

Analysis of Research-and-Development (R&D) Expenditures

With the adoption of the 1987 amendments to the *Patent Act (Act)*, Canada's Research Based Pharmaceutical Companies (Rx&D)³¹ made a public commitment that the brand name pharmaceutical industry would increase its annual R&D expenditures as a percentage of sales to 10% by 1996. In 1999, the Conference Board of Canada concluded that Canada maintains the most favourable tax system for R&D of eleven countries it examined.³²

Under the *Act*, the PMPRB monitors and reports the R&D spending as reported to the Board by patentees, but it has no regulatory authority to influence the type of research or amount of R&D spending by patentees. The *Act* requires each patentee to report its revenues from the sales of drugs and the expenditures made by the patentee in Canada on R&D relating to medicine. For individual patentees, this calculation includes all revenues from Canadian sales of medicines, including revenues from licensing agreements.

Data Sources

Companies that reported sales of patented medicines in 2000 were also required to file R&D data for that calendar year as per the *Patented Medicines Regulations (Regulations)*. Only companies with active Canadian patents pertaining to a medicine sold in Canada are required by the *Act* to report on R&D expenditures. As new patents are granted and others expire, the group of companies required to file R&D data may change from year to year.

The information reported in this chapter is derived from reports filed with the Board by patentees. Under the *Regulations*, patentees are required to certify that the information reported is true and correct by an officer of the company. The PMPRB does not audit but attempts to reconcile the information and to seek corrections or clarifications from patentees if it finds any discrepancies. Each patentee is also given the opportunity to confirm the R&D-to-sales ratio calculated by the PMPRB for that company before publication of this report.

For 2000, 79 companies selling human and veterinary drug products filed reports on R&D. Sales of drugs for both human and veterinary use are included for the purpose of this section of the report. Of those 79 companies, 37 were Rx&D members. The data from the 79 reporting firms are the basis of this report. The total R&D expenditures reported by all the companies was \$944.7 million while the expenditures reported by the 37 Rx&D members totalled \$815.6 million in 2000, which accounted for 86.3% of the total R&D expenditures for the patented pharmaceutical industry as a whole; their sales revenues totalled \$7.7 billion, accounting for 82.8% of the total sales revenues.

31 Formerly the Pharmaceutical Manufacturers Association of Canada (PMAC).

32 Conference Board of Canada, *Rating R&D Tax Incentives*, November 1999. The conference Board examined eleven countries including, in addition to Canada, Australia, France, Korea, Mexico, United Kingdom, Japan, Sweden, Italy, Germany, United States.

Table 6 | Total R&D Expenditures* and R&D-to-Sales Ratios of Reporting Companies 1988-2000

Year	Companies Reporting	Total R&D Expenditures* (\$M)	Change from Previous Year (%)	Total Sales Revenues (\$M)	Change from Previous Year (%)	R&D-to-Sales Ratio	
						All Patentees (%)	Rx&D Patentees ** (%)
2000	79	944.7	5.6	9309.6	12.0	10.1	10.6
1999	78	894.6	12.0	8315.5	19.2	10.8	11.3
1998	74	798.9	10.2	6975.2	10.9	11.5	12.7
1997	75	725.1	9.0	6288.4	7.4	11.5	12.9
1996	72	665.3	6.4	5857.4	9.9	11.4	12.3
1995	71	625.5	11.5	5330.2	7.5	11.7	12.5
1994	73	561.1	11.4	4957.4	4.4	11.3	11.6
1993	70	503.5	22.1	4747.6	14.0	10.6	10.7
1992	71	412.4	9.6	4164.4	6.9	9.9	9.8
1991	65	376.4	23.2	3894.8	18.1	9.7	9.6
1990	65	305.5	24.8	3298.8	11.0	9.3	9.2
1989	66	244.8	47.4	2973.0	9.4	8.2	8.1
1988	66	165.7	-	2718.0	-	6.1	6.5

Source: PMPRB

* Total expenditures include current expenditures, capital equipment expenditures and allowable depreciation expenses. If the expenditures funded by government are excluded, the ratios for all patentees and for the members of the Rx&D are not affected.

** In the past, Rx&D has reported that its members have achieved a higher R&D-to-sales ratio than reported by the PMPRB. Not all members of Rx&D are required to report to the PMPRB each year as, under the *Patent Act*, only companies with active Canadian patents pertaining to a medicine sold in Canada are required to report on R&D expenditures. For example, some biotechnology companies are engaged in R&D but are not required to report to the PMPRB as they have not made sales of a patented product during this reporting year.

As shown in Table 6, patentees reported total R&D expenditures of \$944.7 million in 2000, an increase of 5.6% over 1999, which is the lowest increase since 1988. Current expenditures accounted for \$895.5 million or 94.8% of total R&D expenditures. Capital equipment costs and allowable depreciation expenses amounted to 3.6% and 1.6% respectively.

R&D Expenditures

Pursuant to the *Regulations*, patentees are required to report those R&D expenditures that would have been eligible for an Investment Tax Credit for scientific research and experimental development under the provisions of the *Income Tax Act* in effect on December 1, 1987.³³ Market research, sales

promotions, quality control or routine testing of materials, devices or products and routine data collection are among the expenditures that are not eligible for an Investment Tax Credit and therefore should not be included in the patentees' filings. Total R&D expenditures include current expenditures, capital equipment costs and allowable depreciation expenses.

³³ The definitions of research and development for purposes of the *Patented Medicines Regulations* are based on definitions under the *Income Tax Act* in 1987 and differ in some respects from definitions used for tax purposes today. The R&D information filed by patentees with the PMPRB is not necessarily consistent with what may ultimately be allowed by the Canada Customs and Revenue Agency for purposes of the *Income Tax Act*.

PATENTEES REPORTED TOTAL R&D EXPENDITURES OF \$944.7 MILLION IN 2000, AN INCREASE OF 5.6% OVER 1999.

Revenues from Sales

The 79 patentees reported total revenues of \$9.3 billion from Canadian sales of patented and non-patented drugs in 2000, up 12.0% over 1999. Patentees are largely brand name companies that sell patented and non-patented drugs. Of total sales revenues, less than 1% was generated by licensing agreements.

R&D-to-Sales Ratios

The ratio of R&D expenditures to sales revenues for the patented pharmaceutical industry was 10.1% in 2000, down from 10.8% in 1999. The ratio for the 37 companies that were members of Rx&D was 10.6% in 2000, down from 11.3% in 1999. Although the total R&D expenditures increased by 5.6%, the R&D-to-sales ratios declined because sales increased even more, by 12.0%. As a result, the R&D-to-sales ratios for all patentees and Rx&D companies were lower in 2000 than in any year since 1992.

As shown in Table 7, of the 79 reporting companies, 17 companies reported having performed no R&D in 2000. Sales revenues for companies with no R&D totalled \$349.5 million in 2000 accounting for 3.8% of total sales revenues for the patented pharmaceutical companies. The 39 companies reporting R&D expenditures with an R&D-to-sales ratio of 10% or less in 2000, was the same as 1999. This group included companies with total sales of \$4.9 billion in 2000 compared to \$4.5 billion in 1999. The 23 companies with ratios of more than 10% accounted for a smaller proportion of total sales, 44.0%, or \$4.1 billion in 2000.

Table 12 on page 41, lists all reporting patentees and their R&D-to-sales ratios.

Table 8 shows how current expenditures on R&D in 2000 were allocated among basic, applied, and other qualifying R&D. Total current expenditures on R&D rose by 5.9% in 2000.

THE RATIO OF R&D EXPENDITURES TO SALES REVENUES FOR THE PATENTED PHARMACEUTICAL INDUSTRY WAS 10.1% IN 2000, DOWN FROM 10.8% IN 1999.

Table 7 | Range of R&D-to-Sales Ratios by Number of Reporting Companies and Total Sales Revenues

Range of R&D-to-Sales Ratio	2000			1999		
	Number of Reporting Companies	Total Sales Revenues (\$M)	%	Number of Reporting Companies	Total Sales Revenues (\$M)	%
0%	17	349.5	3.8	14	273.6	3.3
0%-10%	39	4,860.5	52.2	39	4543.5	54.6
> 10%	23	4,099.6	44.0	25	3498.4	42.1
Total	79	9,309.6	100.0	78	8315.5	100.0

Source: PMPRB

Table 8 | Current R&D Expenditures* by Type of Research, 1999 and 2000

Type of Research	2000		1999		% Change in Expenditures 2000 - 1999
	\$M	%	\$M	%	
Basic	159.1	17.8	155.9	18.4	2.1
• Chemical	69.3	7.7	63.5	7.5	9.1
• Biological	89.8	10.0	92.4	10.9	-2.8
Applied	549.3	61.3	535.2	63.3	2.6
• Manufacturing Process	68.2	7.6	65.2	7.7	4.6
• Pre Clinical Trial I	34.1	3.8	30.1	3.6	13.3
• Pre Clinical Trial II	21.3	2.4	10.9	1.3	95.4
• Clinical Trial Phase I	17.8	2.0	15.3	1.8	16.3
• Clinical Trial Phase II	85.8	9.6	63.6	7.5	34.9
• Clinical Trial Phase III	322.1	36.0	350.1	41.4	-8.0
Other Qualifying R&D	187.0	20.9	154.7	18.3	20.9
TOTAL**	895.5**	100.0	845.8	100.0	5.9

Source: PMPRB

* Current expenditures exclude capital equipment and depreciation expenditures.

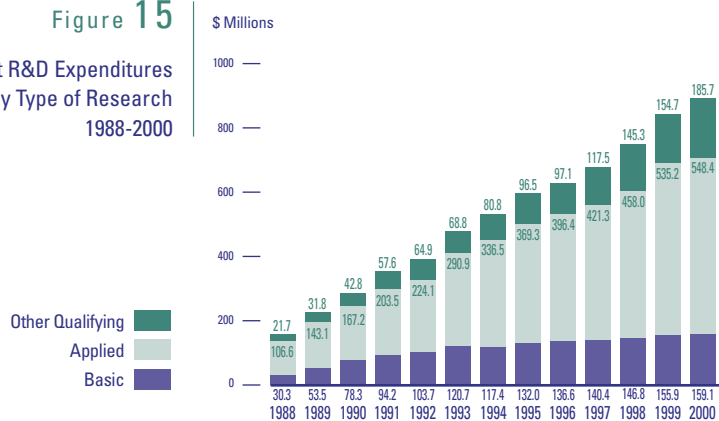
** Column may not equal totals due to rounding.

Patentees reported spending on basic research of \$159.1 million or 17.8% of the total current R&D expenditures in 2000. Basic research is defined as work that advances scientific knowledge without a specific application in view. Expenditures on basic research increased by 2.1% in 2000 but its share of total R&D continued to decline from 18.4% in 1999 to 17.8% in 2000. This is the lowest proportion of total R&D spending on basic research ever reported by patentees since the Board began reporting such information in 1988. The lion's share of R&D spending continued

to be on applied research, \$549.3 million or 61.3% of the total. Applied research is directed towards some practical application, comprising the manufacturing process, pre-clinical trials and clinical trials. Clinical trials totalled \$425.7 million in 2000 and accounted for 77.5% of total applied research expenditures, and 47.5% of the total current R&D expenditures. Manufacturing process accounted for \$68.2 million, or 7.6% of the total current R&D expenditures, and pre-clinical trials accounted for \$55.4 million or 6.2% of the total current R&D expenditures. Other qualifying research, which accounted for 20.9% of total expenditures in 2000, includes drug regulation submissions, bioavailability studies and Phase IV clinical trials.

Figure 15 shows current expenditures on R&D by type of research from 1988 to 2000 and Figure 16 shows their shares of expenditures during those years.

Figure 15
Current R&D Expenditures
by Type of Research
1988-2000



Source: PMPRB

Pharmaceutical patentees report their expenditures on research they conduct themselves (intra-mural) and research performed by others, including universities and hospitals and other manufacturers (extra-mural). Table 9 presents the current R&D expenditures by R&D performer and identifies the intra-mural and extra-mural expenditures. Most R&D was carried out by patentees. In 2000, 58.2% of R&D expenditures was directed to R&D performed by patentees, compared with 55.1% in 1999. Expenditures on R&D performed by universities and hospitals decreased by 16.1% to \$144.6 million from 1999. Expenditures on R&D performed by other companies on behalf of patentees incurred the largest increase with 15.0%, from \$137.9 million in 1999 to \$158.6 million in 2000. The category “others” includes individuals, organizations such as private clinics, and federal and provincial governments. This category increased by 1.9% in 2000.

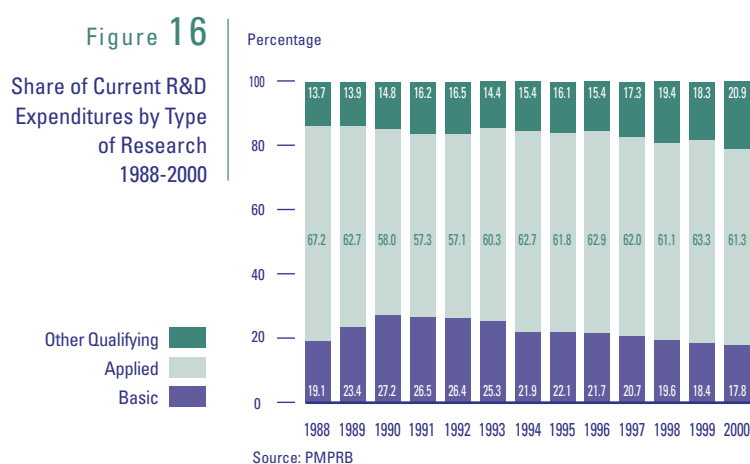


Table 9 | Current R&D Expenditures* by R&D Performer, 1999 and 2000

R&D Performer	2000		1999		% Change 2000 - 1999
	\$M	%	\$M	%	
Intra-mural					
• Patentees	521.2	58.2	465.7	55.1	11.9
Extra-mural					
• Universities and Hospitals	144.6	16.1	172.4	20.4	-16.1
• Other Companies	158.6	17.7	137.9	16.3	15.0
• Others	71.1	7.9	69.8	8.3	1.9
Total	895.5	100.0**	845.8	100.0**	5.9

Source: PMPRB

* Current expenditures exclude capital equipment and depreciation expenditures.

** The percentages may not equal 100% due to rounding.

In 2000, as in previous years, most of the R&D expenditures of pharmaceutical patentees were funded internally. Table 10 shows that in 2000, more than 97% of all patentees' R&D was funded by internal funds and funds provided by associated companies. The share of funding by governments increased by 6.0%. The share of others increased from \$5.9 million in 1999 to \$17.9 million in 2000.

In 2000, R&D spending increased in all parts of Canada. There was no significant change in the regional distribution of R&D spending in 2000. As shown in Table 11 more than 85% of total expenditures continued to be made in Ontario and Québec. Table 13, on page 43, shows the current R&D expenditures as reported by province and by R&D performer for 2000.

Table 10 | Total R&D Expenditures* by Source of Funds, 1999 and 2000

Source of Funds	2000		1999		% Change 2000-1999
	\$M	%	\$M	%	
Company	921.5	97.5	883.7	98.8	4.3
Federal/Provincial Governments	5.3	0.6	5.0	0.6	6.0
Others	17.9	1.9	5.9	0.7	203.4
Total	944.7	100.0	894.6	100.0**	5.6

Source: PMPRB

* Total expenditures include capital equipment and allowable depreciation.

** The percentage does not equal 100 due to rounding.

Table 11 | Current R&D Expenditures* by Location, 1999 and 2000

Location of R&D	2000		1999		% Change 2000 - 1999
	\$M	%	\$M	%	
Atlantic Provinces	25.1	2.8	23.6	2.8	6.4
Québec	372.1	41.6	340.4	40.2	9.3
Ontario	396.2	44.2	381.4	45.1	3.9
Western Provinces	102.0	11.4	100.4	11.9	1.6
Territories	0.012	0.0	0.010	0.0	20.0
Total	895.5**	100.0	845.8	100.0	5.9

Source: PMPRB

* Current expenditures exclude capital equipment and depreciation expenditures.

** Columns may not add up due to rounding

For more details on provincial breakdown, refer to table 13, page 43.

Table 12 | Ratios of R&D Expenditures to Sales Revenues by Reporting Patentee,¹ 1999 and 2000

Company	R&D-to-Sales Ratio (%)	
	2000	1999
3M Pharmaceuticals, 3M Canada Inc.	0.0	8.5
Abbott Laboratories, Limited	1.9	2.2
Agouron Pharmaceuticals Canada Inc.	58.4	15.4
Alcon Canada Inc.	0.0	0.0
Allergan Inc. ²	8.2	8.9
AltiMed, Division of Technilab Pharma	0.0	0.0
Alza Canada	0.0	0.0
Amgen Canada Inc. ²	65.7 ³	63.4 ³
AstraZeneca Canada Inc. ^{2,4}	10.1	–
Aventis Pasteur Limited ³	49.3 ³	66.3 ³
Aventis Pharma ^{2,5}	13.1	–
Axcan Pharma Inc. ²	22.7	10.5
Ayerst Veterinary Laboratories	0.0	0.0
Baxter Corporation	0.2	0.1
Bayer Inc. ²	7.0	6.1
Bayer Inc., Agriculture Division	1.6	3.3
Berlex Canada Inc. ²	5.8	7.4
Biogen Inc.	105.0	45.2
Block Drug Company (Canada) Ltd.	0.0	0.0
Boehringer Ingelheim (Canada) Ltd. ²	25.5 ³	32.8 ³
Bracco Diagnostics Canada Inc.	0.0	0.0
Bristol-Myers Squibb Pharmaceutical Group ²	8.9	8.8
BYK Canada Inc. ²	22.1	13.8
Canderm Pharma Inc.	1.8	4.2
Cangene Corporation	224.4 ³	193.7
CIBA Vision Canada Inc.	3.2	6.7
Colgate Oral Pharmaceuticals	0.0	0.0
Crystaal Corporation, Division of Biovail Corporation International	63.8	51.8
Dermik Laboratories Canada Inc.	0.6	0.0
Draxis Health Inc.	16.1	12.8
Du Pont Merck Pharma Inc. ²	13.4	15.1
Eli Lilly Canada Inc. (includes Elanco Animal Health Division) ²	11.5	12.8
Ferring Inc.	1.3	1.7
Fournier Pharma Inc. ²	6.6	4.3
Fujisawa Canada Inc. ²	13.0	14.0
Galderma Canada	0.5	0.9
Genetics Institute Inc.	0.0	0.0
Genzyme Canada Inc. (not a patentee in 1999)	0.0	–
Gilead Sciences, Inc. ⁶	43,363.0 ³	487.4 ³
Glaxo Wellcome Inc. ²	13.4	13.4
Hoffmann-La Roche Limited ²	6.7	11.9
ICN Canada Limited	1.7	1.7
Janssen-Ortho Inc. ²	9.0	9.3
Johnson & Johnson Merck Consumer Pharmaceuticals of Canada	0.0	0.0
Knoll Pharma Inc. ²	9.3	7.8

Leo Laboratories Canada Ltd. ²	7.4	10.0
Ligand Pharmaceuticals (Canada)	0.0	0.0
Lundbeck Canada Inc. ²	8.9	3.7
Mallinckrodt Medical Inc. ²	0.01	0.2
McNeil Consumer Healthcare Canada	2.3	2.3
Medicis Canada Ltd.	0.0	0.0
Merck Frosst Canada Inc. ²	14.3	16.0
Merial Canada Inc.	0.4	0.3
Novartis Animal Health Canada Inc.	0.2	0.2
Novartis Consumer Health Canada Inc.	1.2	1.0
Novartis Pharmaceuticals Canada Inc. ²	11.1	12.2
Novo Nordisk Canada Inc.	1.3	1.3
Nycomed Amersham Canada Ltd.	1.1	1.9
Organon Canada Ltd. ²	2.9	3.8
Ortho Dermatological, Division of Johnson & Johnson Inc.	0.0	0.0
Pathogenesis Canada Ltd. (not a patentee in 1999)	0.0	–
Pfizer Canada Inc. (includes Pfizer Animal Health Group) ²	9.2	7.9
Pharmacia & Upjohn Inc. ²	11.2	10.8
Procter & Gamble Pharmaceuticals Canada, Inc. ²	15.7	17.4
Purdue Pharma ²	4.7	5.5
Sanofi-Synthélabo Canada Inc. ^{2,4}	34.9 ³	51.6 ³
Schein Pharmaceutical Canada Inc. (not a patentee in 1999)	2.1	–
Schering Canada Inc. ²	8.9	9.1
Searle Canada Inc. ²	5.1	9.0
Serono Canada Inc.	7.6	10.4
Servier Canada Inc. ² (not a patentee in 1999)	0.0	–
Shire Canada Inc.	1.0	2.2
SmithKline Beecham Pharma Inc. ²	7.4	7.8
Solvay Pharma Inc. ²	8.3	9.4
The Liposome Company, Inc.	1.9	4.8
Warner-Lambert Canada Inc. (Parke-Davis) ²	5.7	7.6
Warner-Lambert Consumer Healthcare ²	0.8	0.7
Wyeth-Ayerst Canada Inc. ²	12.0	9.3
Yamanouchi Pharmaceutical Co. Ltd.	0.0	0.0

Source: PMPRB

- 1 The revenues from royalties are included in calculating each company's ratio, but are deducted, when appropriate, for the industry-wide aggregation to avoid double-counting. Federal and provincial government grants have been netted from the expenditures used to calculate the individual R&D-to-sales ratios but are included in the aggregate statistics. Differences between the list of firms filing data on prices and those filing R&D data are due to differences in reporting practices between patentees and their affiliates or licencees as well as the fact that veterinary patentees are required to file information on R&D expenditures, but some are not required to report price and sales information each year.
- 2 Member of Rx&D. This information has been added at the request of stakeholders and is based on published sources.
- 3 These ratios have been verified with the companies. The largest part of their R&D expenditures was provided by non arms length companies.
- 4 Astra Pharma Inc. merged with Zeneca Pharma Inc. to form AstraZeneca Canada Inc. in 2000. The R&D-to-Sales ratio for Astra Pharma Inc. and Zeneca Inc. were, respectively, 10.2% and 6.7% in 1999.
- 5 Hoechst Marion Roussel Canada Inc. merged with Rhône Poulenc Rorer Canada Inc. to form Aventis Pharma Inc. The R&D-to-Sales ratio for Hoechst Marion Roussel Canada Inc. and Rhône Poulenc Rorer Canada Inc. were, respectively, 13.7% and 25.4% in 1999.
- 6 Formerly known as NeXstar Pharmaceuticals, Inc.

Table 13 | Current R&D Expenditures by Province and by R&D Performer, 2000

Province	R&D Performer						Percentage of Expenditures		
		Patentees	Other Companies	University	Hospitals	Others	Total	Rx & D	
Newfoundland	\$(000)	1,095.60	1,267.53	1,064.15	996.04	1,048.69	5,472.00	4,098.56	0.61
	%	20.02	23.16	19.45	18.20	19.17	100.00	0.53	
Prince Edward Island	\$(000)	1.06	144.20	172.90	99.59	158.07	573.70	446.41	0.06
	%	-0.19	25.14	30.14	17.36	27.55	100.00	0.06	
Nova Scotia	\$(000)	3,150.92	2,143.09	1,832.55	5,068.98	2,268.37	14,463.91	13,622.48	1.62
	%	21.79	14.82	12.67	35.05	15.69	100.00	1.76	
New Brunswick	\$(000)	1,306.50	966.70	52.02	1,084.05	1,150.56	4,559.83	3,154.50	0.51
	%	28.65	21.20	1.14	23.77	25.23	100.00	0.41	
Québec	\$(000)	237,710.63	78,328.69	7,902.24	26,710.57	21,467.33	372,119.45	349,951.80	41.56
	%	63.88	21.05	2.12	7.18	5.77	100.00	45.27	
Ontario	\$(000)	249,158.72	54,123.70	20,379.22	40,875.13	31,707.42	396,244.19	317,141.41	44.25
	%	62.88	13.66	5.14	10.32	8.00	100.00	41.03	
Manitoba	\$(000)	12,649.06	1,827.89	1,604.78	2,926.85	1,793.63	20,802.20	9,824.18	2.32
	%	60.81	8.79	7.71	14.07	8.62	100.00	1.27	
Saskatchewan	\$(000)	1,556.37	1,487.05	2,051.98	1,451.66	1,821.03	8,368.09	7,716.98	0.93
	%	18.60	17.77	24.52	17.35	21.76	100.00	1.00	
Alberta	\$(000)	10,058.35	12,827.32	8,122.34	6,195.86	6,034.99	43,238.66	40,842.30	4.83
	%	23.26	29.67	18.79	14.33	13.96	100.00	5.28	
British Columbia	\$(000)	4,532.65	5,499.32	5,680.88	10,307.42	3,603.59	29,623.86	26,174.54	3.31
	%	15.30	18.56	19.18	34.79	12.16	100.00	3.39	
Yukon; N.W.T.; Nunavut	\$(000)	0.00	0.00	0.00	12.45	0.00	12.45	12.45	0.001
	%	0.00	0.00	0.00	100.00	0.00	100.00	0.002	
Canada	\$(000)	521,217.75	158,615.49	48,863.04	95,728.59	71,053.66	895,478.53	772,985.60	100.00
	%	58.21	17.71	5.46	10.69	7.94	100.00	100.00	

Source: PMPRB

- The percentage under each R&D category gives the percentage of all money spent in that category in that province.
- Expenditures as a percentage of total means percentage of R&D expenditures in that province compared to total R&D in Canada.
- Rows and columns may not equal totals due to rounding.
- Current expenditures plus capital expenditures (equipment + depreciation) = total R&D expenditures.