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Industry, Science and
Technology Canada

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Technologie Canada

FEDERAL EXPENDITURES FOR

BIOTECHNOLOGY

1989-1992

Canada

FEDERAL EXPENDITURES FOR

BIOTECHNOLOGY

1989-1992

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**Biotechnology Directorate
Chemicals and Bio-Industries Branch
Industry, Science and Technology Canada
March 1993**

1993-94

1993-94

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Aussi disponible en français sous le titre "Rapport sur les dépenses du gouvernement fédérale en biotechnologie".

FOREWORD

This report has been prepared by the Biotechnology Directorate, Chemicals and Bio-Industries Branch, Industry, Science and Technology Canada. It is an update of two previous documents detailing the federal government's expenditures for biotechnology: *Federal Expenditures for Biotechnology 1981-1986* and *Federal Expenditures for Biotechnology 1986-1989*.

The Interdepartmental Committee on Biotechnology recommended this update. We are grateful for their support and for the assistance of the members of the Biotechnology Coordinating Group and officials of other government departments and agencies in providing information on biotechnology-related activities.

Federal expenditures for biotechnology are becoming more diverse; increasingly, new departments and agencies have added activities in biotechnology to their programs. As in the first two reports, biotechnology is defined as the application of science and engineering to the direct or indirect use of living organisms or parts of organisms, in their natural or modified forms, for the production of goods or the provision of services.

For the first time, many of the departments and agencies have included salaries and other operating costs as part of the expenditures and we caution readers not to assume that direct comparisons can be made with former reports.

We acknowledge the work of Luc Allard, summer student from the University of Ottawa, in compiling the data and assisting in the preliminary analysis.

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INTRODUCTION

The reader will find this report to be a record of the broad nature of expenditures for biotechnology in the Federal Government. The biotechnology initiatives of government departments and agencies encompass a wide spectrum from a primary mandate to carry out R&D, to funding and contracting-out, to program coordination and secretariat services.

In 1983, biotechnology was identified as a strategic technology for the future economic success for Canada. The National Biotechnology Strategy (NBS) was established and funds were set aside annually to support government R&D in this enabling technology. R&D Networks were formed to link industry, university and government laboratories, as well as to serve as a communications mechanism to stimulate the ongoing development of biotechnology in strategic areas. A third element of the Strategy was the establishment of the National Biotechnology Advisory Committee to advise the Minister for Science on the status and needs of the Canadian biotechnology community.

Since 1983, and indeed even over the three years 1989-90 to 1991-92, there have been significant changes in the depth and scope of federal biotechnology activities. This report highlights some of these changes and serves as a record of the ongoing federal commitment to biotechnology in Canada.

GUIDE TO THIS REPORT

Financial and Person-Year Expenditures

1. The core of this report deals with financial and person-year expenditures in biotechnology. Information on federal departments and agencies which have discrete identifiable biotechnology expenditures is included in:
 - **Tables 1A, 1B, 1C** reflect the total federal expenditures for biotechnology by department and agency for the three years under review.
 - **Table 1D** shows the evolution of federal biotechnology expenditures by department and agency including per cent of change for the period under review.
 - **Table 1E** provides a breakdown of federal expenditures by sector for the three years under review. More detailed sectoral information can be found in Annex 1.
 - **Section 1** provides a series of tables reflecting biotechnology expenditures, alphabetically, by department and agency.
 - **Section 2** contains a series of charts of expenditures by department and agency over the eleven year period 1981-92 (where applicable) for which the federal government has compiled expenditures for biotechnology activities.

- **Annex 1** contains a series of charts showing expenditures by sector and department and agency.
- 2. The annual allocations of the \$11.9 million National Biotechnology Strategy Fund are not listed separately, but rather are reflected in the total expenditures of the various departments and agencies which received these monies.
- 3. New inclusions in this edition are the biotechnology expenditures of Investment Canada and the International Development Research Centre (IDRC).

Activity Information

1. A number of federal departments and agencies carry out activities involving biotechnology but do not identify these activities with discrete expenditures. Information on these departments and agencies is included along with information on the activities of the expenditure-related departments and agencies in:
 - **Section 3** contains a summary of biotechnology activities by department and agency.
 - **Section 4** offers a preview of anticipated federal biotechnology activities and initiatives by department and agency.
 - **Annex 2** contains a listing of the principal contacts for biotechnology in the federal government by department and agency.

COMMENTS ON THE FINDINGS

In 1986, in the first assessment of federal expenditures for biotechnology, 11 departments and agencies submitted information on expenditures and activities; 18 are included in this update to March 1992. It is noteworthy that of these 18 departments and agencies, only 12 have received funding from the National Biotechnology Strategy for their biotechnology activities.

The contents of Tables 1B, 1C and 1D are summarized in Table 1E, which indicates that federal departments and agencies involved in biotechnology R&D have, on average, increased expenditures 2.2% over the three-year period. In contrast, the non-R&D departments and agencies have shown a 9.1% increase, much of which is due to the new Strategic Technologies Program at Industry, Science and Technology Canada (ISTC) and the activities of Western Economic Development (WD).

Person-years (PYs) involved in biotechnology show a modest increase of 28.5 PYs over the three-year period for departments and agencies.

It should be noted that salaries are included for only 593 of the 1,131 PYs. Therefore, using an average salary of \$50,000 per annum, the total expenditures for 1991-92 (Table 1C) should be increased by \$26,900,000 to read \$187,287,800. There is no method by which to estimate the expenditures of those agencies which did not report the cost of their activities. In addition, the expenditures for biotechnology in the six Networks of Centres of Excellence with biotechnology-related research supported by the federal government, which were approximately \$19.3 million in FY 1991-92, have not been calculated in the findings in this document.

Taking into account estimates for expenditures not specifically reported in this document, it can be estimated that total 1991-1992 federal biotechnology expenditures were in the order of \$200 million.

TABLE 1A

FEDERAL BIOTECHNOLOGY EXPENDITURES AND PERSON-YEARS,
1989-90

DEPARTMENT/AGENCY	EXPENDITURES (\$000)				TOTAL PERSON-YEARS
	IN-HOUSE	CONTRACTS	GRANTS/CONTRIBUTIONS	TOTAL	
Agriculture Canada ¹	19,973.2	0.0	0.0	19,973.2	338.9
Consumer and Corporate Affairs	401.0	0.0	0.0	401.0	6.0
Energy, Mines and Resources ²	615.0	2,100.8	0.0	2,715.8	8.0
Environment Canada ²	1,104.3	150.0	0.0	1,254.3	10.0
Fisheries and Oceans Canada ²	241.9	42.3	0.0	284.2	8.1
Forestry Canada	3,750.0	120.0	0.0	3,870.0	50.0
Health and Welfare Canada	7,493.9	348.5	312.4	8,154.8	113.1
Industry, Science and Technology Canada ²	324.0	0.0	293.4	617.4	NA
International Development Research Centre ²	0.0	0.0	808.1	808.1	NA
Investment Canada ²	0.0	0.0	157.0	157.0	NA
Labour Canada	22.0	0.0	0.0	22.0	0.3
Medical Research Council ²	0.0	0.0	44,461.0	44,461.0	NA
National Defence ²	153.0	190.0	0.0	343.0	5.8
National Research Council ²	27,129.0	0.0	11,041.3	38,170.3	558.9
Natural Sciences and Engineering Research Council ²	0.0	0.0	24,888.0 ³	24,888.0	NA
Western Economic Diversification Canada ²	0.0	0.0	101.1	101.1	NA
TOTAL	61,207.3	2,951.6	82,062.3	146,221.2	1,099.1

1 Capital expenditures not included.

2 Salaries not included.

3 Includes \$500,000 received in transfer from NRC-IRAP NBS Funds.

NA: not available

TABLE 1B

FEDERAL BIOTECHNOLOGY EXPENDITURES AND PERSON-YEARS,
1990-91

DEPARTMENT/AGENCY	EXPENDITURES (\$000)				TOTAL PERSON-YEARS
	IN-HOUSE	CONTRACTS	GRANTS/CONTRIBUTIONS	TOTAL	
Agriculture Canada ¹	23,033.7	0.0	0.0	23,033.7	368.6
Consumer and Corporate Affairs	418.0	0.0	0.0	418.0	6.0
Energy, Mines and Resources ²	720.0	2,367.0	0.0	3,087.0	8.0
Environment Canada ²	1,385.5	400.0	0.0	1,785.5	18.5
Fisheries and Oceans ²	330.0	121.6	0.0	451.6	6.9
Forestry Canada	3,900.0	167.0	0.0	4,067.0	52.0
Health and Welfare Canada	8087.2	594.6	306.4	8,988.2	122.3
Industry, Science and Technology Canada ²	715.0	0.0	765.3	1,480.3	NA
International Development Research Centre ²	0.0	0.0	209.0	209.0	NA
Investment Canada ²	0.0	0.0	226.0	226.0	NA
Labour Canada	72.0	0.0	0.0	72.0	0.3
Medical Research Council ²	0.0	0.0	48,863.0	48,863.0	NA
National Defence ²	126.0	245.0	0.0	371.0	5.8
National Research Council ²	22,770.0	0.0	10,217.8	32,987.8	558.9
Natural Sciences and Engineering Research Council ²	0.0	0.0	26,607.0 ³	26,607.0	NA
Western Economic Diversification Canada ²	0.0	0.0	900.1	900.1	NA
TOTAL	61,557.4	3,895.2	88,094.6	153,547.2	1,151.2

1 Capital expenditures not included.

2 Salaries not included.

3 Includes \$121,000 received in transfer from NRC-IRAP NBS Funds.

NA: not available

TABLE 1C

**FEDERAL BIOTECHNOLOGY EXPENDITURES AND PERSON-YEARS,
1991-92**

DEPARTMENT/AGENCY	EXPENDITURES (\$000)				TOTAL PERSON-YEARS
	IN-HOUSE	CONTRACTS	GRANTS/CONTRIBUTIONS	TOTAL	
Agriculture Canada ¹	22,611.7	0.0	0.0	22,611.7	352.7
Consumer and Corporate Affairs	435.0	0.0	0.0	435.0	6.0
Energy, Mines and Resources ²	670.0	2,171.5	0.0	2,841.5	9.0
Environment Canada ²	1,301.2	325.0	0.0	1,626.2	16.7
Fisheries and Oceans ²	258.0	165.5	0.0	423.5	7.2
Forestry Canada	4,425.0	264.0	0.0	4,689.0	59.0
Health and Welfare Canada ³	8,359.8	794.7	306.4	9,460.9	120.1
Industry, Science and Technology Canada ²	689.0	0.0	4,405.9	5,094.9	11.0
International Development Research Centre ²	0.0	0.0	315.3	315.3	NA
Investment Canada ²	0.0	0.0	160.0	160.0	NA
Labour Canada	72.0	0.0	0.0	72.0	0.3
Medical Research Council ²	0.0	0.0	51,210.0	51,210.0	NA
National Defence ²	204.0	396.0	0.0	600.0	5.0
National Research Council ²	22,032.0	0.0	8,309.4	30,341.4	544.0
Natural Sciences and Engineering Research Council ²	0.0	0.0	27,129.0	27,129.0	NA
Western Economic Diversification Canada ²	0.0	0.0	3,377.4	2,006.7	NA
TOTAL	61,057.7	4,116.7	95,213.4	160,387.8	1,131.0

1 Capital expenditures not included.

2 Salaries not included.

3 Includes \$70,500 received in transfer from NRC-IRAP NBS Funds.

NA: not available

TABLE 1D

**EVOLUTION OF FEDERAL BIOTECHNOLOGY EXPENDITURES
BY DEPARTMENT/AGENCY,
1989-92**

DEPARTMENT/ AGENCY	89-90		90-91			91-92			% Change Over 3 Years
	\$(000)	%	\$(000)	%	% Change	\$(000)	%	% Change	
Agriculture Canada	19,973.2	13.6	23,033.7	15.0	15.3	22,611.7	14.1	-1.8	13.2
Consumer and Corporate Affairs	401.0	0.3	418.0	0.3	4.2	435.0	0.3	4.1	8.5
Energy, Mines and Resources	2,715.8	1.9	3,087.0	2.0	13.7	2,841.5	1.8	-8.0	4.6
Environment Canada	1,254.3	0.9	1,785.5	1.2	42.3	1,626.2	1.0	-8.9	29.6
Fisheries and Oceans Canada	284.2	0.2	451.6	0.3	58.9	423.5	0.3	-6.2	49.0
Forestry Canada	3,870.0	2.6	4,067.0	2.6	5.1	4,689.0	2.9	15.3	21.2
Health and Welfare Canada	8,154.8	5.6	8,988.2	5.8	10.2	9,460.9	5.2	13.8	16.0
Industry, Science and Technology Canada	617.4	0.4	1,480.3	1.0	139.8	5,094.9	3.2	244.2	725.2
International Development Research Centre	808.1	0.5	209.0	0.1	-74.1	315.3	0.2	50.9	-61.0
Investment Canada	157.0	0.1	226.0	0.1	43.9	160.0	0.1	-29.2	1.9
Labour Canada	22.0	0.01	72.0	0.05	227.3	72.0	0.04	0.003	227.3
Medical Research Council	44,461.0	30.4	48,863.0	31.8	9.9	51,210.0	32.0	4.8	15.2
National Defence	343.0	0.2	371.0	0.2	8.2	600.0	0.4	61.7	74.9
National Research Council	38,170.3	26.1	32,987.8	21.5	-13.5	30,342.4	19.0	-8.0	-20.5 ¹
Natural Sciences and Engineering Research Council	24,888.0	17.0	26,607.0	17.3	6.9	27,129.0	17.0	2.0	9.0
Western Economic Diversification Canada	101.1	0.1	900.1	0.6	790.2	3,377.4	2.1	275.2	3240.6
TOTAL	146,221.2		153,547.2		5.0	160,388.8		4.4	9.7

¹ Decline caused by attrition of positions across the NRC; refer to Tables 1A, 1B and 1C for PY reductions in biotechnology. Reduction due to reduced % level of funding per project and as a maximum for Biotechnology Development Program (BDP), and reduced % level of funding per collaborative project for Biotechnology Contribution Program (BCP).

TABLE 1E

FEDERAL BIOTECHNOLOGY EXPENDITURES BY SECTOR,
1989-90, 1990-91, 1991-92

SECTOR ¹	1989-90		1990-91		1991-92	
	\$(000)	%	\$(000)	%	\$(000)	%
Agriculture ²	15,825.3	34.4	19,784.9	38.8	18,953.8	36.0
Animal Development ²	3,049.2	6.6	3,589.2	7.0	4,304.0	8.1
Aquaculture/Fisheries	4,423.7	9.6	3,737.1	7.3	4,234.7	8.0
Biomass Energy/Bio-Energy	1,978.1	4.3	2,171.7	4.3	2,081.8	4.0
Environment ²	1,620.0	3.5	2,164.4	4.2	1,803.1 ¹	3.4
Food ²	2,557.8	5.6	2,774.8	5.4	2,487.4	4.7
Forestry	3,932.5	8.5	4,230.3	8.3	4,939.6	9.3
Health and Safety ²	12,004.2	26.1	11,867.0	23.3	13,293.8	25.2
Mining	546.7	1.2	525.6	1.0	357.9	1.0
Pulp and Paper	65.4	0.1	140.7	0.3	194.0	0.3
TOTAL	46,002.9	100.0	50,985.7	100.0	52,650.1	100.0

- 1 Expenditures by departments and agencies which could not be categorized in given sectors are not accounted for in this table.
- 2 Expenditures include regulatory support/research.

SECTION 1:

**FEDERAL EXPENDITURES AND PERSON-YEARS
BY DEPARTMENT/AGENCY**

1989-90, 1990-91, 1991-92

I Department: Agriculture Canada

Headquarters: Sir John Carling Building
930 Carling Avenue
Ottawa, Ontario
K1A 0E4

Contacts: Research Coordinator
Research Coordination Directorate
Research Branch
(613) 995-7084

Director
Pesticide Directorate
Food Production and Inspection Branch
(613) 993-4544

Total Biotechnology Budget 1989-90: \$19,973,200
Biotechnology Person-Years 1989-90: 338.9 PYs

Total Biotechnology Budget 1990-91: \$23,033,700
Biotechnology Person-Years 1990-91: 368.6 PYs

Total Biotechnology Budget 1991-92: \$22,611,700
Biotechnology Person-Years 1991-92: 352.7 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ¹					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
BIOCROP, BIOREM, BIOZOOTECH ² and BIONET	37.5	-	50.0	-	50.0	-
Resources	5,219.4	96.0	3,014.7	51.5	2,113.3	35.3
Crops	8,972.9	168.8	13,122.0	231.8	12,845.2	220.3
Animals	2,833.9	50.5	3,330.5	57.5	4,041.8	68.3
Food	1,238.2	18.8	1,417.7	20.5	1,451.4	21.3
Regulatory	666.3	4.8	1,164.3	7.3	1,217.5	7.5
Research Branch - unspecified	1,005.0	-	934.5	-	892.5	-
TOTAL	19,973.2	338.9	23,033.7	368.6	22,611.7	352.7

- 1 i) Capital expenditures not included.
- ii) Overhead costs for management, support services and physical plant maintenance not included.
- 2 The BIOZOOTECH Network was established in Fall 1990.

II Department: Consumer and Corporate Affairs

Headquarters: Place du Portage - Phase I
50 Victoria Street
Hull, Quebec
K1A 0C9

Contact: Director
(613) 953-7845

Total Biotechnology Budget 1989-90: \$401,000
Biotechnology Person-Years 1989-90: 6.0 PYs

Total Biotechnology Budget 1990-91: \$418,000
Biotechnology Person-Years 1990-91: 6.0 PYs

Total Biotechnology Budget 1991-92: \$435,000
Biotechnology Person-Years 1991-92: 6.0 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Research/Review of Intellectual Property; Examination and Processing of Biotechnology Patent Applications; Dissemination of Information on Patenting	401,000.0	6.0	418,000.0	6.0	435,000.0	6.0

III Department: Energy, Mines and Resources

Headquarters: 580 Booth Street
Ottawa, Ontario
K1A 0E4

Contact: See below

Total Biotechnology Budget 1989-90: \$2,715,800
Biotechnology Person-Years 1989-90: 8.0 PYs

Total Biotechnology Budget 1990-91: \$3,087,000
Biotechnology Person-Years 1990-91: 9.0 PYs

Total Biotechnology Budget 1991-92: \$2,814,500
Biotechnology Person-Years 1991-92: 9.0 PYs

IIIa) CANMET (Canada Centre for Mineral and Energy Technology)

Contact: Manager
Environmental Laboratory
(613) 996-5619

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ¹					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
Bio-Recovery	154.0	2.0	80.0	1.0	37.0	0.5
Effluent Treatment	146.0	1.9	320.0	4.0	335.0	4.5
Acid Mine Drainage	154.0	2.0	160.0	2.0	149.0	2.0
Biocorrosion	116.0	1.5	120.0	1.5	112.0	1.5
BIOMINET Network	45.0	0.6	40.0	0.5	37.0	0.5
SUB-TOTAL	615.0	8.0	720.0	9.0	670.0	9.0
<u>Contracts</u>						
Bio-Adsorption	137.0	-	160.6	-	13.3	-
Acid Mine Drainage	101.7	-	125.0	-	158.6	-
Petroleum	162.1	-	351.7	-	269.8	-
Support Services	-	-	29.7	-	29.8	-
SUB-TOTAL	400.8	-	667.0	-	471.5	-
TOTAL	1,015.8	8.0	1,387.0	9.0	1,141.5	9.0

¹ Do not include salaries.

**IIIb) Bioenergy Development Program
Alternative Energy Division
Efficiency and Alternative Energy Technology Branch**

Contact: Director
(613) 996-6195

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Technology Development	750.0	700.0	700.0
Process Applications	300.0	350.0	400.0
Product Development	650.0	650.0	600.0
TOTAL	1,700.0	1,700.0	1,700.0

IV Department: Environment Canada

Headquarters: Biotechnology Centre
 Conservation and Protection Service
 Place Vincent-Massey
 351 St. Joseph Blvd., 14th Floor
 Hull, Quebec
 K1A 0H3

Total Biotechnology Budget 1989-90: \$1,254,300
 Biotechnology Person-Years 1989-90: 10.0 PYs

Total Biotechnology Budget 1990-91: \$1,785,500
 Biotechnology Person-Years 1990-91: 18.5 PYs

Total Biotechnology Budget 1991-92: \$1,626,200
 Biotechnology Person-Years 1991-92: 16.7 PYs

IVa) Biotechnology Section

Contacts: Chief, New Substances Division
 Commercial Chemicals Branch
 (819) 997-4336

Head
 Biotechnology Section
 Commercial Chemicals Branch
 (819) 953-6684

Director
 Technology Development
 and Technical Services Br.
 Environmental Protection
 Directorate
 Unit 100, Asticou Centre
 Hull, Quebec
 K1A 0H3
 (819) 953-3090

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
BIOQUAL Network	25.0	-	25.0	-	25.0	-
Regulatory Activities ¹	165.0	2.0	250.0	3.0	300.0	4.0
SUB-TOTAL	190.0	2.0	275.0	3.0	325.0	4.0
<u>Contracts</u>						
To support regulations ²	150.0	-	400.0	-	325.0	-
TOTAL	340.0	2.0	675.0	3.0	650.0	4.0

1 Regulatory activities include development of draft regulations, initiation of components of Domestic Substances List (DSL) for biotechnology products including efforts on harmonization with other jurisdictions and consultations on regulations and DSL and interim reviews of products.

2 Contract work in support of the regulations includes work on information requirements regarding nontarget effects and fate (microcosm procedures), monitoring methods (markers), field trial methods, database support, environmental information on key genera which may fall under the Canadian Environmental Protection Act, and treatability studies. Some of this work was done collaboratively with the US-Environmental Protection Agency.

IVb) Wastewater Technology Centre (WTC)

Headquarters: 867 Lakeshore Road
 P.O. Box 5068
 Burlington, Ontario
 L7R 4L7

Contact: Director
 (416) 336-4855

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
Biological Processes:						
Pulp and Paper	57.3		125.3		194.0	
Toxic Chemical Control	60.0		144.7		194.0	
Bioremediation of contaminated groundwaters and soils	-		-		58.2	
Residue Management:						
Degradation of chlorinated organics in soil systems	50.0		47.5		30.0	
TOTAL	167.3	n/a	317.5	n/a	476.2	n/a

IVc) National Waters Research Institute (NWRI)

Contact: Project Leader
 (416) 336-4923

No data available.

IVd) Environmental Protection - Quebec

Headquarters: Capitaine Bernier Laboratories
1001 Pierre-Dupuy Street
Longueuil, Quebec
J4K 1A1

Contact: Research Biologist
(514) 651-6862

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ¹					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
Development of tools in ecotoxicology	487.0	5.0	576.0	12.5	455.0	10.6
Development of procedures in ecotoxicology	260.0	3.0	217.0	3.0	45.0	2.1
TOTAL	747.0	8.0	793.0	15.5	500.0	12.7

1 Do not include salaries.

V **Department:** Fisheries and Oceans Canada

Headquarters: 200 Kent Street
Ottawa, Ontario
K1A 0E6

Contacts: Director
Aquaculture and Resource Development Branch
(613) 990-0275

Head
Fish Culture Research Section
West Vancouver Laboratory
(604) 666-7928

Total Biotechnology Budget 1989-90: \$284,200
Biotechnology Person-Years 1989-90: 8.1 PYs

Total Biotechnology Budget 1990-91: \$451,600
Biotechnology Person-Years 1990-91: 6.9 PYs

Total Biotechnology Budget 1991-92: \$423,500
Biotechnology Person-Years 1991-92: 7.2 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ¹					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
In-House						
A-Base						
- O&M	64.5	8.1	74.8	6.9	12.5	7.2
- Capital	85.8	-	24.2	-	-	-
National Biotechnology Strategy Funds						
- O&M	85.0	-	173.0	-	180.0	-
- Capital	-	-	53.0	-	60.0	-
- AQUATECH Network O&M	6.6	-	5.0	-	5.5	-
SUB-TOTAL	241.9	8.1	330.0	6.9	258.0	7.2
Contracts						
A-Base to Companies	23.9	-	42.6	-	101.0	-
- NBS to Companies O&M	-	-	47.0	-	41.5	-
- Companies Capital	-	-	12.0	-	5.0	-
National Biotechnology Funds						
- AQUATECH O&M to Universities	23.9	-	20.0	-	18.0	-
SUB-TOTAL	42.3	-	121.6	-	165.5	-
TOTAL	284.2	8.1	451.6	6.9	423.5	7.2

1 Do not include salaries.

VI Department: Forestry Canada

Headquarters: Place Vincent Massey
351 St. Joseph Blvd.
Hull, Quebec
K1A 1G5

Contact: Coordinator
Forest Biotechnology
(819) 997-1107

Total Biotechnology Budget 1989-90: \$3,870,000
Biotechnology Person-Years 1989-90: 50.0 PYs

Total Biotechnology Budget 1990-91: \$4,067,000
Biotechnology Person-Years 1990-91: 52.0 PYs

Total Biotechnology Budget 1991-92: \$4,689,000
Biotechnology Person-Years 1991-92: 59.0 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
O&M	3,725.0	50.0	3,875.0	52.0	4,400.0	59.0
BIOFOR Network	25.0	-	25.0	-	25.0	-
SUB-TOTAL	3,750.0	50.0	3,900.0	52.0	4,425.0	59.0
Contracts	120.0	-	167.0	-	264.0	-
TOTAL	3,870.0	50.0	4,067.0	52.0	4,689.0	59.0

VII Department: Health and Welfare Canada

Headquarters: Tunney's Pasture
Ottawa, Ontario
K1A 0K9

Contact: See below

Total Biotechnology Budget 1989-90: \$8,154,800
Biotechnology Person-Years 1989-90: 113.1 PYs

Total Biotechnology Budget 1990-91: \$8,988,200
Biotechnology Person-Years 1990-91: 122.3 PYs

Total Biotechnology Budget 1991-92: \$9,460,900¹
Biotechnology Person-Years 1991-92: 120.1 PYs

**VIIa) Drugs Directorate
i) Bureau of Drug Research**

Contact: Director
(613) 957-1059

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Research in support of the regulatory approval process for biotechnology derived drugs:						
O&M	557.0	9.0	872.0	11.3	738.0	10.0
Capital	60.0	-	59.0	-	40.0	-
NBS Funds:						
BIONET Network	12.5	0.3	12.5	0.3	12.5	0.3
Capital	-	-	-	-	48.0	-
SUB-TOTAL	629.5	9.3	943.5	11.6	838.5	10.3
Contracts	-	-	5.0	-	-	-
TOTAL	629.5	9.3	948.5	11.6	838.5²	10.3

1 Includes \$70,500 received in transfer from NRC-IRAP NBS Funds.
2 Includes \$48,000 received in transfer from NRC-IRAP NBS Funds.

**VIIa) Drugs Directorate
ii) Bureau of Biologics**

Contact: Director
(613) 957-8065

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Regulatory approval for biotechnology derived drugs:						
O&M	3,053.8	50.0	2,973.8	48.0	3,263.3	48.0
Capital	192.8	-	236.8	-	185.6	-
SUB-TOTAL	3,246.6	50.0	3,210.6	48.0	3,448.9	48.0
Grants	312.4	-	306.4	-	306.4	-
Contracts	160.0	-	320.0	-	328.0	-
SUB-TOTAL	472.4	-	626.4	-	634.4	-
TOTAL	3,719.0	50.0	3,837.0	48.0	4,083.3	48.0

**VIIb) Laboratory Centre For Disease Control
Bureau of Microbiology**

Contact: Director
(613) 957-1329

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
O&M	2,020.0	-	2,250.0	-	2,419.0 ¹	-
Immunology	70.0	4.0	80.0	5.0	215.0	5.0
Bacteriology	100.0	10.0	120.0	10.0	82.0	10.0
Sexually Transmitted Diseases	140.0	6.0	200.0	7.0	225.0	7.0
Special Pathogens	190.0	10.0	250.0	10.0	150.0	12.0
Viral Oncology	60.0	5.0	70.0	6.0	160.0	6.0
Enteric Pathogens	140.0	10.0	145.0	12.0	110.0	10.0
TOTAL	2,720.0	45.0	3,115.0	50.0	3,361.0	50.0

¹ Includes \$19,000 received in transfer from NRC-IRAP NBS Funds.

VIIc) Food Directorate

Contact: Director General
(613) 957-1821

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Research in support of regulations (toxicology, microbiology and nutrition)	216.9	3.5	326.7	4.0	323.6	4.5
Contracts	12.0	-	14.0	-	14.0	-
TOTAL	228.9	3.5	340.7	4.0	337.6	4.5

**VIIId) Environmental Health Directorate
Bureau of Chemical Hazards**

Contact: Director
(613) 957-3133

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Development of regulations, assessment methods, and assessment of potential health impacts of biotechnology products:						
O&M	253.0	4.2	246.3	5.2	403.6	5.9
Capital	11.0	-	.3	-	15.4	-
Development and improvement of toxicology methods for mutagenicity:						
O&M	111.4	1.1	224.2	3.5	101.6	1.3
Capital	305.5	-	20.6	-	3.3 ¹	-
SUB-TOTAL	680.9	5.3	578.9	8.7	523.9	7.2
Contracts	176.5	-	255.6	-	316.6	-
TOTAL	857.4	5.3	834.5	8.7	840.5	7.2

¹ Includes \$3,500 received in transfer from NRC-IRAP NBS Funds.

VIII Department: Industry, Science and Technology Canada

Contact: Director
Biotechnology Directorate
(613) 954-3042

Total Biotechnology Budget 1989-90: \$617,400
Total Biotechnology Budget 1990-91: \$1,480,300
Total Biotechnology Budget 1991-92: \$5,094,900

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Grants and Contributions			
Technology Outreach Program (TOP)	93.4	77.0	103.9
Strategic Technologies Program (STP) - Biotechnology	200.0	688.3	4,302.0
National Biotechnology Advisory Committee (NBAC)	200.0	200.0	200.0
National Biotechnology Strategy (NBS)	104.0	99.0	99.0
Advocacy and Business Intelligence	20.0	416.0	390.0
TOTAL	617.4	1,480.3	5,094.9

IX **Department:** **International Development Research Centre**

Contact: Program Officer
250 Albert Street
P.O. Box 8500
Ottawa, Ontario
K1G 3H9
(613) 236-6163

Total Biotechnology Budget 1989-90: \$808,100
Total Biotechnology Budget 1990-91: \$209,000
Total Biotechnology Budget 1991-92: \$315,300

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Support for Scientific and Technical Research in Biotechnology into the needs of Developing Countries	808.1	209.0	315.3

X **Department:** Investment Canada

Contact: Director
Investment Development Division
(613) 995-0306

Total Biotechnology Budget 1989-90: \$157,000
Total Biotechnology Budget 1990-91: \$226,000
Total Biotechnology Budget 1991-92: \$160,000

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Contributions	157.0	226.0	160.0

XI Department: Labour Canada

Headquarters: Place du Portage, Phase II
165 Hôtel de Ville Street
Hull, Quebec
K1A 0J2

Contact: Director
Technical Services Division
(613) 997-3265

Total Biotechnology Budget 1989-90: \$22,000
Biotechnology Person-Years 1989-90: 0.3 PYs

Total Biotechnology Budget 1990-91: \$72,000
Biotechnology Person-Years 1990-91: 0.3 PYs

Total Biotechnology Budget 1991-92: \$72,000
Biotechnology Person-Years 1991-92: 0.3 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
A-Base Funds						
O&M	22.0	0.3	22.0	0.3	22.0	0.3
National Biotechnology Strategy Funds						
Occupational Safety and Health Steering Committee on Biotechnology	-	-	50.0	-	50.0	-
TOTAL	22.0	0.3	72.0	0.3	72.0	0.3

XII Department: Medical Research Council

Contact: Director
Program Branch
(613) 954-1959

Total Biotechnology Budget 1989-90: \$44,461,000

Total Biotechnology Budget 1990-91: \$48,863,000

Total Biotechnology Budget 1991-92: \$51,210,000

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Grants	44,461.0	48,863.0	51,210.0

XIII Department: National Defence

Headquarters: Constitution Building
305 Rideau Street
Ottawa, Ontario
K1A 0K2

Contact: Project Manager
Industrial Research Program
(613) 996-2839

Head
Biomedical Defence Section
(403) 544-4000

Total Biotechnology Budget 1989-90: \$343,000
Biotechnology Person-Years 1989-90: 5.8 PYs

Total Biotechnology Budget 1990-91: \$371,000
Biotechnology Person-Years 1990-91: 5.8 PYs

Total Biotechnology Budget 1991-92: \$600,000
Biotechnology Person-Years 1991-92: 5.0 PYs

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ¹					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
<u>In-House</u>						
Defence against CB Warfare	153.0	5.8	126.0	5.8	204.0	5.0
Contracts	190.0	-	245.0	-	396.0	-
TOTAL	343.0	5.8	371.0	5.8	600.0	5.0

1 Do not include salaries.

XIV Department: National Research Council Canada

Headquarters: 100 Sussex Drive
Ottawa, Ontario
K1A 0R6

Contact: Vice-President
Physical and Life Sciences
(613) 993-9244

Total Biotechnology Budget 1989-90: \$38,170,300
Biotechnology Person-Years 1989-90: 558.9 PYs

Total Biotechnology Budget 1990-91: \$32,987,800
Biotechnology Person-Years 1990-91: 562.8 PYs

Total Biotechnology Budget 1991-92: \$30,341,400
Biotechnology Person-Years 1991-92: 544.0 PYs

XIVa) Biotechnology Research Institute, Montreal, Quebec

Contact: Director General
(514) 496-6101

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Biochemical Engineering	1,594.0	50.0	1,216.0	50.0	1,117.0	50.0
Genetic Engineering	1,591.0	46.0	1,382.0	46.0	1,211.0	44.0
Protein Engineering	2,814.0	43.0	1,175.0	42.0	2,094.0	41.0
Molecular Immunology	727.0	13.0	521.0	13.0	344.0	13.0
Pilot Plant	850.0	15.0	1,546.0	15.0	1,372.0	15.0
Administration and Support	4,488.0	35.0	3,992.0	39.0	3,788.0	41.0
TOTAL	12,064.0	202.0	9,832.0	205.0	9,926.0	204.0

XIVb) Institute for Biological Sciences, Ottawa, Ontario

Contact: Director General
(613) 993-6005

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Biomedical NMR	1,530.0	42.0	1,317.0	20.0	429.0	16.0
Cell Systems	-	-	812.0	45.0	567.0	36.0
Protein Structure and Design	1,558.0	52.0	944.0	41.0	687.0	41.0
Structural Immunology	1,006.0	52.0	283.0	31.0	590.0	31.0
Administration and Support	2,639.0	32.0	2,328.0	40.0	2,114.0	33.0
TOTAL	6,733.0	178.0	5,684.0	177.0	4,387.0	157.0

XIVc) Plant Biotechnology Institute, Saskatoon, Saskatchewan

Contact: Director General
(306) 975-4191

BIOTECHNOLOGY ACTIVITY	EXPENDITURES					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Gene Technology	610.0	28.0	620.0	27.0	580.0	27.0
Cell Technology	491.0	26.0	527.0	27.0	590.0	27.0
Biological Chemistry	641.0	28.0	605.0	25.0	530.0	25.0
Transgenic Plant Centre	492.0	3.0	373.0	3.0	600.0	3.0
Administration and Support	2,130.0	23.0	2,157.0	25.0	1,924.0	24.0
TOTAL	4,364.0	108.0	4,282.0	107.0	4,224.0	106.0

XIVd) Institute for Marine Biosciences, Halifax, Nova Scotia

Contact: Director General
(902) 426-8278

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)					
	1989-90		1990-91		1991-92	
	\$(000)	PY	\$(000)	PY	\$(000)	PY
Analytical Chemistry	954.0	8.8	513.0	10.5	540.0	12.1
Biological Chemistry	1,096.0	17.8	553.0	20.8	918.0	19.1
Marine Biology	524.0	22.8	380.0	23.0	481.0	23.4
Administration and Support	1,394.0	21.5	1,526.0	19.5	1,556.0	22.4
TOTAL	3,968.0	70.9	2,972.0	73.8	3,495.0	77.0

XIVe) 1. Industrial Research Assistance Program

Contact: Director
National Elements
(613) 993-1790

2. NRC Biotechnology Program Office

Contact: Director
(514) 496-6233

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
1. IRAP - Biotechnology Development Program	6,942.2	5,693.8	4,808.4
Administration and Support	347.1	275.0	250.0
SUB-TOTAL	7,289.3	5,968.8	5,058.4
2. NRC - Biotechnology Contribution Program	3,500.0	3,895.0	2,850.0
Administration and Support	252.0	354.0	401.0
SUB-TOTAL	3,752.0	4,249.0	3,251.0
TOTAL	11,041.3	10,217.8	8,309.4

XV Department: Natural Sciences and Engineering Research Council

Contacts: Director
Strategic Grants and Networks
(613) 996-2717

Strategic Grants Officer
Targeted Research Directorate
(613) 996-7198

Total Biotechnology Budget 1989-90: \$24,888,000¹
Total Biotechnology Budget 1990-91: \$26,607,000²
Total Biotechnology Budget 1991-92: \$27,129,000

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Research Grants Program	14,769.0	13,891.0	15,181.0
Strategic Grants Program	6,780.0	8,771.0	8,047.0
Research Partnership Program	3,259.0	3,746.0	3,748.0
Infrastructure Grants	80.0	199.0	153.0
TOTAL	24,888.0¹	26,607.0²	27,129.0

- 1 Includes \$500,000 received in transfer from the NRC/IRAP NBS Funds.
- 2 Includes \$121,000 received in transfer from the NRC/IRAP NBS Funds.

XVI Department: Western Economic Diversification Canada

Contact: Director General
Agriculture
Saskatoon, Saskatchewan
(306) 975-5937

Total Biotechnology Budget 1989-90: \$101,100
Total Biotechnology Budget 1990-91: \$636,300
Total Biotechnology Budget 1991-92: \$2,006,700

BIOTECHNOLOGY ACTIVITY	EXPENDITURES \$(000)		
	1989-90	1990-91	1991-92
Grants	11.1	575.2	503.8 ¹
Repayable Contributions	90.0	61.1	1,502.9
TOTAL	101.1	636.3	2,006.7

1 To April 22, 1991.

SECTION 2:

ELEVEN-YEAR SUMMARY OF TOTAL BIOTECHNOLOGY PROGRAM

EXPENDITURES BY DEPARTMENT/AGENCY

1981-92

I Agriculture Canada

YEAR	EXPENDITURES \$(000)			
	In-House	Contracts	Grants/ Contributions	Total
1984-85 ¹	145.0	50.0	-	195.0
1985-86	5,350.9	50.0	40.0	5,440.9
1986-87	7,000.5	50.0	110.0	7,160.5
1987-88	5,322.7	102.3	200.0	5,625.0
1988-89	5,151.5	225.0	166.0	5,542.5
1989-90	19,973.2	-	-	19,973.2
1990-91	23,033.7	-	-	23,033.7
1991-92	22,611.7	-	-	22,611.7

1 Biotechnology was not isolated as a discrete expenditure until 1984-85.

II Consumer and Corporate Affairs

YEAR	EXPENDITURES \$(000)
1989-90 ¹	401,000.0
1990-91	418,000.0
1991-92	435,000.0

1 Biotechnology was not isolated as a discrete expenditure until 1989-90.

III Energy, Mines and Resources

YEAR	EXPENDITURES \$(000)		
	In-House	Contracts	Total
1981-82	15.0	100.0	115.0
1982-83	30.0	75.0	105.0
1983-84	40.0	785.0	825.0
1984-85	75.0	1,025.0	1,100.0
1985-86	75.0	1,200.0	1,275.0
1986-87	300.0	1,075.0	1,375.0
1987-88	300.0	1,075.0	1,375.0
1988-89	420.0	1,325.0	1,755.0
1989-90	615.0	2,100.8	2,715.8
1990-91	720.0	2,367.0	3,087.0
1991-92	670.0	2,171.5	2,841.5

IV Environment Canada

YEAR	EXPENDITURES \$(000)			
	In-House	Contracts	Grants/Contributions	Total
1983-84 ¹	709.0	290.0	63.0	1,062.0
1984-85	1,050.0	313.0	113.0	1,476.0
1985-86	726.0	255.0	291.0	1,272.0
1986-87	591.0	325.0	-	916.0
1987-88	969.5	97.0	-	1,066.5
1988-89	737.0	429.8	55.0	1,221.8
1989-90	1,104.3	150.0	-	1,254.3
1990-91	1,385.5	400.0	-	1,785.5
1991-92	1,301.2	325.0	-	1,626.2

1 Biotechnology was not isolated as a discrete expenditure until 1983-84.

V Fisheries and Oceans Canada

YEAR	EXPENDITURES \$(000)			
	In-House	Contracts	Grants/Contributions	Total
1982-83 ¹	-	30.0	-	30.0
1983-84	-	197.0	-	197.0
1984-85	-	107.0	11.0	118.0
1985-86	75.0	88.0	8.0	171.0
1986-87	144.0	104.5	-	248.5
1987-88	209.0	114.4	-	323.4
1988-89	216.9	85.0	-	301.9
1989-90	241.9	42.3	-	284.2
1990-91	330.0	121.6	-	451.6
1991-92	258.0	165.5	-	423.5

1 Biotechnology was not isolated as a discrete expenditure until 1982-83.

VI Forestry Canada

YEAR	EXPENDITURES \$(000)		
	In-House	Contracts	Total
1981-82 ¹	110.0	116.0	227.0
1982-83 ¹	224.0	166.0	390.0
1983-84 ¹	176.0	104.0	280.0
1984-85 ¹	362.0	359.0	721.0
1985-86 ¹	323.0	300.0	623.0
1986-87 ¹	343.0	177.0	520.0
1987-88 ¹	367.0	147.0	514.0
1988-89 ¹	400.0	57.0	457.0
1989-90	3,750.0	120.0	3,870.0
1990-91	3,900.0	167.0	4,067.0
1991-92	4,425.0	264.0	4,689.0

1 Some groups involved in biotechnology were not included in the years 1981 through 1989.

VII Health and Welfare Canada

YEAR	EXPENDITURES \$(000)			
	In-House	Contracts	Grants/Contributions	Total
1981-82	45.0	-	-	45.0
1982-83	66.0	-	-	66.0
1983-84	178.0	-	-	178.0
1984-85	200.0	33.0	-	233.0
1985-86	324.0	27.0	-	351.0
1986-87	1,487.0 ¹	23.0	-	1,510.0
1987-88	1,620.0	40.0	14.0	1,674.0
1988-89	1,611.4	210.9	-	1,822.3
1989-90	7,493.9	348.5	312.4	8,154.8
1990-91	8,087.2	594.6	306.4	8,988.2
1991-92	8,359.8	794.7	306.4	9,460.9 ²

1 Some groups involved in biotechnology activities were not included in the years 1981 through 1986.

2 Includes \$70,500.00 received in transfer from NRC-IRAP NBS Funds.

VIII Industry, Science and Technology Canada

YEAR	EXPENDITURES \$(000)		
	In-House	Grants/Contributions	Total
1981-82	-	1,900.0	1,900.0
1982-83	-	4,000.0	4,000.0
1983-84	-	1,900.0	1,900.0
1984-85	-	2,600.0	2,600.0
1985-86	-	3,000.0	3,000.0
1986-87	200.0	2,100.0	2,300.0
1987-88	400.0	3,800.0	4,200.0
1988-89	200.0	2,400.0	2,600.0
1989-90	324.0	293.4	617.4
1990-91	715.0	765.3	1,480.3
1991-92	689.0	4,405.9	5,094.9

IX International Development Research Centre

YEAR	EXPENDITURES \$(000)
1989-90 ¹	808,099.0
1990-91	209,000.0
1991-92	315,280.0

1 Biotechnology was not isolated as a discrete expenditure until 1989-90.

X Investment Canada

YEAR	EXPENDITURES \$(000)
1989-90 ¹	157.0
1990-91	226.0
1991-92	160.0

1 Biotechnology was not isolated as a discrete expenditure until 1989-90.

XI Labour Canada

YEAR	EXPENDITURES \$(000)
1989-90 ¹	22.0
1990-91	72.0
1991-92	72.0

1 Biotechnology was not isolated as a discrete expenditures until 1989.

XII Medical Research Council

YEAR	EXPENDITURES \$(000)		
	Awards and Specific Grants	Grants/Contributions	Total
1984-85 ¹	217.0	8,000.0	8,217.0
1985-86	977.0	20,000.0	20,977.0
1986-87	982.0	27,000.0	27,988.0
1987-88	1,023.0	35,000.0	36,023.0
1988-89	514.0	41,000.0	41,514.0
1989-90	-	44,461.0	44,461.0
1990-91	-	48,863.0	48,863.0
1991-92	-	51,210.0	51,210.0

1 Biotechnology was not isolated as a discrete expenditure until 1984-85.

XIII National Defence

YEAR	EXPENDITURES \$(000)		
	In-House	Contracts	Total
1986-87 ¹	180.0	250.0	430.0
1987-88	200.0	185.0	385.0
1988-89	240.0	250.0	490.0
1989-90	153.0	190.0	343.0
1990-91	126.0	245.0	371.0
1991-92	204.0	396.0	600.0

1 Biotechnology was not isolated as a discrete expenditure until 1986-87.

XIV National Research Council, NRC-BCP and IRAP-BDP

YEAR	EXPENDITURES \$(000)			
	In-House	Contracts	Grants/Contributions	Total
1981-82	6,200.0	8,600.0	-	14,800.0
1982-83	6,850.0	8,830.0	-	14,686.0
1983-84	7,728.0	12,060.0	-	19,788.0
1984-85	10,393.0	14,040.0	1,500.0	25,933.0
1985-86	10,894.0	12,620.0	1,500.0	25,014.0
1986-87	13,590.0	1,225.0	5,980.0	20,795.0
1987-88	18,795.0	1,315.0	4,783.0	24,893.0
1988-89	20,010.0	1,650.0	8,934.0	30,594.0
1989-90	27,129.0	-	11,041.3	38,170.3
1990-91	22,770.0	-	10,217.8	32,987.8
1991-92	22,032.0	-	8,309.4	30,341.4

XV Natural Sciences and Engineering Research Council

YEAR	EXPENDITURES \$(000)						
	Strategic Grants	Operating Grants	Infrastructure Grants	URF Program	Univ. Industry Program	R&D Program	Total
1983-84 ¹	3,638.0	7,217.0	-	236.0	-	50.0	11,141.0
1984-85	4,488.0	7,464.0	-	304.0	237.0	35.0	12,529.0
1985-86	4,451.0	9,320.0	222.0	413.0	309.0	50.0	15,766.0
1986-87	4,697.9	9,577.0	225.0	350.6	16.8	51.5	15,820.0
1987-88	5,238.5	9,826.8	187.2	229.7	248.6	-	16,731.0
1988-89	5,223.4	11,526.1	187.2	142.5	2,745.0	-	19,824.3 ²
1989-90	6,780.0	-	80.0	-	3,259.0	14,769.0	24,888.0 ³
1990-91	8,771.0	-	199.0	-	3,746.0	13,891.0	26,607.0 ⁴
1991-92	8,047.0	-	153.0	-	3,748.0	15,181.0	27,129.0

- 1 Biotechnology was not isolated as a discrete expenditure until 1983-84.
- 2 Includes \$621,000 transferred from NRC-IRAP.
- 3 Includes \$500,000 transferred from NRC-IRAP.
- 4 Includes \$121,000 transferred from NRC-IRAP.

XVI Western Economic Diversification Canada

YEAR	EXPENDITURES \$(000)
1989-90 ¹	101.1
1990-91	900.1
1991-92	3,377.4

1 Biotechnology was not isolated as a discrete expenditure until 1989-90.

SECTION 3:

**SUMMARY NOTES ON ACTIVITIES, EXPENDITURES AND PERSON-YEARS
IN BIOTECHNOLOGY BY DEPARTMENT/AGENCY,
FISCAL YEAR 1991-92**



A. Agriculture Canada

Activities:

- Resource research: gene resources (intramural \$2,113,300);
- Animal research: production, reproduction, nutrition, health (\$4,041,800);
- Plant research: crop improvement, nitrogen fixation, weed, insect and disease biocontrol (intramural \$12,845,200);
- Food research: production, processing, nutrition, food safety (intramural \$1,451,400); and,
- Regulatory research: diagnostics, techniques (intramural \$420,000).

1991-92 Expenditures: \$22,611,700
1991-92 Person-Years: 352.7 PYs

B. Atlantic Canada Opportunities Agency (ACOA)

Activities:

- The Atlantic Canada Opportunities Agency is directly responsible for federal funding of small and medium-sized business and, industrial development policy and programs in Atlantic Canada. Innovation and technology transfer are top priorities of the Agency. Cooperation Agreements with Agriculture Canada, Fisheries and Oceans Canada, Forestry Canada, and, Energy, Mines and Resources Canada have biotechnology components. Also, the Innovation Element of the Action Program and the Fisheries Alternative Program can support innovative biotechnology projects.

C. Consumer and Corporate Affairs Canada (CCAC)

Activities:

- Subject to the *Patent Act* and Patent Office practice, applications and the granting of intellectual property rights (patents) in respect of any new and useful art, process, machine, manufacture of composition of matter, or any new and useful improvement in any art, process, machine, manufacture or composition of matter are reviewed.

- Through the publication of the contents of patent documents granted and through the patent search facilities of the Information and Technology Exploitation Branch, information on the state of the art in any given technology and assistance to individuals and firms in the determination of viable research projects is disseminated.
- Canada's intellectual property laws including the *Patent Act* are modernized and harmonized through the use of the consultative mechanism, the Intellectual Property Advisory Committee (IPAC). Canada's policy on IP protection is formulated with other stakeholders for negotiation in international trade forums such as the GATT-TRIPs and NAFTA.
- The Bureau of Consumer Affairs is participating in the federal policy-making process in the area of biotechnology to ensure that consumers' concerns about health and safety are given full consideration. In the absence of a clear understanding of consumers' concerns about genetically-engineered and other biotechnology products, the commercialization of domestic and import biotechnology products could be unsuccessful. Establishing marketplace rules which enable consumers to make informed choices when purchasing goods produced through biotechnology is therefore an important objective of the coming years. While the Bureau has initiated market watch activities, the development of a framework that will seek to maintain consumer confidence in genetically-engineered products and to monitor biotechnology advances is the next step.

While no specific program operated by the Department focuses solely on biotechnology, both the Patent Office and the Intellectual Property Review Branch devote considerable resources to addressing the patentability of biotechnological inventions, to dissemination of technological information, and to consideration of the most appropriate legislative framework for the patenting of inventions in Canada.

<i>1991-92 Expenditures:</i>	\$435,000
<i>1991-92 Person-Years:</i>	6.0 PYs

D. Energy, Mines and Resources Canada (EMR)

Activities:

- Metal recovery from effluent;
- Microbial degradation of pollutants;
- Passive biological mitigation of acid mine drainage;
- Immobilized fungal adsorption of uranium;

- Biocorrosion; and
- Biomass Energy Program.

The Coal Research Laboratory's work on microbial methane degradation ended at the end of fiscal 1988-89. This laboratory was recently renamed the Western Research Centre (WRC) and has begun a program involving toxicity measurement and control in tar sands process wastes.

During 1990-92 CANMET developed processes for the treatment of three pollutants in liquid effluent that are produced by the mining industry. In addition, contracting-in during 1991-92 earned CANMET \$43,000.

CANMET trained six students and one person from industry in biotechnology procedures. One staff member also participated in a nine-month secondment to a Japanese biotechnology laboratory.

During 1991-92 the CANMET biotechnology group either completed, or had under way, five cost recovery projects for \$62,000, and is currently negotiating projects valued at \$140,000. Ties with industry have been significantly strengthened during the past three years.

1991-92 Expenditures: \$2,841,500
1991-92 Person-Years: 9.0 PYs

E. Environment Canada

Activities:

- Development of regulatory tools including ways to test for effects on nontarget organisms in microcosms, investigation of experimental environmental study endpoints, uses of markers, monitoring methods and analyses of effluent and investigation of resources for reviews such as the development of profiles of key genera and databases;
- Development of regulations for biotechnology products that fall under the *Canadian Environmental Protection Act (CEPA)*;
- Continuation of the administration of BIOQUAL, the Network for environmental quality; and
- Research and development on methods for pollution control and degradation of toxic chemicals and other aspects of bioremediation including treatability studies.

1991-92 Expenditures: \$1,626,200
1991-92 Person-Years: 16.7 PYs

F. External Affairs and International Trade Canada (EAITC)

Activities:

- International activities are supported and coordinated through a network of S&T counsellors and technology development officers at 36 Canadian Missions abroad.
- Biotechnology is a key activity in international bilateral S&T cooperation arrangements as well as in the Department's involvement in multilateral S&T activities (e.g. Organization for Economic Co-operation and Development, Human Frontier Science Program).
- The Department and NRC/IRAP are jointly responsible for managing the Technology Inflow Program, which is aimed at helping private sector organizations acquire emerging technologies (including biotechnology) from abroad.
- The Department performs an important catalytic and coordinating function in bringing together the science-based departments and agencies to discuss international S&T initiatives/priorities. The Interdepartmental Committee on International Science and Technology Relations (ICISTR), is chaired by the Director General of the Trade Competitiveness Bureau. This Committee acts as a forum for discussing the Canadian government's international S&T policies and priorities.

1991-92 Biotechnology Expenditures:

There is no program specifically aimed at biotechnology but, under the Technology Inflow Program (TIP), the Going Global Strategy (Japan S&T Fund and Europe 1992 S&T Initiatives) and the International Partnerships Programs, resources are available for promoting S&T collaboration in biotechnology.

The Technology Inflow Program:

The objective of the program is to promote the acquisition of foreign technologies to develop new or improved Canadian products, processes or services within small and medium-sized companies. The support available is 75% of eligible costs to a maximum of \$10,000. In some instances, this amount can be exceeded. The TIP can be used for the following activities:

- visits abroad (up to three representatives from small and medium-sized enterprises);
- visits from foreign companies to transfer technology; and
- visits abroad by a technology specialist to learn about new technology.

Going Global:

Under the "Going Global" strategy, two programs provide financial assistance to stimulate S&T cooperation in several areas of interest, including biotechnology: the Japan Science and Technology Fund (JSTF) and the Europe 1992 Science and Technology Initiatives.

The JSTF supports:

- long-term researcher exchanges with Japan;
- short-term visits leading to the development of new projects or the advancement of an existing collaboration;
- the Canadian component of a joint project;
- bilateral workshops; and
- language training for Canadian researchers participating in exchanges.

The fund has a budget of \$26.5 million for fiscal years 1989-94.

The Europe 1992 Science and Technology Initiatives support incremental costs associated with public and private-sector initiatives to implement joint R&D projects with European partners. The budget is \$2.2 million for fiscal years 1989-94.

International Partnerships Programs:

The International Partnership Programs are measures aimed at implementing the Green Plan obligations in the context of the Canadian priorities of both sustainable development and competitiveness. The International Partnerships Programs are composed of three funds:

- a Multilateral Contributions and Negotiations Funds to strengthen international organizations concerned with the environment to ensure they respond to Canadian interests. The total budget for fiscal years 1991-92 to 1996-97 is \$31.648 million;
- a Bilateral Initiative Fund to expand bilateral environmental relations with countries which have a direct impact on Canada's environment. The total budget for fiscal years 1991-92 to 1996-97 is \$10.392 million; and
- an Environmental Technology Transfer Opportunities Fund to facilitate the transfer of Canadian technology and expertise to other countries. The total budget for fiscal years 1991-92 to 1996-96 is \$8.645 million.

G. Fisheries and Oceans Canada

Activities:

- Investigation of the relationship between the levels of C-reactive Protein in fish blood and the general level of health of cultured animals and development of an ELISA test for an acute phase protein serum amyloid;
- Research at the Centre of Disciplinary Expertise (CODE) in Biotechnology and Genetics in Aquaculture, including:
 - . studies on transgenic salmon;
 - . chromosome set manipulation to induce gynogenesis, tetraploidy, etc., in Pacific salmon; other methods to control the sex of fish;
 - . developments of methods to accelerate the growth rate of fish;
 - . development of methods to control maturation; and
 - . stock identification;
- AQUATECH '91 Fisheries and Marine Biotechnology Network meeting in Montreal, Quebec;
- AQUATECH '92 Fisheries and Marine Biotechnology Network meeting in Halifax, Nova Scotia.

Fisheries and Oceans was also involved in training:

TYPE OF TRAINEE	NUMBER OF PERSONS TRAINED		
	1989-90	1990-91	1991-92
Post-Doctoral Fellows	3	2	5
Graduate Students	5	9	7
Lab Technicians	2	5	4
Coop Students	4	7	6
Job Development Program	-	2	2
Visiting Scientists	2	4	3
TOTAL	16	29	27

1991-92 Expenditures: \$423,500

1991-92 Person-Years: 7.2 PYs

H. Forestry Canada

Activities:

- Research carried out at six regional laboratories and two institutes across Canada;
- Forest production: somatic embryogenesis, micropropagation, gene regulation and molecular genetics for tree improvement and growth enhancement;
- Pest management: biological pest control agents, environmental fate; and
- Coordination of the BIOFOR Network in forest biotechnology.

1991-92 Expenditures: \$4,689,000

1991-92 Person-Years: 59.0 PYs

I. Health and Welfare Canada

Activities:

- Regulation and assessment of food, drugs, cosmetics, medical devices and diagnostic radiopharmaceuticals derived through biotechnology;
- Basic and applied research (molecular genetics, immuno-chemistry, microbiology, physiology, molecular biophysics and biochemistry, biomathematics) in support of regulations (drugs, food);
- Advice to industry and other federal agencies;
- Inspection of drug plants;
- Testing of human and veterinary drugs;
- Monitoring of health status of population and disease control;
- Evaluation of potential human health hazards of microbial pesticides;
- Development of notification regulations and assessment procedures for biotechnology products under CEPA (in collaboration with Environment Canada); and
- Networking (BIONET).

1991-92 Expenditures: \$9,460,900

1991-92 Person-Years: 120.1 PYs

J. Industry, Science and Technology Canada (ISTC) - Biotechnology Directorate

In October 1991, the Strategic Technologies Planning Division of the Policy Branch was reorganized for more effective functioning and coordination of government programs. The Biotechnology Policy Group, which had been part of the Strategic Technologies Directorate, was transferred to the Biotechnology Directorate, in the Chemicals and Bio-Industries Branch.

Activities:

- The Directorate:
 - i) facilitates investment in commercial biotechnology and provides funding for alliances in pre-commercial biotechnology development projects between industry and other interested partners, including universities and other research organizations. The major vehicle for this effort is the Strategic Technologies Program (STP) which was created in 1989;
 - ii) plays an advocacy role for the Canadian biotechnology industry with federal government regulators, and international bodies, such as the Organization for Economic Co-operation and Development and the European Economic Community;
 - iii) administers the National Biotechnology Strategy (NBS) with responsibility for: co-ordinating the biotechnology research of the federal departments and agencies, maintaining a strong research base for the development of biotechnology, increasing the supply of highly qualified personnel, enhancing scientific cooperation and technology transfer between government, university laboratories and industry, supporting research and the development of regulations for the products and processes of biotechnology, and encouraging networking across industry, academia and government through eight National Biotechnology Networks; and
 - iv) has responsibility for providing Secretariat services for the Interdepartmental Committee on Biotechnology and its sub-groups, the Biotechnology Coordinating Group, the Sub-Group on Safety and Regulations in Biotechnology and the eight National Biotechnology Strategy Networks.

- The NBS funds, \$11.9 million allocated directly to departments from Treasury Board, are represented in the various reports from the departments in this document. The funding ISTC receives is used to provide Secretariat services for the Interdepartmental Committees as well

as coordinating and assisting the regulatory departments with special activities, such as the publication "Biotechnology Regulations: A Users' Guide."

- A member of the Directorate is the lead for the Canadian delegation to National Group of Experts on Safety in Biotechnology, OECD. NBS funds held by ISTC help to defray travel costs of the members.
- An evaluation of the NBS carried out in 1991 by an outside consultant indicated that the Strategy has been very worthwhile and that the Networks have been very successful. The consultant suggested that a change in focus, such as towards increasing expenditures for research into regulations, may be appropriate at this time.
- A principal responsibility is providing Secretariat services for the National Biotechnology Advisory Committee (NBAC), a group of senior businessmen and academics who provide advice to the Minister for Science.

Established in 1983, the NBAC was restructured in May 1989 and charged with a mission to create a national biotechnology business strategy for Canada. The Committee has produced two major reports in the last two years: i) the Fourth Report, 1989-90, sub-titled, "Towards A National Biotechnology Business Strategy: The Process"; and ii) the Fifth Report, 1991, "National Biotechnology Business Strategy: Capturing Competitive Advantage for Canada". Additional supplementary reports were also produced in conjunction with the above reports.

Over the past two years, the NBAC has met in Toronto, Calgary, Montreal and Ottawa. In addition, there have been meetings of the Steering Committee and Working Groups in the areas of Intellectual Property and Regulations, Finance, Agri-business and Food, Waste Treatment, and Forestry, held in Toronto, Vancouver, Burlington and Ottawa.

Committee members have been meeting with various ministers and senior management officials regarding relevant recommendations in the Business Strategy. They have also been meeting with stakeholders across Canada in the financial community, various provincial ministries, research organizations, universities, and Cabinet committees in order to inform them of the recommendations and to seek support in their implementation.

<i>1991-92 Expenditures:</i>	\$5,094,900
<i>1991-92 Person-Years:</i>	11.0 PYs

K. International Development Research Centre

Activities:

- Scientific and technical research into the needs of developing countries was supported.
- Areas in which Canadian institutions receive support include plant breeding, animal genetics, fish culture, waste treatment, medicine and information science (relating to biotechnology activities).
- Of 21 projects supported in biotechnology between 1989-90 and 1992-93, eight have involved Canadian institutions, specifically five universities and one hospital. The total IDRC expenditure for biotechnology research during this period was just over \$5 million CAD, of which over 20% was spent in Canadian institutions.

Expenditures: \$1,332,379

L. Investment Canada

Activities:

All activities were to assist Canadian firms in forming partnerships with foreign firms. These partnerships usually involved a mixture of investment, trade and technology considerations:

- promotion of Canadian firms in Europe with a view to forming investment, joint ventures and alliances;
- organization of a major promotion event at the Association of Biotechnology Companies' Conference (U.S.) in Toronto;
- support for biotechnology missions;
- development of biotechnology investment prospecting kit which is part of a project to attract foreign investment in Canada and strategic alliances with Canadian firms and institutes; and
- development of support for the Bio-Recognition conference.

1991-92 Expenditures: \$160,000

M. Labour Canada

Activities:

Labour Canada established the Occupational Safety and Health (OSH) Steering Committee on Biotechnology in 1989. This is a stakeholder Committee with representatives from industry, organized labour, academia, provincial governments and the federal government. The Committee organized a symposium on the OSH aspects of biotechnology in March 1991 in Montreal.

The proceedings of the symposium are being printed. Also, based on the discussions during the symposium, the Steering Committee drafted a list of concerns, and prioritized them. Utilizing the funds obtained through the National Biotechnology Strategy Fund, contracts have been awarded to study some of the high priority concerns.

The topics under study are:

- assessing potential risks to the health of workers from biological agents (natural or modified) in workplaces;
- the potential risk to the health of workers from contamination of products peculiar to biotechnological processes, e.g. tryptophan;
- the carcinogenicity of oncogenes and the potential risks to workers who might be handling them; and
- potential adverse health effects from polymerize chain reaction processes.

1991-92 Expenditures: \$72,000
1991-92 Person-Years: 0.3 PYs

N. Medical Research Council (MRC)

Activities:

The one formal mechanism to encourage and support research and training in biotechnology is through the Grants Program.

1991-92 Expenditures: \$51,210,000

O. National Defence (DND)

Activities:

The Defence and Civil Institute of Environmental Medicine (DCIEM), North York (Toronto), Ontario, undertook:

- Research relating to biomedical aspects of health hazards in Canadian Forces operational environments, particularly with respect to toxic contaminants in confined work spaces; liposome delivery of prophylactic and therapeutic drugs and biologics; and trauma immunology and biochemistry;
- Fundamental and applied research in immunology, liposome architecture and metabolism, mass spectrometry, toxicology, biochemistry, and industrial hygiene; and
- Advice to National Defence Headquarters, other government departments, and national agencies.

1991-92 Expenditures: \$600,000

1991-92 Person-Years: 5.0 PYs

P. National Research Council Canada (NRC)

Activities:

- The NRC's Biotechnology Program emphasizes strategic or generic research with a broad range of industrial applications. This research bridges the gap between basic science and the kind of applied research done in industry to develop specific products.
- The heart of the program is the leading-edge R&D work performed at the Plant Biotechnology Institute (PBI) in Saskatoon, the Institute for Biological Science (IBS) in Ottawa, the Biotechnology Research Institute (BRI) in Montreal, and the Institute for Marine Biosciences (IMB) in Halifax.
- PBI focuses on the biotechnology of plants; IBS performs frontier research in mammalian systems, BRI links itself with industry, and IMB concentrates on marine organisms and the environment.

- These four divisions employ over 700 scientists, engineers and support personnel.

1991-92 Expenditures: \$25,533,000
1991-92 Person-Years: 544.0 PYs

Q. Natural Sciences and Engineering Research Council (NSERC)

Activities:

There are five grant programs directly related to biotechnology:

- Operating Grants Program (individual and team);
- Infrastructure Grants Program;
- Strategic Grants Program;
- University Research Fellowships Program in animal biology, cell biology and genetics, and plant biology and chemistry; and
- Research Partnerships Program, which includes industrial research chairs and cooperative R&D projects.

1991-92 Expenditures: \$27,129,000

R. Western Economic Diversification Canada (WD)

Activities:

- The Department's mandate is to work towards the broadening of the economic base of Western Canada, and to act as an advocate for the region.
- Under the Western Diversification Program (WDP), assistance comes in the form of contributions. The amount of funding, as well as terms and conditions, varies from project to project and is subject to audit. Businesses of all sizes are eligible to apply.

- The National Agricultural Biotechnology Initiative (NABI) was implemented in September 1988 as a joint initiative of the federal government and the four western provinces.
- Up to \$50 million (\$25 million from the federal government through WD, plus contributions from provincial governments) is available to help support the commercialization of agricultural biotechnology.

1991-92 Expenditures: \$3,377,376

SECTION 4:

FUTURE ACTIVITIES IN BIOTECHNOLOGY



FUTURE ACTIVITIES IN BIOTECHNOLOGY

Agriculture Canada will continue research on applications of biotechnology to crop and livestock production and protection, food quality and nutrition and sustainability of the agricultural sector.

The **Atlantic Canada Opportunities Agency**, working in close cooperation with federal/provincial governments and with the private sector, will continue to be directly responsible for federal funding of small and medium-sized businesses and industrial development policy and programs in the Atlantic region. The Agency is evaluating biotechnology as a future strategic technology initiative.

Consumer and Corporate Affairs Canada, proposes to continue its activities in 1992-93 in the area of biotechnology and undertake a number of new initiatives. The Department intends to begin policy development work, including extensive research and consultations, on issues associated with the patenting of lifeforms. In addition, research will be undertaken to develop a clear understanding of consumer concerns and perceptions about biotechnological products.

Energy, Mines and Resources Canada will continue to work with industry through the BIOMINET Network. The Canada Centre for Mineral and Energy Technology (CANMET) has initiated a research program on biotechnology applications in fossil fuels and, through both in-house activities and contracts, is supporting research in treatment of refining wastes, microbial enhanced oil production and stress crack corrosion related to pipelines.

Environment Canada continues to work toward having in place a regulatory system under the *Canadian Environment Protection Act* for biotechnology products and uses not covered under existing legislation. These include microorganisms for bioremediation, enhanced oil recovery, metal recovery and pollution control. Environment Canada will continue to investigate regulatory tools needed for testing the environmental impact of biotechnology products including the importance of identification and concept of familiarity; and will continue to develop endpoints for specific testing requirements such as nontarget testing, fate testing, effects on natural cycles, gene transfer and genetic stability. Environment Canada will also continue research into the use of microorganisms in bioremediation of toxic chemicals and the protocols required to test product efficacy.

External Affairs and International Trade Canada will continue to support international S&T cooperation by allocating resources into its Going Global Strategy (Japan Strategic Technology Fund and Europe 1992 S&T Initiatives), the Technology Inflow Program and the International Partnerships Programme of the Green Plan.

Forestry Canada will focus future activities in biotechnology mainly on tree improvement programs; biocontrol agents; technology development in somatic embryogenesis; micropropagation; gene regulation; gene transfer; and gene libraries. This will involve legislative, regulatory, and impact aspects of this technology. Protocols will be developed to assess the environmental fate of biotechnology products in forest ecosystems.

Health and Welfare Canada will direct activities towards: modern analytical and biochemical techniques and methodologies for safety, efficacy and quality assessment of biotechnology produced food, drugs, therapeutic agents, microbial pesticides and biotechnology microorganisms reported under CEPA for use in industrial and environmental applications; new approaches to disease control; an understanding of the genetic and biochemical basis of disease; and policy in support of regulations for health care products.

Industry, Science and Technology will continue the following roles:

- **Advocacy:** as an advocate for industry in the field of biotechnology, ISTC will support efforts to resolve horizontal issues, such as the need for a more appropriate regulatory framework for biotechnology, intellectual property protection, problems of access to venture capital in all stages of company development, and insufficient numbers of highly qualified human resources. All of these factors are impeding the successful development, commercialization and marketing of biotechnology.
- **Risk Sharing:** funding from the STP and other programs such as TOP will continue to support and stimulate the Canadian biotechnology industry.
- **International Links:** ISTC will help to promote Canada's biotechnology profile as well as Canadian biotechnology firms internationally and will use the brokerage system and focused initiatives to facilitate commercial opportunities between Canada and the rest of the world through missions to Canada, one-on-one and case-by-case, and joint venture initiatives.
- **Canada** has recently initiated a Canadian Human Genome Program, which will be a part of the International Human Genome effort.

- **Liaison-Secretariat Support:** ISTC will continue its role in chairing the Interdepartmental Committee on Biotechnology and the various sub-committees. In addition, a mechanism for effectively monitoring the NBS Fund will be devised during the 1993-94 fiscal year.
- ISTC will support and guide the activities of the NBAC, as the Committee continues to seek the ways and means to implement the recommendations in its Fifth Report. New initiatives in other sectors such as aquaculture, mining and energy were planned at the Fall 1992 meeting of the Committee, in Winnipeg.
- Initiatives in the various sectors of ISTC, such as forestry, mining, pharmaceuticals and health care will have an increasing component involving biotechnology.

Investment Canada will continue to promote the development of Canada's biotechnology industry by promoting a variety of strategic alliances such as inward investment, joint ventures, licensing agreements, collaborative research, technology inflow and commercialization.

Labour Canada's activities will be governed by the Occupational Safety and Health (OSH) Steering Committee on Biotechnology. It is expected that the Committee will promote discussion of specific issues of concern, possibly on a regional or sectoral basis.

National Defence will continue to develop biotechnologies for the rapid identification/detection of chemical and biological (CB) agents, infectious microorganisms and toxins. In addition, the application of this technology to the delivery of therapeutic drugs will be investigated as will the use of the products of biotechnology for the removal/destruction of CB agents.

The **National Research Council's** mandate in biotechnology is to carry out research and development in collaboration with Canadian industries, universities and other government agencies to support national socioeconomic objectives. NRC does this through the integrated efforts of four institutes located across Canada: the Plant Biotechnology Institute in Saskatoon, Saskatchewan, the Institute for Biotechnological Sciences in Ottawa, Ontario, the Biotechnology Research Institute in Montreal, Quebec, and the Institute for Marine Biosciences in Halifax, Nova Scotia.

The Plant Biotechnology Institute focuses research on agriculture, forestry and the plant industries, doing research aimed at producing novel crop and forest plants and generating enabling technologies for testing these plants. These efforts are supported by the Institute's modern Transgenic Plant Facility.

The Institute for Biological Sciences performs frontier research in mammalian cell biosciences. The Institute's multidisciplinary approach, which covers areas such as protein engineering, structural immunobiology, and molecular\cell biology, is aimed at supporting the pharmaceutical and health industries.

The Biotechnology Research Institute concentrates its efforts in biochemical and molecular engineering, linking its aims to the market objectives of a broad cross-section of industry, environmental, forestry, agricultural, food, and pharmaceutical companies. Its is supported in its efforts by a state-of-the-art pilot plant equipped with a clean room and other Good Industrial Large Scale Practices and Good Manufacturing Facilities.

The Institute for Marine Biosciences concentrates its efforts on the utilization of marine resources and the protection of the marine environment. Research ranges from analytical and organic chemistry through to the biochemistry and biology of marine organisms. It is a world leader in the development of marine analytical standards and reference materials, and operates one of Canada's largest aquaculture research stations.

The Natural Sciences and Engineering Research Council Of Canada will continue to assist in the promotion and maintenance of a base of high-quality biotechnology research and in the provision and development of highly qualified biotechnology personnel. In addition, the council will maintain the area of biotechnology in its Strategic Grants Program, which promotes targeted research in selected fields of national importance. It will also continue to promote research partnerships among university, industrial and government biotechnology laboratories.

Western Economic Diversification Canada recognized that certain elements of the National Agricultural Biotechnology Initiative program needed to be redesigned in order to increase its effectiveness. Effective September 6, 1991 the following changes were implemented: agreement extended from September 30, 1991 to March 31, 1994; government assistance for projects no longer need to be cost shared on a 50% federal government and 50% provincial government basis; government assistance to eligible projects can be either funded jointly or funded by either level of government. Also, biotechnology projects from other sectors outside of agriculture can be considered in cases where there is a strong link to agriculture.

ANNEXES



**BIOTECHNOLOGY ACTIVITIES BY SECTOR
AND DEPARTMENT/AGENCY**

Sector	Agriculture									
	1989-90		1990-91			1991-92			% Change Over 3 Years	
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total		% Change
Agriculture		9,331.0	59.0	13,551.6	68.5	45.2	13,280.4	70.1	-2.0	42.3
EMR										
Environment										
Fisheries										
Forestry										
H&W										
Labour										
NRC		4,364.0	27.6	4,282.0	21.6	-1.9	4,224.0	22.3	-1.4	-3.2
NRC/IRAP		2,130.3	13.5	1,951.3	9.9	-8.4	1,449.4	7.6	-25.7	-32.0
TOTAL		15,825.3	100.0	19,784.9	100.0	25.0	18,953.8	100.0	-4.2	19.8

Sector	Animal Development									
	1989-90		1990-91			1991-92			% Change Over 3 Years	
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total		% Change
Agriculture		3,049.2	100.0	3,589.2	100.0	17.7	4,304.0	100.0	19.9	41.2
EMR										
Environment										
Fisheries										
Forestry										
H&W										
Labour										
NRC										
NRC/IRAP										
TOTAL		3,049.2	100.0	3,559.2	100.0	17.7	4,304.0	100.0	19.9	41.2

**BIOTECHNOLOGY ACTIVITIES BY SECTOR
AND DEPARTMENT/AGENCY**

Sector	Aquaculture/Fisheries								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR									
Environment									
Fisheries	284.2	6.4	451.6	12.1	58.7	423.5	10.0	-6.2	49.0
Forestry									
H&W									
Labour									
NRC	3,968.0	89.7	2,972.0	79.5	-25.1	3,495.0	82.5	17.6	-11.9
NRC/IRAP	171.5	3.9	313.5	8.4	82.5	316.2	7.5	0.9	84.4
TOTAL	4,423.7	100.0	3,737.1	100.0	-15.5	4,234.7	100.0	13.3	-4.3

Sector	Biomass Energy/Bio-Energy								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR	1,978.1	100.0	2,171.7	100.0	9.8	2,081.8	100.0	-4.1	5.2
Environment									
Fisheries									
Forestry									
H&W									
Labour									
NRC									
NRC/IRAP									
TOTAL	1,978.1	100.0	2,171.7	100.0	9.8	2,081.8	100.0	-4.1	5.2

**BIOTECHNOLOGY ACTIVITIES BY SECTOR
AND DEPARTMENT/AGENCY**

Sector	Environment								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR	146.0	9.0	320.0	14.8	119.2	335.0	18.6	4.7	129.5
Environment	1,197.0	73.9	1,660.2	76.7	38.7	1,432.2	79.4	-13.7	19.6
Fisheries									
Forestry									
H&W									
Labour									
NRC									
NRC/IRAP	277.0	17.1	184.2	8.5	-33.5	35.9	2.0	-80.5	-87.0
TOTAL	1,620.0	100.0	2,164.4	100.0	33.6	1,803.1	100.0	-22.2	11.3

Sector	Food								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture	1,361.6	59.5	1,566.2	66.2	15.0	1,601.6	77.5	2.3	17.6
EMR									
Environment									
Fisheries									
Forestry									
H&W									
Labour									
NRC									
NRC/IRAP	927.4	40.5	799.8	33.8	-13.8	465.4	22.5	-41.8	-49.8
TOTAL	2,289.0	100.0	2,366.0	100.0	3.4	2,067.0	100.0	-12.6	-9.7

**BIOTECHNOLOGY ACTIVITIES, BY SECTOR
AND DEPARTMENT/AGENCY**

Sector	Forestry								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR									
Environment									
Fisheries									
Forestry	3,870.0	98.4	4,067.0	96.1	5.1	4,689.0	94.9	15.3	21.2
H&W									
Labour									
NRC									
NRC/IRAP	62.5	1.6	163.3	3.9	161.3	250.6	5.1	53.5	301.0
TOTAL	3,932.5	100.0	4,230.3	100.0	7.6	4,939.6	100.0	16.8	25.6

Sector	Health and Safety								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR									
Environment									
Fisheries									
Forestry									
H&W	8,426.8	71.3	9,283.7	79.9	10.2	10,535.0	81.6	13.5	25.0
Labour	22.0	0.2	72.0	0.6	227.3	72.0	0.6	0.0	227.3
NRC									
NRC/IRAP	3,365.4	28.5	2,266.3	19.5	-32.7	2,290.8	17.8	1.1	-31.9
TOTAL	11,814.2	100.0	11,622.0	100.0	-1.6	12,897.8	100.0	11.0	9.2

**BIOTECHNOLOGY ACTIVITIES BY SECTOR
AND DEPARTMENT/AGENCY**

Sector	Mining								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR	546.7	100.0	525.6	100.0	-3.9	357.9	100.0	-31.9	-34.5
Environment									
Fisheries									
Forestry									
H&W									
Labour									
NRC									
NRC/IRAP									
TOTAL	546.7	100.0	525.6	100.0	-3.9	357.9	100.0	-31.9	-34.5

Sector	Pulp/Paper								
	1989-90		1990-91			1991-92			% Change Over 3 Years
	DEPARTMENT/ AGENCY	\$(000)	% of Total	\$(000)	% of Total	% Change	\$(000)	% of Total	
Agriculture									
EMR									
Environment	57.3	87.6	125.3	89.1	118.7	194	100.0	54.8	238.6
Fisheries									
Forestry									
H&W									
Labour									
NRC									
NRC/IRAP	8.1	12.4	15.4	10.9	90.1				
TOTAL	65.4	100.0	140.7	100.0	115.1	194	100.0	37.9	196.6

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