research Inst. Mount Sinai Hospital Joseph and Wolf Lebovic Health Complex

nurturing virtual companies and, at an appropriate stage, formally incorporated companies within the Institute, reducing costs and also allowing for greater proximity between the foundation science and product development projects. Costs are covered by the company either in cash or equity but the operational overhead is a fraction of what would be needed in an off-site facility as Institute resources such as HR, payroll, etc. can be tapped into. The incubation period allows the company to mature its products to an appropriate validation and valuation point before securing major investment and graduating as an independent entity in its own premises. Perhaps the biggest challenge for commercialization remains the dearth of early stage funding. Proof of Principle funds can help mature research findings to a point sufficient for private sector investment, but funding is limited with no certainty of follow-on funding if milestones are achieved thus requiring multiple rounds of competitive funding. Time frames for PoP funds frequently don't correspond to technology development/ validation time frames particularly in the biomedical field. Developing means to provide timely and adequate support for moving promising products and services forward would pay dividends but remains a significant challenge. In addition to our obligation and desire to translate scientific knowledge into improved patient health through commercialization vehicles, grant-based research funding has flat-lined over the past 5 years with little sign of increasing in the near future. Hence, other sources of income become more important in supporting research activities. We expect our innovative approaches utilizing our expertise, discoveries and resources through initiatives such as MSS and in-house companies to grow, supporting our own programs and bridging the gulf between academic research and commercial activities.

# SEARCH

# FOR

## ANSWERS

Miranda, 17 Fundraiser, Bass Player, Teenager Diagnosed with rhabdomyosarcoma and key in helping to find the answers. Dr. Abha Gupta Physician, Haematology/Oncology Involved in designing a novel clinical trial to improve survival of patients with rhabdomyosarcoma – a rare cancer of the connective tissues.

# **SickKids**

We'll do anything for them. But we can't do it alone. Please give generously. 1-800-661-1083 or www.sickkidsfoundation.com

Samuel Lunenfeld Research Institute at Mount Sinai Hospital is a \$90 million per annum research facility home to over 30 of Canada's top biomedical and clinical researchers. Since its inception in 1985, the Lunenfeld has fostered opportunities for commercialization and business development through its Office of Technology Transfer and Industry Liaison. Over this time, the OTTIL has evolved in response to the many changes in the scientific and business environment. As the OTTIL's name suggests, we take a holistic approach to working with industry to advance our mutual interests in promoting wellness and the improved diagnosis, prognosis and treatment of disease. Our activities encompass spin-offs, licensing and close interaction with pharma and biotech spanning sponsored research, interactive large-scale collaborations and research services including clinical trials. OITTL staff also work closely with MaRS Innovation, a federally funded Centre of Excellence in Commercialization of Research that helps integrate and add value to the research commercialization efforts of its member institutions.

Along with the traditional activities of technology transfer,

we realise we have substantial assets and expertise that are not used 24/7. These include sophisticated technologies such as FACS, mass spectrometry, high throughput robotic screening as well as integrated mouse modelling and phenotyping resources at the Toronto Centre for Phenogenomics, a world-class mouse research facility jointly operated by Mount Sinai Hospital and the Hospital for Sick Children. Moreover, Mount Sinai has a successful independent business entity, Mount Sinai Services (MSS) conducting contract research services for industry clients - effectively an in-house CRO. By partnering with MSS, SLRI is able to effectively leverage the spare capacity of these capabilities with proceeds used to support research operations. Moreover, collaboration between MSS and our OTTIL helps advance our own commercialization projects.

A decade ago, research institutions were encouraged to spin out their technologies into self-supporting, independent companies. While some succeeded, many were underfunded, weighed down by heavy overhead costs frequently leading to failure. It is essential that we pursue effective strategies to grow sustainable companies. We have taken a different approach by

<sup>66</sup> Perhaps the biggest challenge for commercialization remains the dearth of early stage funding.
 Proof of Principle funds can help mature research findings to a point sufficient for private sector investment...

Jim Woodgett and Terry Donaghue



# **Colleges:** Open to Business



Robert Fripp Senior Associate The Impact Group

dministrators at Canadian colleges and polytechnics are sounding happier – even if their happiness is marred by the fact that they can't move forward faster.

Colleges: Open to Business. That's our title. Take it literally! Canadian colleges are eager to collaborate with small and medium sized enterprises (SMEs). Colleges have the faculty, students and equipment to work on applied research for companies in many sectors. Already they further productivity, marketability, scalability, innovation – in short, success – for industry partners whose challenges they solve. Examples help set that scene. ronment in our new health sciences campus. "Ocorant came to us for micro-electronics. They went away with much more. A polytechnic or college is able to offer a multi-disciplined approach to helping industry with innovation challenges."

Business innovation doesn't always aim at creating a new technology. Calgary's Bow Valley College (BVC) teamed with engineering firm WorleyParsons Canada to develop Essential Skills workplace training in partnership with the Association of Canadian Community Colleges. WorleyParsons employs many new immigrants with exceptional technical skills, but who lack Canadian workplace experience.

"This goes beyond English as a second language. It includes cultural communication, culture in the workplace, and how we structure information and processes for workflow," says BVC's Krista Medhurst, the Business Leader for Test of Workplace Essential Skills (TOWES), a widely used skills assessment test developed by BVC.

"We have used this model with the aerospace and petroleum industries, but it was the first time we had applied it at an employer's location to an immigrant population," adds Medhurt.

Before describing applied research at Algonquin College, Dr. Mark

they were marketing their system."

Algonquin's strong competency in ICT and digital media is helping bring in industry from several fields: healthcare and construction currently.

"By the end of 2012 every faculty and department will have been involved in applied research projects," says Hoddenbagh. "We engaged 500 students last fiscal year; 400 of them are engaged with in-class projects, which means that the students are working for marks in a course that is part of their study program. The student hands-on component is critical to what we do."

At Centennial College, Trish Dryden, Associate V.P. Research and Corporate Planning, names NexJ Systems as "typical of projects we work on. We are now in our fourth round of applied research for NexJ. The company is developing 'Next Generation' Enterprise Customer Relationship Management for Financial Services, Insurance and Health.

"CONII" (Colleges Ontario Network for Industry Innovation) "funded NexJ's first round of applied research with Centennial, in 2010. Then a second round with CONII escalated to involve researchers from York University. NexJ was creating online games to improve the health of diabetic patients by engaging them with games to provide timely infor-

<sup>66</sup> By the end of 2012 every faculty and department will have been involved in applied research projects...
The student hands-on component is critical to what we do. <sup>99</sup>

Mark Hoddenbagh, Director, Applied Research and Innovation, Algonquin College

Ocorant Inc. makes heart-monitoring vests that people wear while moving around. Electrodes monitor a patient's chest, recording cardiac ata which the wearer reports by phone to a doctor's office. Ocorant approached George Brown College for help making the sensors. That was just the start of collaboration. Dr. Robert Luke, George Brown's Assistant V.P. Research and Innovation, explains: "We have a significant fashion design program, so we were also able to help Ocorant design a vest to position the sensors and technology comfortably. Our engineering faculty and students worked on the microelectronics; fashion students built the garment. Then we linked Ocorant to students in our nursing program. They tested the vest on people in the simulated home envi-

Hoddenbagh reminded us that a college's priority is to enhance student education.

Hoddenbagh, Algonquin's Director Applied Research and Innovation, described the college's work with Impakt Protective. This company designs sports helmets to make it easier to detect whether an athlete may have suffered a concussive blow. "Impakt Protective was working on a sensor and accelerometers you could put into a sports helmet to detect the force and direction of a blow," says Hoddenbagh. "The system calculates whether an event may be concussive. That way you can get the person to treatment right away. mation – to help them make informed choices. Then we did some Flashbased prototypes to give NexJ an idea of how their system would work.

"Now we are among sixteen part-

in working with NAIT on "solutions-based research." Collaborations range from developing prototypes of robotic equipment involved in conveyor belt assembly automation, to creating a virtual museum for Metis history.

"Industry partnerships and industry needs drive us," says novaNAIT

eds drive us," says novaNAIT applied research in many industrial
 Industry partnerships and industry needs drive us.
 We do research internally, partner with companies externally, or broker partnerships between

companies already working with us. **77** Klay Dyer, Director, novaNAIT

Director Dr. Klay Dyer. "We do research internally, partner with companies externally, or broker partnerships between companies already working with us."

Services include prototype development, validation, testing and business incubation; even helping startups apply for grants, patents and licences.

Partnering with the City of Edmonton to install a solar photovoltaic research system atop NAIT's roof also creates industrial opportunities. The project shares live data 24-7. "This has grown to include many start-ups and SMEs sharing expertise," says Dyer, "as well as the research and data being produced."

The Dean of Research at the Humber Institute of Technology and Advanced Learning, Dr. Patricia Morgan, describes Humber's "interest in building a culture of innovation and entrepreneurism." Towards this goal, Humber operates Innovation Humber Incubator and the New Venture Seed Fund. "Our goals," says Morgan, made setting up the seed fund "seem like a logical next step." Students compete by developing a business plan. Committees adjudicate these. sectors. But never before at this rate. The pace of collaboration is gathering speed; the scale and nature of participation is growing; comfort levels and expectations on both sides are rising; and tangible rewards are winning public exposure and being discussed in influential circles.

leagues," says Morgan. "They are

now working with MaRS Innova-

tion with a second round of funding,

This sort of collaboration between

businesses on one side and publicly

funded colleges and polytechnics on

the other has produced important

about \$150,000 from investors."

"So why are my colleges painted with the same brush as universities, when we talk about what's wrong with the system?"

That question comes from Nobina Robinson, the C.E.O. of Polytechnics Canada and, last year, a member of the Jenkins Panel, which the government tasked to review "Federal Support to Research and Development." The Panel filed its report as Innovation Canada: A Call to Action. One part reads:

"Studies have repeatedly documented that business innovation in Canada lags behind other highly developed countries. This gap is of vital concern because innovation is the ultimate source of the long-term competitiveness of businesses and message: "With its strong public research base, Canada could translate knowledge into commercial success more effectively."

"In the end," says Robinson, "it's about making things. We have a pure high-science culture in Canada, but we don't have an engineering culture that makes things the way Germany does. That is where specifically applied research from college to business can help."

Putting students to work on applied research for local firms often gets graduates their first jobs, too. Eighty-five percent of SMEs choosing to work with colleges are small, not medium-sized, firms. They are unlikely to have R&D departments. Trained graduates are especially important as specialist employees.

Six years ago the Natural Sciences and Engineering Research Council of Canada (NSERC) launched the College Community Innovation Program (CCIP). Canada spends \$3.1 billion on science. NSERC gets \$1.1 billion of that, of which \$35 million goes to Canadian colleges.

"That's one cent in the dollar," says Robinson. Ironically, that one cent was originally designed to position colleges within their communities, not specifically to handle applied research for local businesses. Applied research done by colleges for businesses produces output to take to market and skilled jobs.

"It's not enough," comments George Brown's Robert Luke. "Canada needs to increase its support for industry-academic applied research collaboration, including that going to colleges for applied research collaboration with businesses. What we have is a start, but demand is fast outstripping supply. We get more than 250 requests for help each year. We can accept about half."

Nonetheless, college administrators praise the people at NSERC administering CCIP. Suddenly there has been "more funding and capacity-building at provincial, territorial and national levels. It seems like a sea-change," says Centennial's Trish Dryden. "At the Association of Canadian Community Colleges conference people weren't asking 'How do we do this?" any more. They were asking 'How do we do this better?" "

"Algonquin linked Impakt Protective with a software developer and a wireless specialist – two professors, each working with two students. In less than six months of work with us ners working with NexJ and York University on a \$15.5 million grant under FedDev's Technical Development Program." The overall purpose: to build a new people-centred and technology-enabled system that will allow people to better manage their own health and more easily connect with health and wellness professionals, an integral part of Canada's focus on health and wellness.

In a number of sectors, Centennial is seeing its partner industries "sending us their suppliers as well."

Five years ago Edmonton's Northern Alberta Institute of Technology (NAIT) launched novaNAIT, a onestop shop for industries interested "Each young business is eligible for up to \$8,000. One first year winner was Spently.com." Designed for merchants of any size, Spently's product sends one customer, or 3,000 customers, an electronic receipt, usually by email. A receipt can be either generic, as in "10% off your next purchase," or tightly targeted, "Andrew, this deal is just for you. The next widget you buy from us will be 25% off."

"Spently has moved to the big

the quality of life of Canadians..."

Robinson comments, "If people understood that college-based applied research is done in collaboration with companies to solve their practical problems, then they could stop thinking of college and university research as competing against each other.

"Where that collaboration is able to happen, it's working wonderfully," she adds. "A recent OECD report ranked Canada as one of the highest investing countries in upstream ideas-generation, but we don't do enough to link applied research and industry." In September, that report, Science and Innovation: Canada, condensed that

What about funding? "At national level, the federal government certainly sees value unfolding, and colleges are expanding capacity in several ways," adds Dryden.

Here's one example of what has been done: the nine members of Polytechnics Canada conducted \$33.1 million of sponsored research in fiscal 2010/11. In fiscal 2011/12 that figure rose to \$44.2 million, up about one quarter in a single year. That figure from just nine colleges is larger than the total amount distributed by NSERC's CCIP program. Now, if governments were to prime the college pump a little more, what might be possible across this land?



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# COLLEGES AND SMEs Getting Innovations Out the Door



James Knight President & CEO Association of Canadian Community Colleges

timulating innovation in Canada's small and medium enterprises (SMEs) will do more than any other measure to improve productivity and create jobs. SMEs constitute 98% of Canadian companies and employ 60% of working Canadians, but they often lack the expertise and resources needed to innovate and compete in the global marketplace.

They turn to their local college, institute of technology, cégep and polytechnic for support. These institutions have the expertise, the equipment and the eager young minds to help with product and process innovation, technological improvements, marketing, business planning and growing the pool of highly skilled professionals SMEs need. With 1000 campuses, colleges are accessible in all parts of Canada. In 2010-11, 4,444 private companies, primarily SMEs, partnered with colleges on applied research projects.

According to the OECD Economic Surveys: Canada 2012, "colleges are becoming proactive in directly meeting the needs of small businesses in areas of problem solving, process innovation and technical skills, even though they benefit from little taxpayer support via the granting councils". <sup>1</sup>

The Government of Canada has begun to recognize the contribution of colleges to Canada's innovation eco-system. The College and Community Innovation Program administered by the National Sciences and Engineering Research Council provides funding for college based applied research partnerships, and the Canada Foundation for Innovation provides resources for scientific and industrial equipment, both on a competitive basis.

These investments generate powerful outcomes, but constitute only 1.25% of the \$2.9 billion invested annually by the Government of Canada in research carried out institutions of higher education. Further investment to support collegeindustry partnerships, increasing this amount over time to 5%, would enhance Canada's productivity and competitiveness while creating new jobs.

According to the Canadian Chamber of Commerce, skills and human resourc-

es shortages comprise the single largest factor constraining the business growth. The Canadian Federation of Independent Business reports that where there are skills shortages, four college graduates are required for every university graduate. Applied research is a critical component of education in colleges. Students work with employers to find solutions to real-world challenges. These handson experiences produce graduates with highly valued problem solving and innovation skills.

Colleges are growing institutional research infrastructure to create more opportunities for faculty and students, to strengthen partnerships with industry and community organizations, and to build research networks at the regional and national levels.

SMEs report that research partnerships with colleges have stimulated new and improved products and services, enhanced their company's profile and generated market opportunities.

SMEs gain access to state of the art equipment, facilities and highly skilled faculty and students that they could not otherwise afford. Increased revenue resulting from these partnerships enables SMEs to create jobs and to stimulate local and regional economies.

# What our partners are saying about us...

"Manitoba winter conditions can be problematic for many conventional vehicles. (...) The novel nature of plug-in hybrid electric vehicles (PHEVs) made cold-weather operation and cabin warmth a specific concern. (...) The cold-weather improvements undertaken at Red River College turned out to be a critical success factor for the Manitoba PHEV demonstration. Without these modifications, vehicle failures and reduced performance would have resulted".

Centre for Emerging Renewable Energy, Inc., Manitoba

"The resources at Durham College's disposal are invaluable to a business of our type. Without... the wonderful staff... we would have been greatly hampered in our efforts to take this product to market. It is a great feeling knowing that the resources are out there and others are genuinely concerned and driven to help develop a greener future."

Hotwash Inc., Ontario

"The opportunity to work with the bright students in Sheridan's applied research program was a natural fit for us. We firmly believe that industry has a vested interest in shaping the future workforce. By leveraging the fresh insight from a younger generation, like those at Sheridan College, PharmaTrust can continue to produce innovative technology, and maintain leadership in patient-focused healthcare."

Patient Care Automation Services, parent company of **PharmaTrust**, Ontario

"We have a great working relationship! The staff at the Office of Applied Research at the College of North Atlantic took a high interest in our project, showing enthusiasm and helping to enhance our process for creating our new product, the Fresh FryTM. (...) They were very accommodating to supply needed equipment, and understood our requirements for product development."

Humber Valley Potato Company, Newfoundland and Labrador

"Lakeland College was a phenomenal partner (...) providing resources, man-hours, equipment, technical support and exposure. They also added credibility to the project. Our town, the community, our businesses and families have all benefited from the partnership..."

Town of Elk Point, Alberta

sa



### Humber offers applied research for growth and development in Ontario



Taking action. Humber faculty, Craig Crane and Marcin Kedzior, along with industry partner PROBUILT, and Humber students, work on the Dream Home R-House. The design and build of the Dream Home for the 2011 National Home Show led to research in net zero energy design.

#### humber.ca/research

# Turn your ideas 2 into solutions

Innovation, creativity and collaboration are vital to our economy, and to our community. Centennial's Applied Research and Innovation Centre catalyzes and accelerates business productivity and competitiveness. Find out how we can help your company grow – visit centennialcollege.ca/applied

<sup>&</sup>lt;sup>1</sup> OECD Economic Surveys: Canada 2012, Organization for Economic Co-Operation and Development, page 79



# **POLYTECHNIC APPLIED RESEARCH:** OPEN FOR BUSINESS INNOVATION



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

anada's polytechnics and colleges offer industry-facing applied research solutions that fill gaps in the country's R&D pipelines. Our focus on applied research, innovation and commercialization supports industry innovation needs in ways that are complementary to established, discovery-based research institutions. This is a strength, and a necessary facet of a healthy R&D continuum.

Since 2008, the institutions that comprise Polytechnics Canada (BCIT, SAIT Polytechnic, NAIT, Conestoga, Sheridan, Humber, Seneca, George Brown and Algonquin Colleges) have worked with 3,759 Canadian companies, 95% of which are small and mid-sized enterprises, conducted 2,481 applied research projects solving industry-identified problems, involved 22,515 college students and 1,978 college staff or faculty in applied research activity, and developed 948 prototypes for their industry research partners. Colleges across the country are involved in similar activity, as Canada initiates investment in college applied research as a vital lever in the R&D toolkit.

The breadth of industry partnerships that polytechnic and college applied research enables was noted in the recent Council of Canadian Academies Expert Panel Report on "The State of Science and Technology in Canada, 2012." The report shows that as a country we excel in many fields of research, and punch above our weight in terms of publications and international research influence. However, we fall short of unlocking the potential commercial value of the outcomes of basic research. In addition, Canadian businesses perform much less R&D as compared with our international counterparts. Our collective historical identity as "hewers of wood and drawers of water" has meant that ideas are just another basic resource that we draw from the land and export without adding value. Our competitors are exploiting our research to their commercial advantage. Polytechnics and colleges focus

on speed to market and engaging our students in industry innovation. We offer industry and universities alike four key advantages:

• Access to talent - our faculty who are industry professionals, and our students. By engaging our students in applied research we train the highly qualified and skilled people needed for the innovation economy, who gain crucial innovation skills as part of their applied education.

· Access to state-of-the-art facilities - our industry-focused teaching facilities double as applied research labs for companies or scientists who do not have equipment or need help making a prototype or product.

· Access to markets and networks we leverage our close ties to industry to help our research partners develop products and sales.

• Access to capital - government funding provides matching capital for companies to engage in innovation partnerships, creating economies of scale for firms with ideas but lacking in-house R&D capacity.

The 2007 federal Science and Technology Strategy gave impetus to college applied research capacity through the creation of the College and Community Innovation Program. Yet, the CCIP is the only federal program for polytechnic and college applied research. It is underfunded as compared to demand: we currently turn companies away both for lack of funding and capacity, limiting our ability to be "open for business innovation."

Firms in Canada are not yet making effective use of the postsecondary research facilities we have, but this is changing. Polytechnic and college applied research can play a more robust role in strengthening national and regional capacity to innovate. We work with research centres and industry partners to enhance competitiveness in the sectors we serve. Our applied research centres offer services to industry that are not currently



Canada needs to encourage industry-academic partnerships and have each party play to their strengths, be this basic research, applied research, or industry focused innovation. We need a better balance between the input and output sides of the innovation equation. Broadening the potential outputs for R&D by supporting applied research will foster increased productivity, enable Canada to realign R&D expenditure imbalances, and correct our longstanding poor record on industrial innovation.

There is work to be done by the polytechnic and college sectors in continuing to build the applied research capacity while finding better ways to measure outcomes. This requires us to focus on outputs and on collaborative data gathering to show the return on the (modest) CCIP investment. We would do well to encourage greater linkages among university, polytechnic and college research institutions, and greater industry-academic partnerships overall, building a true innovation system that plays to the strengths of all its parts. By working together, we can increase Canada's global competitiveness.

Dr. Robert Luke is AVP, Research and Innovation, George Brown College, and Chair, Polytechnics Canada Research Group. He served as a member of the Council of Canadian Academies Expert Panel on Science and Technology in Canada, 2012.



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A TOWES staff member, Alisa partnered with the Vermillion Energy/YWCA Skills Training Centre to conduct an in-depth essential skills case study using the TOWES (Test of Workplace Essential Skills) tools.

TOWES is a shining example of how applied research can be commercialized and used nationally. From its humble beginnings as a Bow Valley College applied research project, it now has more than 43 distributors across Canada and 70,000+ test cases to quantify the important role of essential skills in all workplaces.



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### **New Partnership Models**

*Continued from page 7* 

program. The HEAR (High Erucic Acid Rapeseed) chair is an example of how fundamental research can lead to new commercial products," says Dr. Digvir Jayas, V.P. Research at the University of Manitoba.

Jayas suggests a more liberalized approach to data sharing and intellectual property (IP) management can lead to even more success. He is exploring a new model that would allow industry to lead IP commercialization and pay royalties based on sales, rather than selling the technology upfront.

other ways. It recently partnered with the Kauffman Foundation to offer a new support program for INRS professors and students that provides technology entrepreneurs with the tools and skills needed to start their own company.

#### New Approaches to **Drug Discovery**

Pharmaceutical companies have other reasons for embracing new models of collaboration and investment. The rising costs and longer timelines associated with turning a

#### •• The biggest obstacle to industry-academic collaboration is communication. <sup>99</sup>

David Hill, Scientific Director, Lawson Health Research Institute

"It's hard to negotiate something when you don't know what it will be worth eventually. Inevitably, universities will think it's worth more than the company. It's one of the reasons these negotiations take longer than they should," says Jayas.

Similar out-of-the-box thinking is happening at the University of Quebec's National Institute of Scientific Research (INRS) where companies may donate to the institution's foundation in lieu of paying royalties or licensing fees.

"Too often, universities will spend more money protecting their IP than they will eventually get from royalties," says INRS Director General Dr. Daniel Coderre. "We're putting in place an approach that would allow us to transfer IP faster and at a lower cost, and in return we think it will generate more contracts and more donations to our foundation."

INRS is supporting industry in

promising molecule into a regulatory-approved drug has given birth to a mixed model for drug discovery, with big pharma partnering more with university-based drug discovery groups to take early research to

a more advanced stage. In 2010, Merck Canada committed to invest \$100 million over the next five years in Quebec-based academic institutions and companies. Half the money will be used as venture capital for early-stage biopharmaceutical start-ups. A significant amount of the remaining \$50 million will go to major academic research centres and industryacademic consortia in Quebec.

Merck has already invested \$6 million in the Quebec Consortium for Drug Discovery (CQDM) and \$6.8 million in AmorChem, a life sciences venture capital fund. In collaboration with Lumira Capital, Teralys Capital and other partners,

Merck announced in March of this year a \$35-million investment in the Merck Lumira Biosciences Fund, to support early stage life science innovation in Québec.

At CQDM, companies set the research direction, decide which projects get funded and have nonexclusive first rights to license any new technologies. A mentor from each company also works with academic researchers to ensure projects align with industry needs.

"The mentorship is important," says Jennifer Chan, V.P. for Policy and Communications at Merck Canada. "It provides an opportunity for pharma to provide their subject matter expertise and for academic researchers to benefit from this shared knowledge."

Further announcements are pending this fall. "The next phase of our investment commitment will look at partnerships with the major academic research centres in Quebec," says Chan.

Another paradigm shift has been the exodus of clinical trials from North America to low-cost countries. It's driving Canadian hospitals to come up with creative ways to compete.

"We used to compete with two private companies in Sherbrooke for clinical research contracts," explains Dr. Serge Marchand, the Scientific Director at Sherbrooke's university hospital (CHUS). "I sat down with these companies and we saw that we could attract more trials by joining forces. We now have a big pharma company that is interested in collaborating with us."

In May, the partners launched a web portal that provides both pharma companies and patients with an online window to clinical research in Quebec's Eastern Townships. People with lower back pain, for example, can register their interest in participating in a trial, and a company can see how many people are available for a study.

CHUS also collaborates with research centres across the province to compete globally for multi-centre clinical trials. "We can pull everything together and recruit patients in Montreal, Québec, Sherbrooke and elsewhere in the province for larger, integrated clinical trials."

Some trials are initiated by industry; others by hospital investigators. Then there are companies like GlaxoSmithKline which invite scientists to submit ideas that align with the company's research priorities. In all cases, it's important to involve industry partners early in the process, insists Dr. David Hill, Scientific Director, Lawson Health Research Institute in London Ont.

"It's a way for us to insert our ideas into the company's R&D plan," he explains. "It may be an alternative use for an existing drug or an underserved population the company hasn't had the time or intention to focus on - adult drugs prescribed off label to children are a classic example."

Lawson also conducts joint R&D with industry. One of its more notable successes is an imaging software that colour codes the speed of blood. It can be found in every CT scanner that General Electric sells globally, generating about \$1 million annually in royalties for the hospital.

"The biggest obstacle to industry-academic collaboration is communication," adds Hill. "Recognizing how we can help industry and industry recognizing that there are more ways that hospital research can be useful for them, other than participating in an industry-led trial as a recruitment site."

Dr. Patrick McGrath agrees. The Integrated V.P., Research and Innovation, at the IWK Health Centre and Capital District Health Authority in Halifax, says the declining number of clinical trials across North America combined with the industry's reluctance to fund riskier research means hospitals need to look for new partnership opportunities.

Sometimes that means collaborating with smaller companies. For example, the IWK is conducting a small clinical trial with blueberry growers in Nova Scotia to study whether drinking blueberry juice can slow the progression of macular degeneration, the leading cause of vision loss and blindness.

The IWK Health Centre is also incubating biotech start-up DeNovaMed which will begin clinical trials within two years on a new class of antibiotics to fight drug-resistant superbugs like MRSA.

"Is this a new model when we have their employees working in our facility because they're still in incubator stage? Yes I guess it is," says McGrath. "We collaborate where it makes sense.'

How to Get

conferences and monitor scientific journals to keep abreast of the latest academic research. What caught the attention of one Canadian company was a 2009 paper led by researchers at St. Joseph's Healthcare Hamilton proving how a single test could rapidly and accurately detect 19 different respiratory viruses, including influenza (H1, H3 and B) and the common cold. The tests inventor Dr. James Mahony says hospitals could save up to \$1 million annually if they implemented the test widely. The company is now working with Mahony to further commercialize the technology.

"This company mostly develops standard bacterial culture and antibody tests, but had nothing in molecular testing. We've now been working with them for a year to develop a menu of eight or nine different virus and bacterial tests. We may form a start-up company through McMaster University or the company may set up a new division or an entirely new company," says Mahony, who heads St. Joseph's Virology and Chlamydiology Laboratory.

capital route but that's also difficult these days."

#### **Getting to Know Each Other**

If companies aren't knocking at your university door, try a little speed dating. That's what the University of Victoria had in mind when it launched its Taste of UVic events where faculty members meet with industry representatives to discuss their latest research. It was at last year's event where a major pharmaceutical company learned about a ground breaking technology that isolates genes from Arctic bacteria and then uses them with pathogens to construct bacterial vaccines that reduce the need for antibiotics and diminish the risk of bacterial infection. The discovery has led to a new start-up company and the phama company has licensed the technology for use in a specific field of use.

"We're making a real effort to match the right company with the right professor so we're not wasting anyone's time," explains Brent Sternig, President and CEO, UVic Industry Partnerships.



IWK Health Centre and blueberry growers in Nova Scotia are studying the effects of blueberry juice in slowing the progression of macular degeneration.

Mahony's track record is impressive. In 1988 he developed the first molecular test for Chlamydia trachomatis, a sexually transmitted pathogen. More recently, he developed tests for the SARS, H1N1 and West Nile viruses. His lab also developed techniques that inhibit respiratory viruses from multiplying inside cells, which would give health professionals a powerful weapon in preventing a pandemic virus from spreading.

While developing these technologies is never easier, he says it can be Sternig. an even greater challenge bringing them to market. "Big pharma companies are getting out of the game and waiting for small companies to do the development and animal trials. Then they'll buy the company and move into human trials," says Mahony. "We could go the venture Partnership is the basis for sity of Waterloo is the Southern Ontario Water Consortium (SOWC). innovation, whether in the sphere Announced in 2011 and still in its early stages, SOWC is a massive partnership benefitting from multiple supporters including IBM and the Government of Ontario. SOWC will serve as a platform for waterrelated research and testing, and the development of water and wastewa-

UVic also takes advantage of an NSERC program designed to foster new relationships between companies and academic researchers. ENGAGE grants of \$25,000 enable companies to work with a researcher on six-month projects. Companies aren't required to provide cash up front and they own any resulting IP.

"These projects give industry an opportunity to work with a university to see how that relationship can benefit them, which can open doors to much larger projects," adds

UVic's V.P. Research Dr. Howard Brunt says it represents a new way of doing business with companies. "The days are over when universities tried to hold onto all their IP and then flog it with industry. We need to work with industry to understand what they need and how we can help."

### COLLABORATION **Key to Building Canada's Knowledge-based Economy**



address this gap, and improve our capacity for innovation, is for academia, industry and government to work collaboratively on common research initiatives.

Canadian universities produce a highly talented workforce, not to high-performance computing platforms in the country.

The first round of these university research projects focus on developing innovative, marketable solutions for problems within cities, the healthcare field, and energy and water management systems. In concert, IBM researchers have launched dozens of projects related to high performance and agile computing. Agile computing is an acceleration technology that will dramatically improve computing speeds and efficiency. This will enable our research partners to tackle grand challenges that to-date have been out of reach because the cost of the computing power was prohibitive. The research network will ensure our Canadian researchers a spot at the front of the line. That's just one example of our P3 strategy. This year, we also, together with the Canadian federal government, the Ontario provincial government, and the City of Barrie, invested in a greenfield data centre to help support these ongoing research initiatives, as well as the adoption of other innovative technologies such as cloud computing, advanced virtualization and energy management. Also this year, we partnered with the Government of Quebec, the Université de Sherbrooke, the City of Bromont and Teledyne (Dalsa) to open a centre of excellence for innovation in the micro electronics field. This research facility will stimulate and accelerate the commercialization of new electronic microchips and microelectro-mechanical systems. IBM undertook these three significant investments to foster more knowledge-based industries, improve competitiveness and advance this country's innovation legacy. More importantly, we've done so in lockstep with all levels of government as well as academic partners because we believe this is one of the best ways to ensure Canada remains "open for business."

John Lutz President IBM Canada

ccording to the World Economic Forum, which nnually studies and benchmarks factors underpinning the national competitiveness of more than 100 global economies, Canada is continuing to lose ground. This year, for instance, they downgraded Canada by two notches, compared to the previous ranking, placing us 14th overall.

Some would argue 14th out of a field of 144 isn't bad. And we score good marks for our "highly efficient markets", "well-functioning and transparent institutions" and "excellent infrastructure." But what's concerning is the report's finding 'insufficient capacity to innovate" is one of the most problematic factors for doing business in this country.

At IBM, we've always believed continued investment in research and development is an important driver for Canada's competitiveness and future growth. We've been innovating locally for more than 100 years, and rank among Canada's top five private R&D investors for the past five years. Last year alone, we invested more than \$500 million into research activities on Canadian soil, part of the \$6 billion we spent globally on R&D.

But we're also cognizant of the fact there is an innovation gap in this country, one that falls between research and commercialization. We believe one of the best ways to

mention solid research and some of the best breakthrough ideas. Industry has the mindset and know-how to take new ideas and commercialize them. All levels of governments have at their core a mandate focused on job creation, economic growth and long-term prosperity, and funding to support that.

Combine this trio of complementary agendas and we have the ability not only to change the research climate in Canada, but to deepen and strengthen our knowledge-based economy. We must start seeing universities, industry and government as part of the same research continuum.

Now is a particularly opportune time to do this. Today, organizations are operating in a world of accelerating complexity and massively available information. Sensors embedded in devices, online transactions, social media interactions and a myriad of other activities collectively generate 2.5 quintillion bytes of information every day, and we are only at the beginning of this explosive growth of 'big data."

Concurrently, we're seeing the rise of intelligent computer systems that can learn, mine and analyze these enormous data sets, revealing insights from what has to this point only been information. This lucky confluence of events is providing researchers with an unprecedented opportunity to develop answers to solve some of the world's biggest challenges.

In fact, this is precisely the goal of a research and development network we announced in April 2012, with the Governments of Canada and Ontario, and a consortium of seven Ontario universities and the Ontario Centres of Excellence. It will help build home-grown software and engineering skills to accelerate the commercialization of Canadianled research and development, and link some of our universities' top researchers to one of the fastest

Collaborative research that creates bridges so smart people can work directly with other smart people is the key to moving "Made in Canada" innovation out of the labs into commercialization, and then exporting it onto the world economic stage.

#### Industry's Attention

Companies often attend scientific

#### Novel **Approaches** Continued from page 4

named after benefactor RBJ Schlegel Holdings Inc. and uWaterloo. RIA is actively improving the care prospects for older adults in community-based and long-term care environments. In combines philanthropic vision and resources with university research, college skills development and public funding for innovation.

Another major collaborative effort spearheaded by the Univer-

### **Opening Organizations** to **Business**

Continued from page 5

really big potential pay-offs for Canada while others will be smaller and target regional or industry specific agendas. All must pass through our new design, funding and decision process and receive financial commitments from partners. NRC programs will be market-oriented and collaborative, built around a sound understanding of industry value chains; with clear technology deployment paths identified.

NRC programs will be managed through a series of stage-gates before and after launch. At each successive gate, activities will be assessed with increasing rigour on their value proposition, business case, benefit to Canada and return on investment. After being launched, progress against planned budgets, schedules, targets and milestones will be regularly assessed to ensure they contribute to moving Canada to a higher level of innovation perforter technologies. Aging and water resource management are key local - and international - issues. Collaborative partnerships ensure a well-rounded approach to applied research and problem-solving.

of commerce or in creating solutions to major public challenges - and universities are uniquely well-positioned to convene partnerships. Universities have the freedom of inquiry, the community relationships, the research ability and the commercialization potential to generate economic activity while actively supporting the health and welfare of their local communities.

Universities, businesses and communities are stronger together than we are apart.

can only occur by winning industry contracts away from university labs. That may happen occasionally, but industry goes where they get what they need. Sometimes that is university labs, sometimes government labs like NRC and sometimes elsewhere.

An effective innovation business requires Effective and efficient business processes. So NRC has also been rebuilding finance and accounting, program management (investment oversight - capital and operating), project management, CTE performance management (providing the "tools" to manage) and client management systems.

To conclude - NRC has embarked on a major transformation that will set the stage for the next two or three decades. The transformation will see us move from an - academic, science push and largely government approach - to one that is much more business-like, focused on pull-based innovation outcomes and benefit to Canada. NRC is opening its doors to business on terms business can understand.

#### mance and increased industry participation. With this new framework in place, NRC is well equipped to respond to the regularly changing needs of Canadian industry.

We also intend to link our IRAP capabilities much more intimately into our R&D business. IRAP has a rich understanding of industry across the country that will be used to help us in program design. They will also provide up-front linkages to markets for deployment and value chain development.

NRC intends to increase the share of costs carried by the private sector, especially in areas close to market such as testing, certification and problem solving. As we shift to more client-focused, demand-driven research, NRC also expects revenues from external sources to rise significantly. Some people have suggested that growing private sector revenues at NRC

#### Continued from page 16

in R&D spending last year and breaks a 5-year string of R&D declines. Revenues improved even more strongly than R&D among the 92 companies that provided revenue data, rising by 10.4% year-over-year.

Research In Motion Limited retained its hold on first place in the national ranking, spending over \$1.5 billion on R&D, a 10.8% improvement. Bombardier Inc. jumped 8 positions in the ranking with a 27.0% increase and total spending of over \$1.3 billion.

Research intensity - R&D spending divided by revenues - was 2.7% in Fiscal 2011 (for the 92 Top 100 firms that provided revenue data), which was a decline of -3.5% from the previous year. Faster growth in revenues than in R&D spending accounted for the drop.

In Fiscal 2011, 63 companies posted increases in their research spending compared with 35 firms where spending dropped. (R&D spending was flat at 2 other companies.) This compares with only 48 firms that increased their R&D spending last year.

#### THE \$100 MILLION CLUB

Each year RE\$EARCH Infosource highlights the companies in its \$100 Million Club – an elite group of firms that spend \$100 million or more annually on R&D. In

The \$100 Million Club						
2011 Rank	Company	Industry				
1	Research In Motion	Comm/Telecom Equipment				
2	Bombardier	Aerospace				
3	BCE	Telecommunications Services				
4	Magna International	Automotive				
5	IBM Canada (fs)	Software & Computer Services				
6	Pratt & Whitney Canada (fs)	Aerospace				
7	Atomic Energy of Canada	Engineering Services				
8	Ericsson Canada (fs)	Comm/Telecom Equipment				
9	AMD Canada (fs)	Electronic Systems & Parts				
10	Alcatel-Lucent (fs)	Comm/Telecom Equipment				
11	Cenovus Energy	Energy/Oil & Gas				
12	TELUS	Telecommunications Services				
13	Apotex	Pharmaceuticals/Biotechnology				
14	Imperial Oil	Energy/Oil & Gas				
15	Sanofi (fs) <sup>(a)</sup>	Pharmaceuticals/Biotechnology				
16	Open Text	Software & Computer Services				
17	Ontario Power Generation	Electrical Power & Utilities				
18	GlaxoSmithKline Canada (fs)	Pharmaceuticals/Biotechnology				
19	CAE	Aerospace				
20	Pfizer Canada (fs)	Pharmaceuticals/Biotechnology				
21	Rogers Communications	Telecommunications Services				
21	Vale Canada (fs)	Mining & Metals				
23	Constellation Software	Software & Computer Services				
24	Hydro-Québec	Electrical Power & Utilities				
fs = Foreign subsidiary (includes R&D spending for Canadian operations only) (a) Includes Sanofi Canada and Sanofi Pasteur Limited						

Fiscal 2011, 24 firms gained Club status, compared with 23 firms last year. Fifteen members were Canadian companies and 9 were foreign subsidiaries. New to the Club this year were Vale Canada, Constellation Software and Cenovus Energy.

Total Club spending on research was \$8.14 billion, a rise of 7.2%, which was better than the 6.1% allcompany increase and much better than the combined 2.9% R&D spending increase for non-Club firms.

Reflecting the importance of larger R&D performers, the \$100 Million Club members accounted for 74% of total Top 100 R&D spending in Fiscal 2011.

Once again, companies in the ICT (information and communications technology) sector dominated the \$100 Million Club.

#### **INDUSTRY PERFORMANCE**

In Fiscal 2011, 13 Top 100 performers in the Communications/Telecom Equipment sector spent a total of nearly \$2.48 billion on research and development, accounting for 23% of the total. However, 5 Aerospace firms were not far behind, spending a total of \$2.01 billion or 18% of Top 100 R&D spending. Twenty-one Pharmaceuticals/Biotechnology firms spent a total of \$1.27 billion, accounting for 12% of the total R&D spending, down from 13% of the total in Fiscal 2010,

> which represented a significant -8.3% spending drop from the previous year. All ICT sectors combined accounted for 46 of the Top 100 total, which indicates the importance of the sector in gauging overall Canada's R&D performance.

#### THE TOP 10 R&D **INTENSIVE FIRMS**

In Fiscal 2011, 5 of the 10 most researchintensive firms - companies that spent a high proportion of revenues on R&D - were in the Pharmaceuticals/Biotechnology sector. This is down from 7 such firms in 2010, which reflects the softness in this sector.

#### **GAINERS AND LOSERS**

The 10 leading firms in R&D spending growth in Fiscal 2011 all increased their spending by 55.0% or more. The largest gainer was Celestica, which recorded a 341.7% gain in R&D spending. Martinrea International posted an impressive increase of 225.7% in its spending, followed by Canadian Solar (178.4%), Neo Material Technologies (135.6%) and Dorel Industries (127.2%).

A number of established companies led the list of firms where R&D spending dropped substantially in Fiscal 2011. This group included Merck (-66.7%), BCE (-30.7%) and GlaxoSmithKline Canada (-26.6%).

#### LOOKING AHEAD

The 2012 Top 100 Corporate R&D Spenders List comes as a pleasant surprise, with spending jumping by 6.1% in total, breaking a moribund 5-year cycle. R&D spending growth was propelled by an overall 10.4% increase in revenues, which was the highest rate of revenue growth we have recorded since Fiscal 2008. However, the industry sector data reveal a worrying drop in R&D spending in the Pharmaceuticals/Biotechnology and Telecommunications Services sectors. Had those sectors' R&D spending not dropped the overall Top 100 result would have been even better.

The positive 2012 result reflects the situation faced by many companies in Fiscal 2011, a year which saw corporate revenues and profits hold up quite well in the face of deteriorating global economic dynamics. Undoubtedly, the strength of the Canadian dollar also gave some momentum to R&D spending. However, stripping out the results for the 24 largest R&D performers a more cautionary tale emerges. R&D spending by the other 76 firms on the list expanded by only 2.9%, a far more modest result.

The 2012 list was enhanced by strong spending growth at Research In Motion and Bombardier. Since posting its data RIM's fortunes have turned and cost saving has been the order of the day. This implies that RIM's results next year will be pressed to match Fiscal 2011. Bombardier is investing heavily to develop its new C-Series aircraft, which accounts for much of its 27.0% spending increase. At some point that spending will also come off the boil. These examples indicate that a great deal of corporate R&D spending is opportunitydriven and episodic, which from a company standpoint is rational, but which adds volatility to the data on national research performance.

The Spring 2012 federal budget made some substantial changes to Canada's premier corporate R&D support program, the Scientific Research and Experimental Development tax incentives. (A considerable amount of provincial government support is also linked to SR&ED.) The impact of the changes will be

#### **Top 10 Companies by Growth** 2011 Rank R&D % Change Growth Overall Company 2010-2011 1 95 Celestica Martinrea International 68

3	80	Canadian Solar	178.4	
4	64	Neo Material Technologies	135.6	
5	57	Dorel Industries	127.2	
6	71	Oncolytics Biotech	91.8	
7	54	Trican Well Service	86.0	
8	38	Aptalis Pharma (fs)	75.6	
9	21	Vale Canada (fs)	62.7	
10	59	Total E&P Canada (fs)	55.0	
fs = Foreign subsidiary (includes R&D spending for Canadian operations only)				

341.7

225.7

#### Top 100 – Leading Industries

R&I Industry (	D Spending % of Total)
Communications/Telecom Equipment (13)	23
Aerospace (5)	18
Pharmaceuticals/Biotechnology (21)	12
Software & Computer Services (12)	9
Telecommunications Services (4)	8
Automotive (4)	6
Energy/Oil & Gas (8)	6
Electronic Systems & Parts (8)	5

Top 10 Research Intensive Companies*					
2011 Research Intensity	Rank Overall	Company	R&D as % of Revenue		
1	87	Cardiome Pharma	1,011.3		
2	78	Tekmira Pharmaceuticals	119.7		
3	45	QLT	103.1		
4	7	Atomic Energy of Canada	87.0		
5	69	AEterna Zentaris	69.1		
6	30	PMC-Sierra (fs)	63.7		
7	79	Bioniche Life Sciences	54.9		
8	70	DragonWave	52.6		
9	89	NexJ Systems	47.4		
10	58	Sandvine	35.3		
Based on companies with \$1 million or more of revenue only fs = Foreign subsidiary (includes R&D spending for Canadian operations only)					

to diminish support for companies' R&D capital and overhead expenses starting this year. If these changes turn out to be a large influence on firms' research performance, then we would expect the positive Fiscal 2011 result to revert to trend - i.e. anaemic performance. So the big question is "Was Fiscal 2011 an anomaly or a signpost to the future"? We will find out next year.

Bottom 10 Companies by Growth					
2011 R&D Crowth	Rank	Company	% Change		
urowin	Overall	Company	2010-2011		
1	66	Merck (fs)	-66.7		
2	3	BCE	-30.7		
3	18	GlaxoSmithKline Canada (	fs) -26.6		
4	77	Resolute Forest Products (f	s) -25.4		
5	20	Pfizer Canada (fs)	-22.0		
6	50	EnCana	-20.6		
7	83	Teck Resources	-19.0		
8	75	Xerox Canada (fs)	-18.7		
9	40	AstraZeneca Canada (fs)	-16.1		
10	94	Hydro One	-15.0		
fs = Foreign subsidiary (includes R&D spending for Canadian operations only)					

## **MOVING BEYOND** THE R&D 'BENCH'



100 Corporate Research & Development Spenders. Our research facility in Burnaby, BC represents a robust and ongoing investment in the life sciences industry with many of Amgen's proprietary research innovations having been developed or invented there. However, in terms of healthcare, research and development is just a stepping stone. The bigger challenge is translating this research into innovative new medicines and ensuring these medicines get into the hands of Canadians. Canada's approach to assessing the value of healthcare innovation is causing us to fall behind the rest of the world, particularly when it comes to access by patients to new therapies. We need to improve the delivery of innovative medicines to the patients who need them. So, while much research and development or 'bench' work – is taking place in Canada, we stumble when bringing that medication to the patient or 'bedside'. According to Wyatt Health Management's Rx&D International Report on Access to Medicines, 2010-2011, Canada ranked 31 out of 32 OECD countries when it came to the number of firstin-class drugs recommended for inclusion in the country's various public drug plans, with a listing average of 38 per cent on public drug plan formularies in Canada. On average, 81.4 per cent of first-in-class drugs are listed in the other OECD countries. As a nation, we rank far behind other countries in the proportion of new drugs recommended for coverage in 13 out of 15 disease areas. However, as Governments struggle to contain healthcare costs, they are continually looking for ways to measure the cost of new therapies against the anticipated benefit. For example, benefits such as the economic impact of a new medicine that allows someone to

million annually - and, in 2011, return to work sooner or reduces was named one of Canada's Top the burden on caregivers in the household are not counted because they fall outside the health system. This means that patient convenience, workplace productivity and the burden on family members - which have material and measurable societal and economic benefits – aren't considered in the assessment of a medication's value. In considering this, our current drug evaluation process seems overly simplistic, and negates the wider societal benefits of new healthcare technologies that may ultimately lead to improved patient outcomes and overall health. In moving beyond drug discovery and taking a lead in ensuring innovative medicines reach and benefit patients, we need to look at new models based on collaboration; ones that take into account broader multiple factors, such as the level of innovation, societal benefits, the severity of the disease and unmet needs. Revitalizing our approach to assessing the value of medicine is a shared responsibility and requires collective action. There is tremendous opportunity to build trust and better outcomes by working more closely with Government and academic institutions, fostering better partnerships both at the clinical and patient level, and mutual understanding of the constraints and needs of different stakeholders in the drug review process. Amgen Canada is committed to bringing diverse points of view to Canadians and starting a broad public discussion in an effort to foster change, which is why we sponsor PolicyMatters.ca, an online forum for health system leaders and stakeholders to discuss and debate topics in Canadian health policy. By working more effectively together, Canada can build a successful model that moves important, innovative medicines faster and more safely from bench to bedside.

### R&D. Is in our DNA.

Developing one of Canada's most

Dr. Clive Ward-Able Executive Director, Research and Development Amgen Canada Inc.

n a highly competitive global market, research and development is a crucial element in driving innovation and success. Even the Government of Canada recognizes this, having invested more than \$800 million in initiatives aimed at encouraging research that will build a competitive economy for Canada. So why is it, then, that with all this investment, there seems to be so little emphasis placed on ensuring this great research gets into the hands of Canadians, whether it's a new product, device or medicine?

Let's look at the healthcare sector. We know that Canada is often recognized for its high standards in research and development. We have state-of-the-art public sector research facilities and are wellknown for our research Centres of Excellence. These high standards lead many healthcare companies to invest heavily in the Canadian research and development (R&D) sector by operating research facilities and conducting clinical trials here.

Amgen Canada is one such company, investing a significant amount in R&D in Canada - around \$60

significant natural resources is a huge responsibility—and one that we take seriously. Counted among Canada's top 50 corporate R&D spenders, our focus is on developing the oil sands in ways that create economic value for Canadians and limit our impact on the environment. That's why Syncrude has been an industry leader from the beginning-innovating in all areas of oil sands development.

For continued updates on our commitment to responsible development, sign up for our e-newsletter at syncrude.ca





NOVEMBER 2, 2012

### CANADA'S TOP JRPORAT Έ **R&D SPENDERS**

# Canada's Corporate

PREPARED BY RE\$EARCH INFOSOURCE INC., AN IMPACT GROUP COMPANY

R&D SPENDING JUMPS — Canada's Top 100 Corporate R&D Spenders posted a surprising 6.1% increase in their combined spending on research and development in Fiscal 2011. This counters a severe -9.4% decline

### Canada's Top 100 Corporate R&D Spenders 2012



**RE\$EARCH** Infosource Inc.









Rank			R&D Spending			Revenue	Research Intensity	
			EV2011	EX2010	% Change	EV2011	R&D as	
2011	2010	Company	\$000	\$000	2010-	\$000	Revenue***	Industry
1	1	Research In Motion Limited* ++	\$1,542,007 \$1,336,274	\$1,391,395 \$1,052,558	10.8	\$18,234,059 \$18,147,018	8.5 7 4	Comm/Telecom Equipment
2 3	2	BORDardier Inc." BCE Inc.	\$569,100	\$1,032,338 \$821,000	-30.7	\$18,147,018 \$19,497,000	7.4 2.9	Telecommunications Services
4 5	5 3	Magna International Inc.* IBM Canada Ltd. (fs)	\$519,278 \$500,000	\$463,455 \$551,100	12.0 -9.3	\$28,434,647 nd	1.8	Automotive Software & Computer Services
6	6	Pratt & Whitney Canada Corp. (fs)	\$473,000	\$395,000	19.7	\$2,730,000	17.3	Aerospace
/ 8	4 7	Ericsson Canada Inc. (fs)	\$441,900 \$323,000	\$476,400 \$353,000	-7.2 -8.5	\$308,013	87.0 30.6	Comm/Telecom Equipment
9 10	8 9	AMD Canada (fs) Alcatel-Lucent (fs)	\$283,255 \$237,000	\$241,694 \$233.000	17.2 1.7	nd nd		Electronic Systems & Parts Comm/Telecom Equipment
11	16	Cenovus Energy Inc.	\$200,000	\$135,000	48.1	\$15,696,000	1.3	Energy/Oil & Gas
12 13	16	Apotex Inc.	\$183,000 \$174,003	\$124,000 \$178,852	47.6 -2.7	\$10,397,000 \$1,316,637	1.8 13.2	Pharmaceuticals/Biotechnology
14 15	21 12	Imperial Oil Limited Sanofi (fs) (ª)	\$163,000 \$151,695	\$107,000 \$159,182	52.3 -4 7	\$30,474,000 \$563,296	0.5 26.9	Energy/Oil & Gas Pharmaceuticals/Biotechnology
16	14	Open Text Corporation*	\$144,401	\$133,246	8.4	\$1,022,040	14.1	Software & Computer Services
17 18	15	GlaxoSmithKline Canada (fs)	\$125,000 \$118,433	\$127,000 \$161,315	-1.6 -26.6	\$5,061,000 \$990,498	2.5 12.0	Pharmaceuticals/Biotechnology
19 20	19 13	CAE Inc. Pfizer Canada Inc. (fs)	\$117,042 \$113 544	\$116,951 \$145,488	0.1 -22.0	\$1,629,000 \$1,477,702	7.2 7 7	Aerospace Pharmaceuticals/Biotechnology
21	16	Rogers Communications Inc.	\$109,000	\$127,000	-14.2	\$12,428,000	0.9	Telecommunications Services
21 23	35 25	Vale Canada Limited (15) Constellation Software Inc.*	\$109,000 \$107,645	\$67,000 \$91,282	62.7 17.9	\$8,043,000 \$764,912	1.4 14.1	Software & Computer Services
24 25	22	Hydro-Québec General Motors of Canada Limited* (fs)	\$100,000 \$96,932	\$100,000 \$77 448	0.0 25.2	\$12,392,000 nd	0.8	Electrical Power & Utilities
26	30	Syncrude Canada Ltd.	\$92,030	\$74,010	24.3	nd	15.0	Energy/Oil & Gas
27 28	24 23	Sierra Wireless, Inc.* Novartis Pharmaceuticals Canada Inc.* (fs)	\$90,523 \$90,008	\$92,861 \$98,000	-2.5 -8.2	\$571,883 nd	15.8	Comm/Telecom Equipment Pharmaceuticals/Biotechnology
29 30	29 26	CGI Group Inc. PMC-Sierra Ltd * (fs)	\$86,000 \$84 997	\$75,000 \$80,928	14.7 5 0	\$4,323,237 \$133 522	2.0 63.7	Software & Computer Services
31	32	Suncor Energy Inc.	\$84,000	\$72,000	16.7	\$39,337,000	0.2	Energy/Oil & Gas
32 33	28 34	boenringer ingeineim (Canada) Ltd./Ltée. (fs) Honeywell Canada (fs)	\$75,258 \$70,132	\$75,518 \$68,521	-0.3 2.4	\$484,164 \$1,133,129	6.2	Aerospace
34 35	38 31	MacDonald, Dettwiler and Associates Ltd.	\$68,563 \$65,760	\$60,157 \$72,968	14.0 -9.9	\$761,117 \$692,994	9.0 9.5	Software & Computer Services
36	37	Amgen Canada Inc. (fs)	\$65,186	\$65,851	-1.0	nd	2.5	Pharmaceuticals/Biotechnology
37 38	33 55	Valeant Pharmaceuticals International, Inc.* Aptalis Pharma Inc.* (fs)	\$64,971 \$57,359	\$70,353 \$32,663	-7.6 75.6	\$2,436,598 \$465,257	2.7 12.3	Pharmaceuticals/Biotechnology Pharmaceuticals/Biotechnology
39 40	41 36	EXFO Inc.*	\$56,602 \$55,258	\$45,883 \$65,900	23.4	\$266,803 \$1,570,904	21.2	Medical Devices & Instrumentation
41	42	Janssen Inc. (fs)	\$55,204	\$44,541	23.9	\$883,378	6.2	Pharmaceuticals/Biotechnology
42 43	50 39	Linamar Corporation Mitel Networks Corporation*	\$54,//1 \$53,510	\$36,142 \$53,246	51.5 0.5	\$2,861,445 \$642,618	1.9 8.3	Automotive Comm/Telecom Equipment
44 45	53 54	SMART Technologies Inc.*	\$52,451 \$43,058	\$34,585 \$34,486	51.7 24 9	\$781,443 \$41,768	6.7 103 1	Computer Equipment
46	44	Teledyne DALSA, Inc.* (fs)	\$42,924	\$42,000	2.2	\$229,419	18.7	Electronic Systems & Parts
47 48	48 43	Gennum Corporation* + Zarlink Semiconductor Inc.* +	\$42,044 \$41,690	\$38,109 \$44,261	10.3 -5.8	\$135,669 \$227,714	31.0 18.3	Electronic Systems & Parts Electronic Systems & Parts
49 50	56 40	Cascades Inc. EnCana Corporation**	\$41,568 \$41,270	\$32,500 \$52,000	27.9 -20.6	\$3,625,000 \$8 374 710	1.1 0.5	Forest & Paper Products
51	51	NOVA Chemicals Corporation* (fs)	\$40,553	\$36,047	12.5	\$5,183,873	0.8	Chemicals & Materials
52 53	46 45	Novelis Inc.* (fs) Cangene Corporation*	\$39,564 \$36,706	\$39,136 \$38,607	1.1 -4.9	\$10,461,711 \$148,075	0.4 24.8	Mining & Metals Pharmaceuticals/Biotechnology
54 55	75 57	Trican Well Service Ltd. Evertz Technologies Limited	\$35,918 \$35,719	\$19,307 \$32,026	86.0 11.5	\$2,309,647 \$307,882	1.6 11.6	Energy/Oil & Gas Comm/Telecom Equipment
56 57	58	Westport Innovations Inc.*	\$34,285	\$29,835	14.9	\$146,448	23.4	Transportation
57 58	90 60	Sandvine Corporation*	\$31,876	\$14,033 \$27,402	127.2	\$2,558,459 \$88,365	35.3	Comm/Telecom Equipment
59 60	73 52	Total E&P Canada Ltd. (fs) Pharmascience Inc.	\$31,000 \$30,917	\$20,000 \$34.603	55.0 -10.7	nd \$705.003	4.4	Energy/Oil & Gas Pharmaceuticals/Biotechnology
61 62	67	Thales Canada Inc. (fs)	\$30,000	\$23,500 \$24,000	27.7	\$500,000 \$6,160,000	6.0	Electronic Systems & Parts
62 63	68	Miranda Technologies Inc. <sup>+</sup>	\$29,800 \$27,607	\$23,228	18.9	\$0,109,000 \$181,883	15.2	Comm/Telecom Equipment
64 65	65	Neo Material Technologies Inc.* SNC-Lavalin Group Inc.	\$27,035 \$26,700	\$11,474 \$23.665	135.6 12.8	\$791,325 \$7.209.871	3.4 0.4	Mining & Metals Engineering Services
66 67	27	Merck (fs) Ballard Bower Systems Inc.*	\$26,182	\$78,634	-66.7	\$1,464,843	1.8	Pharmaceuticals/Biotechnology
68	05	Martinrea International Inc.	\$25,053	\$7,692	225.7	\$2,192,931	1.1	Automotive
69 70	70 76	AEterna Zentaris Inc.* DragonWave Inc.* ++	\$24,629 \$23,761	\$21,160 \$19,234	16.4 23.5	\$35,660 \$45,158	69.1 52.6	Pharmaceuticals/Biotechnology Comm/Telecom Equipment
71 72	73	Oncolytics Biotech Inc. Monsanto Canada Inc. (fs)	\$23,387 \$23,000	\$12,192 \$20,000	91.8 15.0	\$0 \$610.000	3.8	Pharmaceuticals/Biotechnology
73	77	ViXS Systems Inc.* ++	\$22,600	\$18,206	24.1	\$70,566	32.0	Electronic Systems & Parts
74 75	61	Huawei Canada (fs) Xerox Canada Inc. (fs)	\$21,620 \$20,845	\$13,950 \$25,625	55.0 -18.7	\$242,000 \$1,137,088	8.9 1.8	Machinery
76 77	72	Bell Aliant Regional Communications, LP Resolute Forest Products Inc. (fs)	\$20,105 \$20,000	\$20,738 \$26,800	-3.1 -25.4	\$2,394,757 \$2,359,000	0.8 0.8	Telecommunications Services
78 70	69 70	Tekmira Pharmaceuticals Corporation	\$19,920	\$22,522	-11.6	\$16,647	119.7	Pharmaceuticals/Biotechnology
79 80	/8	Bioniche Life Sciences Inc. Canadian Solar Inc.*	\$19,782 \$19,623	\$17,922 \$7,048	10.4 178.4	\$36,044 \$1,878,224	54.9 1.0	Other Manufacturing
81 82	80 82	Descartes Systems Group Inc.* ++ Pason Systems Inc	\$18,836 \$17 366	\$17,478 \$16,472	7.8 5.4	\$112,748 \$333 520	16.7 5.2	Software & Computer Services
83	81 71	ArcelorMittal Dofasco Inc. (fs)	\$17,000	\$17,000	0.0	\$3,571,000	0.5	Mining & Metals
85 85	97	Enghouse Systems Limited	\$17,000 \$15,867	\$21,000 \$13,122	-19.0 20.9	\$11,514,000 \$122,559	0.1 12.9	Software & Computer Services
86 87	79 84	Tembec Inc. Cardiome Pharma Corp.*	\$15,638 \$15.058	\$17,677 \$15.798	-11.5 -4.7	\$1,743,000 \$1.489	0.9 1,011.3	Forest & Paper Products Pharmaceuticals/Biotechnology
88	86	Vecima Networks Inc.	\$14,721	\$15,688	-6.2	\$84,533	17.4	Comm/Telecom Equipment
89 90	99	Héroux-Devtek Inc.	\$14,336 \$14,303	\$10,151 \$12,814	41.2 11.6	\$30,249 \$357,572	47.4 4.0	Aerospace
91 92	98 100	MEGA Brands Inc.* SXC Health Solutions Corp.* +	\$14,298 \$14,175	\$12,977 \$12,800	10.2 10.7	\$372,720 \$4.921 263	3.8 0.3	Other Manufacturing Software & Computer Services
93	85	Resverlogix Corp.	\$13,979	\$15,699	-11.0	\$0	0.2	Pharmaceuticals/Biotechnology
94 95	63	Celestica Inc.*	\$13,650	\$16,350	-15.0 341.7	\$7,134,378	0.3	Electronic Systems & Parts
96 97	88 91	20-20 Technologies Inc.* + Psion Inc. (fs)	\$13,511 \$13,492	\$14,663 \$13,888	-7.9 -2.9	\$67,968 \$279,365	19.9 4.8	Software & Computer Services Computer Equipment
98		COM DEV International Ltd.	\$13,318	\$12,366	7.7	\$203,195	6.6	Comm/Telecom Equipment
100	93	Rio Tinto Iron & Titanium Inc. (fs)	\$13,226	\$10,996	-4.3	\$00,073 \$1,074,592	1.2	Mining & Metals







#### **RESEARCH Infosource Inc.** is

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

The Top 100 List is available online at www.researchinfosource.com or by calling (416) 481-7070.

For advertising information, please contact Arlene Dwyer at (416) 481-7070 ext. 23 arlene@ impactg.com

\*Converted to CDN\$ at annual average 2011 = 0.9891, 2010 = 1.0299 (Bank of Canada)

\*\*Revenue reported in US\$ and R&D spending in CDN\$ \*\*\*\$1 million or more of revenue

\*Not current name/acquired/merged \*+Fiscal 2012 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) Includes Sanofi Canada and Sanofi Pasteur Limited.

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Notes: 1. Data were obtained through annual reports, financial statements, securities commission filings, or through a survey.

2. We have attempted, wherever possible, to provide gross R&D spending before deduction of investment tax credits or government grants.

3. We have attempted, wherever possible, to provide revenue net of interest and investment income. 4.

FY2010 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) 5. include revenue and R&D spending for their Canadian operations only.