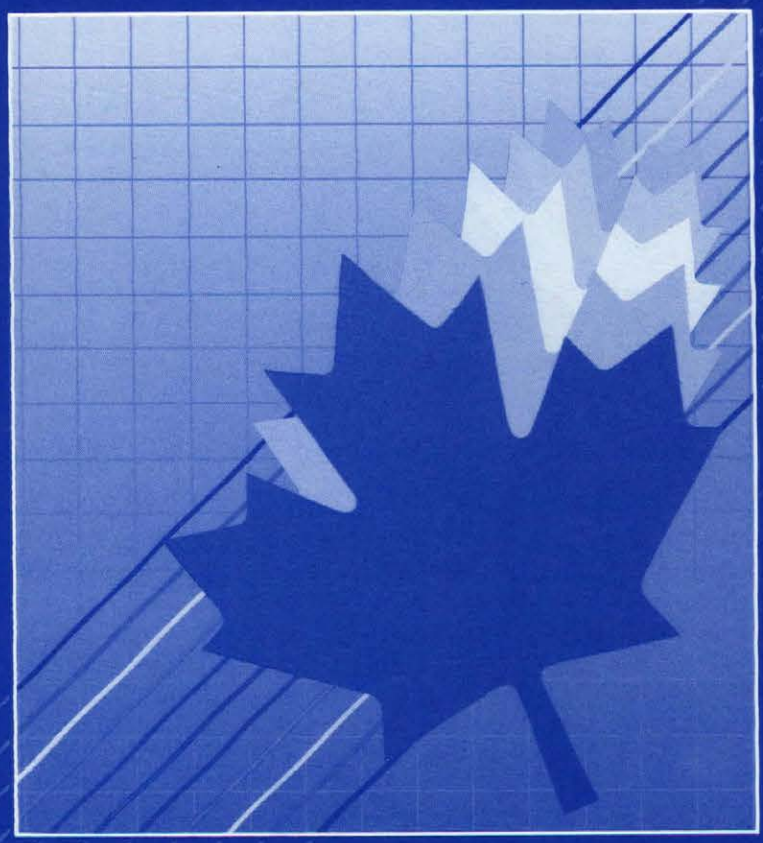
Science and Technology

FEDERAL EXPENDITURES FOR BIOTECHNOLOGY 1981 - 1986



Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

Canada

FEDERAL EXPENDITURES FOR BIOTECHNOLOGY 1981 - 1986

Prepared by:

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Science and Technology
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FOREWORD

This Report was prepared by the Biotechnology Unit, Strategic Technologies Branch, in order to monitor the progress made since the establishment of the National Biotechnology Strategy in 1983. In addition, requests for such data are often received from various Canadian government departments, industry, academia and from international organizations.

The Index (Appendix 3), will also assist those needing to identify key contact personnel in the various government agencies.

For the purposes of this report, biotechnology was broadly defined as "the application of science and engineering to the direct or indirect use of living organisms or parts of organisms or products of organisms, in their natural or modified forms, for the production of goods or the provision of services". It should be noted that the data reported reflects efforts in the new and novel aspects of biotechnology rather than the traditional applied biology techniques.

Moreover, the reader should be aware that it is only recently that some federal government agencies have begun to separate out biotechnology as a unique item in their budgets. As well, it is sometimes difficult to assess accurately what is actually biotechnology research from what is research related to biotechnology; therefore, we caution that the data presented in this Report must be regarded as estimates only.

We would like to express our sincere appreciation to those officials in the federal government departments and funding agencies who participated in the survey for their interest, cooperation, and effort in compiling the data on expenditures and human resources devoted to biotechnology. In addition, we are grateful to Laura Wardlaw for her work in the early months of the survey, and to the staff of the Strategic Technologies Branch for their support in the preparation of this document.

Additional copies may be obtained on written request to:

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October, 1986

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REPORT ON FEDERAL EXPENDITURES IN BIOTECHNOLOGY

1981 - 1986

INTRODUCTION

In 1983, the Minister of State for Science and Technology announced a National Biotechnology Strategy for Canada. The decision to adopt a strategic approach to the development of this technology was taken because it will revolutionize important sectors of the Canadian economy, notably agriculture and forestry. Our major trading partners have invested heavily in biotechnology and both the United States and Japan have made very significant progress in many fields. The commercial and technological results of these investments will have a dramatic impact on our ability to compete in world markets. To protect Canadian companies and jobs, it is imperative that we invest our limited financial resources wisely, in a focused, cooperative manner, to achieve important national goals. The National Strategy aims to build a strong capability in biotechnology R&D and to accelerate its adoption in the commercial milieu. Wise investment by both business and government and more cooperative research with clear industrial applications are vital for success.

As a result, many elements of the National Strategy aim to encourage the allocation of R&D resources to biotechnology in government labs, in companies and at universities. Specific incentives undertaken for this purpose include: a cost-sharing support programme for industrial R&D carried out in collaboration with universities or provincial research centres, (PILP-Biotechnology); the provision of funds to government departments to strengthen their in-house biotechnology R&D capability and encourage collaboration with researchers in other sectors. In addition, in response to the increasing involvement of university-based researchers in biotechnology, NSERC has increased its support for this area through its regular grants and scholarships programmes, through creation of the Biotechnology area in the Strategic Grants Program and through the establishment of a number of research chairs supported jointly by NSERC and private companies.

The National Biotechnology Advisory Committee (NBAC) was set up to monitor the Strategy and to provide the Minister with policy advice. In its 1984 Annual Report the Committee identified a window of opportunity in biotechnology for Canada. However, to succeed, there would have to be an acceleration in the pace of development through substantially greater investment, both in the science base and in technology transfer and development programmes. This expression of concern led the Ministry of State for Science and Technology to undertake a series of surveys to establish the current level and focus of investment in biotechnology in Canada. In addition to presenting a broad picture of the state of biotechnology in Canada the data were intended to act as a benchmark against which changes in the level or

pattern of activity could be measured in future years. We have also attempted to gather information indicating how the situation has changed in the past three to five years and what changes are forecast for the near future. However, these data were not universally available.

The surveys aim to bring together information useful to researchers, planners and policy makers both in Canada and abroad. This report outlines the present level of investment by the federal government, its sector of application, and the approximate human resource commitment. Similar data on provincial governments and industry activities are available in other MOSST background papers.

CAUTIONARY NOTE

It should be noted that many problems arose in preparing this first report and results should be regarded as approximations of the real values. Issues related to the definition of biotechnology raised concern in many areas, particularly where the distinction between basic research and applied "biotechnology" research is difficult to make. It is clear that much work funded by NSERC and MRC in fields such as genetics, microbiology and computer sciences is of fundamental importance to the development of a healthy biotechnology capability. However, the difficulty of defining the boundaries of basic research related to biotechnology led us to include in our totals only funds clearly identified as biotechnology, e.g. due to this difficulty, the figures for NSERC do not include the total amount awarded for highly qualified personnel training in this area.

In addition, the following caveats should be noted. (1) Major capital expenses and salaries for in-house research activities are not included in the total expenditures; the staff in government departments is dealt with as "person-years". (2) Some government departments and granting bodies do not identify biotechnology as a discrete area of bioresearch and may include expenditures in research beyond the definition provided them (see below). Expenditures therefore must be considered estimates. (3) The Canadian Forestry Service was transferred from Environment Canada to Agriculture Canada in September 1984, however, their efforts in biotechnology are presented independently.

Finally, because the primary focus of this report is on Canadian domestic biotechnology R&D activities, the expenditures of External Affairs and the International Development Research Centre (IDRC) were not included in Tables 1B and 1C. However, their programmes in support of international biotechnology development and transfer are summarized in Section 3, Part B.

DEFINITION OF BIOTECHNOLOGY

For purposes of the survey, biotechnology was defined as "the application of science and engineering to the direct or indirect use of living organisms or parts of organisms or products of organisms, in their natural or modified forms for the production of goods or the provision of services." Respondents to the survey questionnaire were requested to provide information focusing on the new approaches to biotechnology rather than on traditional applied biology (see Appendix 4, Question 1i).

METHODOLOGY

The results of the survey have been organized into two main groups: (A) the six federal departments which carry out in-house research as well as awarding contracts and grants, and (B) the three granting bodies which provide grants, contracts, awards and financial contributions for research and industrial development in Canadian universities and industries.

The data collected are presented in a series of tables and/or commentaries as follows:

(1) Table 1A provides a breakdown of federal biotechnology estimates by sector for the same two fiscal years. Tables 1B and 1C reflect the 1984-85 and 1985-86 overall federal expenditures respectively, for science and technology and for biotechnology by department and granting body.

(2) Table 2 describes major federal capital expenditures for biotechnology, 1983/84, 1984/85, and 1985/86.

(3) Section 1 offers a series of tables reflecting expenditures by department and granting bodies, by biotechnology activity carried out in-house, by contract, or by grant. Person-years are included in departmental tables.

(4) Section 2 provides a series of tables describing expenditures by department and by programme, for the five-year period 1981-1986.

(5) Section 3 provides summary notes on activities, programme expenditures and person-years involved in biotechnology in government departments and granting bodies.

There are three appendices. Respondents' proposed future activities are summarized briefly in Appendix 1. Appendix 2 provides a summary of post-secondary educational levels of personnel by discipline (where available). An index of contact persons involved in biotechnology in federal research departments and granting bodies is given in Appendix 3. The survey questionnaire is shown as Appendix 4.

TABLE 1A

FEDERAL BIOTECHNOLOGY R&D SPENDING ESTIMATES BY SECTOR
1984/85 - 1985/86

SECTOR	ESTIMATES ($000'S)			
	1984/85	% OF TOTAL	1985/86	% OF TOTAL
AQUACULTURE/ FISHERIES	$ 1,007	3.4%	$ 826	2.6%
PLANT DEVELOPMENT	10,453	35.7	13,260	41.6
ANIMAL DEVELOPMENT	1,230	4.2	1,781	5.6
FOOD	500	1.7	570	1.8
REGULATORY SUPPORT	239	0.8	289	0.9
FORESTRY	721	2.5	623	1.9
HEALTH - HUMAN AND REGULATORY SUPPORT	233	0.8	369	1.2
CELLULOSE/WASTE TREATMENT	1,441	4.9	1,238	3.9
MINING	500	1.7	525	1.6
BIOMASS ENERGY	600	2.0	750	2.3
* RESEARCH ON ENABLING TECHNOLOGIES APPLICABLE TO ALL SECTORS	12,360	42.2	11,650	36.5
TOTAL	$29,284		$31,881	

* This is the development of biotechnology techniques in cell fusion, cell culture, fermentation, recombinant DNA, biocatalysis, separation and purification, instrumentation and software development which may then be applied in the various sectors.

TABLE 1B

FEDERAL BIOTECHNOLOGY R&D EXPENDITURES 1984/85

DEPARTMENT	EXPENDITURES ($000's)			
	IN-HOUSE*	CONTRACTS	GRANTS/ CONTRIBUTIONS	TOTAL
AGRICULTURE	$ 6,430	$ 2,000	$ 900	$ 9,330
CANADIAN FORESTRY SERVICE	362	359	-	721
ENERGY, MINES & RESOURCES	75	1,025	-	1,100
ENVIRONMENT	1,050	313	113	1,476
FISHERIES & OCEANS	-	106	11	117
HEALTH & WELFARE	200	33	-	233
NATIONAL RESEARCH COUNCIL	10,382	4,410	1,500	16,292
SUB TOTAL	$18,499	$8,246	$2,524	$29,269
GRANTING BODY			**LOANS/ CONTRIBUTIONS /GRANTS**	**TOTAL**
DRIE		$ 70	$ 1,000	$ 1,070
MRC		-	8,217	8,217
NRC - PILP-P		-	6,500	6,500
- IRAP	11	-	3,130	3,141
NSERC		-	12,530	12,530
SUB TOTAL	$ 11	$ 70	$31,377	$31,458
TOTAL**	**$18,510**	**$8,316**	**$31,901**	**$60,727**

* These figures do not include salary estimates for in-house scientific and scientific support personnel.

** See Table 2, page 7, for major capital expenditures.

TABLE 1C

FEDERAL BIOTECHNOLOGY R&D SPENDING ESTIMATES 1985/86 AND BIOTECHNOLOGY PERSON-YEARS

DEPARTMENT	EXPENDITURES ($000's)				PERSON-YEARS*
	IN-HOUSE	CONTRACTS	GRANTS/ CONTRIBUTIONS	TOTAL	TOTAL
AGRICULTURE	$ 9,500	$ 1,150	$ 1,000	$11,650	171
CANADIAN FORESTRY SERVICE	323	300	-	623	52
ENERGY, MINES & RESOURCES	75	1,200	-	1,275	9
ENVIRONMENT	726	255	291	1,272	15
FISHERIES & OCEANS	75	88	8	171	5
HEALTH & WELFARE	342	27	-	369	27
NATIONAL RESEARCH COUNCIL	10,886	4,120	1,500	16,506	353
SUB TOTAL	$21,927	$7,140	$2,799	$31,866	PY 632*
GRANTING BODY			**LOANS/ CONTRIBUTIONS /GRANTS**	**TOTAL**	
DRIE	-	-	$ 1,500	$ 1,500	
MRC	-	-	20,977	20,977	
NRC - PILP-P	-	-	6,200	6,200	
- IRAP	8	-	2,300	2,308	
NSERC**	-	-	15,766	15,766	
SUB TOTAL	$ 8		$46,743	$46,751	
TOTAL* **	**$21,935**	**$7,140**	**$49,542**	**$78,617**	**PY 632***

* Salaries have not been included in the expenditures estimates. However, salary estimates for 632 professional and scientific support personnel are approximately $32 million annually.

** Figures are not available for NSERC scholarships awarded to undergraduate, graduate and post-doctoral students working in areas related to biotechnology.

*** Major capital expenditures (Table 2, page 7) and salaries are not included in totals.

TABLE 2

MAJOR CAPITAL EXPENDITURES FOR BIOTECHNOLOGY BY FACILITY 1983-84, 1984-85, 1985-86

FACILITY	EXPENDITURES ($000's)			TOTAL TO DATE
	1983-84	1984-85	1985-86	
Federal contribution to establishment of Biomedical Research Centre and Pilot Plant (ERDA) Vancouver, B.C.	--	--	$ 1.0	**$ 1.0**
Plant Biotechnology Institute (National Research Council) Saskatoon, Sask.	$ 1.5	$ 4.3	0.1	**5.9**
Biotechnology Research Institute (National Research Council) Montréal, Québec	7.7	20.4	13.9*	**42.0**
Food Research Centre (Agriculture Canada) St-Hyacinthe, Québec	1.0	21.0	11.0	**33.0**
TOTAL	**$10.2**	**$45.7**	**$26.0**	**$81.9**

* Actual Expenditure to 31 March 86; forecast is $19.9 million. The three year total will be $48 million.

SECTION I: FEDERAL EXPENDITURES 1984/85 - 1985/86 AND PERSON-YEARS INVOLVED

A - EXPENDITURES BY DEPARTMENT

I - **Department:** **Agriculture Canada, Research Branch**

Contact: Dr. Ian L. Stevenson
Special Advisor, Biotechnology
Research Branch, Agriculture Canada
Room 2115, K.W. Neatby Building
Ottawa, Ontario
K1A 0C6
(613) 995-9357

Total Biotechnology Budget 1985/86: $11,650,000
Biotechnology Person-Years 1985/86: 171 PY

Biotechnology Activity *		Expenditures ($000's) 84/85	85/86
In-House			
Plant	(121 PY)	$4,840	$7,290
Animal	(29 PY)	1,030	1,650
Food	(13 PY)	500	500
Regulatory Support	(8 PY)	60	60
In-House Total	(171 PY)	$6,430	$9,500
Contracts		2,000	1,150
Grants &		150	250
Assistance Programs		750	750
TOTAL	**171 PY**	**$9,330**	**$11,650**

* These figures represent Canada-wide activities

II - **Department:** **Agriculture Canada,**
Canadian Forestry Service

Contact: Dr. D.M. Shrimpton
Scientific Advisor, Biotechnology
(613) 997-1107

Total Biotechnology Budget 1985/86: $623,000
Biotechnology Person-Years 1985/86: 52 PY

Biotechnology Activity		**Expenditures ($000's)** 84/85	85/86
In-House	(52 PY)	$362	$323
Contracts		359.5	300
TOTAL	**52 PY**	**$721.5**	**$623**

III - **Department:** **EMR - Energy, Mines & Resources**

Headquarters: 580 Booth Street
Ottawa, Ontario
K1A 0G1

Contacts: see below

Total Biotechnology Budget 1985/86: $1,275,000
Biotechnology Person-Years 1985/86: 9 PY

III(a) **CANMET (Canada Centre for Mineral & Energy Technology)**

Contact: Mr. Michael C. Campbell (613) 996-2929
Manager, Extractive Metallurgy Laboratory
Mineral Sciences Laboratories, CANMET

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)			
	IN-HOUSE		CONTRACTS	
CANMET:	84/85	85/86	84/85	85/86
Bioleaching (to recover residual metal values from ore not normally treated) (4.3 PY)	$35	$35	$100	$ 30
Biotechnology impact on unit operations in mineral processing (1.0 PY)	-	-	120	185
Effects of microbial species in mine and mill tailings (2.0 PY)	15	15	80	105
Networking - BIOMINET (0.7 PY)	25	25		-
Biocorrosion and biofouling of metal systems (0.1 PY)	-		50	-
Biocorrosion literature review (0.5 PY)	-	-	-	-
TOTAL 8.6 PY	$75	$75	$350	$320

III(b) **Energy Research Laboratories - Hydrocarbon Conversion Section**

Contact: David P.C. Fung (613) 995-6401

(No In-house R&D)
Involvement in Biotechnology will cease after 31 March, 1986.

BIOTECHNOLOGY ACTIVITY (contracts)	EXPENDITURES ($000's)
	85/86
Conversion of Methane into Methanol (0.1 PY)	$45
TOTAL .1 PY	**$45**

III(c) **Coal Research Laboratories**

Contact: Mr. T. David Brown
Director
(403) 987-8214

(No In-house R&D)

BIOTECHNOLOGY ACTIVITY (contracts)	EXPENDITURES ($000's)	
	84/85	85/86
Biological Control of Methane in Coal Mines, Coal Storage Silos and Shipholds (0.1 PY)	$75	$85
TOTAL .1 PY	**$75**	**$85**

III(d) **Bioenergy Development Program**
Renewable Energy Division
Coal and Alternative Energy Branch

Contact: Doug Hayes (613) 995-9447

(No In-house R&D)

BIOTECHNOLOGY ACTIVITY (contracts)	**EXPENDITURES ($000's)**	
	84/85	**85/86**
Technology Development	$50	$150
Process Applications	$250	$300
Product Development	$250	$250
Policy	$50	$50
TOTAL	**$600**	**$750**

IV - Department: Environment Canada

Location: Conservation and Protection Service
Place Vincent Massey, 12th Floor
351 St. Joseph Blvd.
Hull, Québec
K1A 0E7

Contacts: Dr. M.J. Boddington
Chief
Biotechnology Centre
Commercial Chemicals Branch
(613) 953-1652

Dr. F.G. Hurtubise
Director, Technology
Development and Technical
Services Branch
(613) 994-2103

Mr. A. Townshend
Chief
Program Development
Technology Development
and Technical Services
Branch
(613) 997-1823

Total Biotechnology Budget 1985/86: $1,272,000
Biotechnology Person-Years 1985/86: 15.25 PY

IV(a) Wastewater Technology Centre (WTC)

Location: Canada Centre for Inland Waters
P.O. Box 5050, 867 Lakeshore Road
Burlington, Ontario
L7R 4A6

Contacts: Dr. B. Jank
Director
(416) 336-4740

Mr. T. Bridle
Head
Residue Management Section
(416) 336-4720

Dr. H. Melcer
Head
Biological Processes Section
(416) 336-4546

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
Biological Processes (6 PY)		
- High Rate Anaerobic Processes	$238	$211
- Process Control	338	239
- Toxic Chemical Control	220	59
- Nutrient Removal	10	5
Residue Management (2 PY)	108	80.0
TOTAL WTC 8 PY	**$915**	**$594**

IV(b) **Environmental Protection - Québec**

Location: 1179 de Bleury Street
Montréal, Québec
H3B 3H9

Contact: Dr. R. Van Coillie
Senior Scientist
(514) 283-0196

BIOTECHNOLOGY/ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
In-House: Biotesting	$ 30	$ 30
Treatability Studies	40	40
Monogram (5 PY)	-	1
Contracts: Biotesting	12	12
Treatability Studies	42	60
Monogram	-	7
DSS	187	108
TOTAL EPS Québec 5 PY	**$311**	**$258**

IV(c) **Inland Waters Directorate (IWD)**

Location: Conservation and Protection Service
Place Vincent Massey, 12th Floor
351 St. Joseph Blvd.
Hull, Québec
K1A 0E7

Contact: Dr. D.B. Carlisle
Scientific Research Advisor
(613) 953-1551

ORGANIZATION/ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
In-house: Research in support of regulation (2 PY)	$ 30	$ 30
In-house Sub-Total	$ 30	$ 30
Contracts: - Mutagenicity and PCB	15	
- Biomonitoring of toxicants	12	50
- Biodegradation	30	
Contract Sub-Total	57	50
Grants: - Sewage treatment and bacterial leaching	30	
- Biomonitoring of toxicants	83	
Grant Sub-Total	113	291
TOTAL IWD 2 PY	**$200**	**$371**

IV(e) **Canadian Wildlife Service (CWS)**
Wildlife Toxicology and Pathology Division

Location: National Wildlife Research Centre
100 Gamelin Blvd.
Hull, Québec
K1A 0E7

Contact: Dr. Martin Lis, Chief
(613) 997-1092

ORGANIZATION/ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
In-house: Monoclonal antibodies against bluetongue virus and Giardia lamblia (0.25 PY)	$35	$31
Contracts: Same as in-house	15	18
TOTAL CWS 0.25 PY	**$50**	**$49**

V - **Department:** **Fisheries and Oceans**

Headquarters: 200 Kent Street
Ottawa, Ontario
K1A 0E6

Contact: Dr. I Pritchard
Director
Aquaculture and Resource Development Branch
Fisheries Research Directorate
200 Kent Street
Ottawa, Ontario
(613) 990-0275

Total Biotechnology Budget 1985/86: $171,000
Biotechnology Person-years 1985/86: 5 PY

BIOTECHNOLOGY ACTIVITIES	EXPENDITURES ($000's)	
	1984/85	1985/86
In-House: Chromosomal manipulation, genetic engineering (5 PY)	--	$ 75
Contracts	$107	88
Grants	11	8
TOTAL 5 PY	**$118**	**$171**

VI **Department:** **Health and Welfare Canada**

Location: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

Contacts: See below

Total Biotechnology Budget 1985/86: $369,500
Biotechnology Person-Years 1985/86: 28.2 PY

VI(a) **DRUGS DIRECTORATE**
Bureau of Drug Research

Contact: Dr. Keith Bailey, Director
993-7301

BIOTECHNOLOGY ACTIVITY		IN-HOUSE EXPENDITURES ($000's)	
		84/85	85/86
Genetic Toxicology Evaluation	(2 PY)	$13	$13
Mutagenicity testing, mammalian in vitro systems	(1.5 PY)	10	10
Development in vitro, carcinogenicity system	(1.5 PY)	10	10
Standardization of Allergens	(1 PY)	4	4
Hormone assay method development	(0.2 PY)	1	1
Immunotoxicity assessments	(0.2 PY)	1	1
Hepatotoxicology	(0.2 PY)	1	1
Pharmacokinetics of drugs	(1.0 PY)	1	1
Safety of steroids	(0.1 PY)	1	0
Drug bioavailability	(0.3 PY)	1	1
TOTAL	**8.0 PY**	**$43**	$42

VI(b) **LABORATORY CENTRE FOR DISEASE CONTROL (LCDC)**
Bureau of Microbiology

Contact: Dr. Peter Gill, Director
993-6438

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)			
	IN-HOUSE		CONTRACTS	
	84/85	85/86	84/85	85/86
Molecular Probes (8.7 PY)	$ 63		$13	
Cell Fusion (7.2 PY)	69		20	
Molecular Probes/ Cell Fusion		246		$27
Training & Liaison (0.1 PY)	10	39	-	
TOTAL 16 PY	**$142**	**$285**	**$33**	**$27**

VI(c) **FOOD DIRECTORATE**

Contact: Dr. S.W. Gunner, Director General
990-8879

BIOTECHNOLOGY ACTIVITY	IN-HOUSE EXPENDITURES (000's)	
	84/85	85/86
Research in support of regulations (food toxicology, microbiology and nutrition) (3.1 PY)	$10	$10
Regulation (1.1 PY)	$5	$5
TOTAL 4.2 PY	**$15**	**$15**

VII **Department:** **National Research Council**

Contact: Dr. L. Visentin
Coordinator, Biotechnology Program
(613) 993-6371

Total Biotechnology Budget 1985/86: $25,016,000
Biotechnology Person-Years 1985/86: 353 PY

VII(a) **Division of Biological Sciences**

Contact: Dr. C.T. Bishop
Director
100 Sussex Drive
Ottawa, Ontario
K1A 0R6
(613) 990-0884

BIOTECHNOLOGY ACTIVITY		EXPENDITURES ($000's)	
		84/85	85/86
Biochemistry, Biophysics		$1,110	$1,780
Biomathematics	(51 PY)		
Microbiology	(67 PY)	2,000	1,120
Molecular Genetics	(34 PY)	1,150	610
Physiology	(36 PY)	850	890
TOTAL	**188 PY**	**$5,110**	**$4,400**

VII(b) **Plant Biotechnology Institute (PBI)**

Contact: Dr. Warren Steck
110 Gymnasium Road
Saskatoon, Saskatchewan
S7N 0W9
(306) 975-4191

BIOTECHNOLOGY ACTIVITY		EXPENDITURES ($000's)	
		84/85	85/86
Plant Cell Technology	(25 PY)	$ 427	$1,027
Plant Molecular Genetics	(12 PY)	159	700
Plant Products Technology	(18 PY)	389	500
Plant & Microbial Productivity	(20 PY)	585	449
Bio-organic Chemistry	(18 PY)	362	575
In-House Total	(93 PY)	$1,922	$3,251
Contracts		1,120	950
TOTAL	**93 PY**	**$3,042**	**$4,201**

VII(c) Biotechnology Research Institute (BRI)

Contact: Dr. M. Brossard
Vice-President, Biotechnology
Building M-58, Room 318W
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-1200

BIOTECHNOLOGY ACTIVITY		BUDGET ($000's)	
		84/85	85/86
In-House			
Biochemical Engineering	(17 PY)	$1,000	$1,000
Enzyme Engineering	(1 PY)	250	250
Molecular Immunology	(3 PY)	500	500
Genetic Engineering	(28 PY)	1,000	1,000
Total In-House	(49 PY)	2,750	2,750
Contracts		3,000	3,000
Contributions/External Funding		1,500	1,500
TOTAL	**49 PY**	**$7,250**	**$7,250**

VII(d) Atlantic Research Laboratory (ARL)

Contact: Dr. R.A. Foxall
Director
1411 Oxford Street
Halifax, Nova Scotia
B3H 3Z1
(902) 426-8332

BIOTECHNOLOGY ACTIVITY		EXPENDITURES ($000's)	
		84/85	85/86
In-House			
Bioactives from marine organisms	(5 PY)	$100	$125
Mycotoxins	(5 PY)	120	130
Marine Plant Aquaculture	(13 PY)	380	230
In-House Total	(23 PY)	$600	$485
Contracts		290	170
TOTAL	**23 PY**	**$890**	**$655**

VII(e) Program for Industry/Laboratory Projects (PILP)

Contact: Dr. John R. Vose
Building M-55, Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-1790

TOTAL BIOTECHNOLOGY CONTRIBUTIONS	EXPENDITURES ($000's)	
	84/85	85/86
	$6,500	$6,200

VII(f) **Industrial Research Assistance Program - Large Projects (IRAP-P)**

Contact: Dr. D.G.T. Cooper
Building M-55, Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-5539

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
In-House	$ 11	$ 8
Contributions	3,130	2,300
TOTAL	**$3,141**	**$2,308**

B - EXPENDITURES BY GRANTING BODY

I - **Department:** **Department of Regional Industrial Expansion**

Location: 235 Queen Street
Ottawa, Ontario
K1A 0H5

Contact: Mr. G.A. Ingham
Senior Industrial Development Officer
(613) 954-3092

Total Expenditures for Biotechnology 1985/86: $1,500,000

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)	
	84/85	85/86
Contracts (consulting)	$ 70	
Grants, contributions and loans	1,000	$1,500
TOTAL	**$1,070**	**$1,500**

II - Department: Medical Research Council

Headquarters: 20th Floor
Jeanne Mance Building
Tunney's Pasture
Ottawa, Ontario
K1A 0W9

Contact: Dr. Lewis A. Slotin
Director, Programs Branch
(613) 954-1959

Total Biotechnology Budget 1985/86: $20,977,000

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)
	85/86
Biotechnology Training Centre Award 18 post-doctorates, 12 students	$ 504
Biotechnology Development Grant	387
Biotechnology Retraining Award	86
Grants	20,000
TOTAL	**$20,977**

III - **Department:** **Ministry of State for Science and Technology**

Location: 240 Sparks Street
8th Floor, West
Ottawa, Ontario
K1A 1A1

Contact: Dr. David Shindler
(613) 990-6322

Total Biotechnology Budget 1985/86: $9,400,000

Biotechnology Activity	Allocations / Expenditures ($000's)	
	84/85	85/86
Monitoring NRC's PILP - Biotechnology industry-university program *	$5,100	$6,100
Allocations to federal departments to strengthen R&D, interaction & networking *	3,100	3,100
Biotechnology Unit / National Advisory Committee Secretariat	170	200
TOTAL	**$8,370**	**$9,400**

* Funds are allocated directly to federal departments in support of their programmes

IV - **Department:** **Natural Sciences and Engineering Research Council (NSERC)**

Location: 200 Kent Street, 3rd Floor
Ottawa, Ontario
K1A 1H5

Contacts: Dr. Gilles Julien
Executive Director
(613) 995-5849

Ms. J.E. Halliwell
Director
Research Grants Directorate
(613) 995-5833

Ms. Louise McArthur
Strategic Grants
(613) 996-7198

Total Expenditures for Biotechnology 1985/86: $15,766,351

BIOTECHNOLOGY ACTIVITY	EXPENDITURES ($000's)*	
	84/85	85/86
Operating Grants Program	$ 7,465	$ 9,320
Strategic Grants	4,488	4,452
URF Program	304	413
Infrastructure Grants	-	222
Research Development Program	35	50
University-Industry Program	237	1,309
TOTAL	**$12,530**	**$15,766**

* Manpower programmes not included

SECTION 2: Five-Year Summary of Total Biotechnology Programme Expenditures by Department

A. Department

I. Agriculture Canada, Research Branch

Year	Programme ($000's) In-House	Contracts	Grants	Total
81/82*				
82/83*				
83/84*				
84/85	$6,430	$2,000	$ 900	**$ 9,330**
85/86	9,500	1,150	1,000	**11,650**

II. Canadian Forestry Service

Year	Programme ($000's) In-House	Contracts	Total
81/82	$110	$116	**$227**
82/83	224	166	**390**
83/84	176	104	**280**
84/85	362	359	**721**
85/86	323	300	**623**

III. Energy, Mines and Resources

Year	Programme ($000's) In-House	Contracts	Total
81/82	$15	$ 100	**$ 115**
82/83	30	75	**105**
83/84	40	785	**825**
84/85	75	1,025	**1,100**
85/86	75	1,200	**1,275**

* Biotechnology was not isolated as a discrete expenditure in these years.

IV. Environment Canada

Year	Programme ($000's) In-House	Contracts	Grants	Total
81/82*				
82/83*				
83/84	$ 709	$290	$ 63	**$1,062**
84/85	1,050	313	113	**1,476**
85/86	726	255	291	**1,272**

V. Fisheries and Oceans

Year	Programme ($000's) In-House	Contracts	Grants	Total
81/82*				
82/83	-	$ 30	-	**$ 30**
83/84	-	208	-	**208**
84/85	-	106	$ 11	**117**
85/86	$ 75	88	8	**171**

VI. Health and Welfare

Year	Programme ($000's) In-House	Contracts	Total
81/82	$45	$100	**$ 45**
82/83	66	-	**66**
83/84	178	-	**178**
84/85	200	33	**233**
85/86	324	27	**369**

* Biotechnology was not isolated as a discrete expenditure during these years.

VII. National Research Council

Year	Programme ($000's)* In-House	Contracts	Contributions	Total
81/82	$ 6,200	$ 8,600	-	$14,800
82/83	6,850	8,830	-	14,686
83/84	7,728	12,060	-	19,788
84/85	10,393	14,040	$1,500	25,933
85/86	10,894	12,620	1,500	25,014

* Includes PILP and IRAP contributions.

B. GRANTING BODY

I. Department of Regional Industrial Expansion (DRIE)

Year	ESTIMATED Expenditures ($000's) Contracts/ Consulting	Grants/Loans/ Contributions	Total
81/82		$1,500	$1,500
82/83		2,500	2,500
83/84	$60	1,000	1,060
84/85	70	1,000	1,070
85/86		1,500	1,500

II. Medical Research Council (MRC)

Year	Expenditures ($000's) Awards & Specific Grants	Grants	Total
81/82*			
82/83*			
83/84*			
84/85	$217	$ 8,000	$ 8,217
85/86	977	20,000	20,977

* Biotechnology was not isolated as a discrete expenditure during these years.

III. Ministry of State for Science and Technology (Allocation of Strategy Funds)

	Expenditures ($000's)			
Year	PILP	National Biotechnology Advisory Committee	Networking and Interdepartmental Committees	Total
81/82	-	-	-	-
82/83	-	-	-	-
83/84	$ 400	$ 100	$3,100	**$3,600**
84/85	5,100	170	3,100	**8,370**
85/86	6,100	200	3,100	**9,400**

IV. Natural Sciences and Engineering Research Council (NSERC)

	Expenditures ($000's)						
Year	Strategic Grants	Operating Grants	Infra-Struc. Grants	URF Program	Univ.-Industry Program	R&D Program	Total
81/82*							
82/83*							
83/84	$3,638	$7,217	-	$236	-	$50	**$11,141**
84/85	4,488	7,464	-	304	$ 237	35	**12,529**
85/86	4,451	9,320	$222	413	1,309	50	**15,766**

* Biotechnology was not isolated as a discrete expenditure during these years.

SECTION 3: SUMMARY NOTES ON ACTIVITIES, EXPENDITURES AND PERSON YEARS INVOLVED IN BIOTECHNOLOGY

A. GOVERNMENT DEPARTMENTS

AGRICULTURE CANADA

Activity: - Plant research (crop improvement, nitrogen fixation) (in-house: $7.3M)
- Animal research (production, health) ($1.7M)
- Food research (food processing development, technology innovation) ($0.5M)
- Contracts, grants and assistance programmes ($2.15M)
- Regulatory support (monitoring, mycotoxins, bio-inoculants) ($0.06M)

85/86 Biotechnology Expenditures: $11.65M (includes approximately $2.15M for grants, contracts, assistance programmes)
85/86 Person-Years: 171 PY

Agricultural research is carried out at 19 research stations and centres across Canada and by the Animal Disease Research Institute and Chemistry and Biology Research Institute.

AGRICULTURE CANADA, CANADIAN FORESTRY SERVICE

Activity: - Forest production (micropropagation, nitrogen fixation, mycorrhyzae, silviculture genetics, pest management) ($0.6M)

85/86 Biotechnology Expenditures: $0.6M
85/86 Person-Years: 52 PY

ENERGY, MINES AND RESOURCES

Activity: - Mineral resources (bioleaching, hydrocarbon recovery, mine and mill tailings, biocorrosion, biofouling) ($0.5M)
- Energy (hydrothermolysis of wood, lignocellulosics conversion, biomass fermentation, HF solvolysis of cellulose) ($0.8M)
- Networking (BIOMINET)

85/86 Biotechnology Expenditures: $1.4M (includes approx. $1.3M for contracts, grants)
85/86 Person-Years: 9 PY

ENVIRONMENT CANADA

Activity: - Research in support of regulation (Biomonitoring of toxicants, biodegradation, sewage treatment, bacterial leaching) ($101K)
- Waste treatment (Burlington Wasterwater Technology Centre ($594K)
- Animal health care (Canadian Wildlife Service) ($31K)

85/86 Biotechnology Expenditures: $1.27M (includes approx. $546K in contracts, grants)

85/86 Person-Years: approx. 15.25 PY

FISHERIES AND OCEANS

Activity: - Development of "Super Fish"
- Research into Fish Vaccine Production

85/86 Biotechnology Expenditures: $171K
85/86 Person-Years: 5 PY

HEALTH AND WELFARE

Activity: - Basic and applied research (molecular genetics, immuno-chemistry, microbiology, physiology, molecular biophysics and biochemistry, biomathematics) in support of regulations (drugs, food)
- Advice to industry
- Inspection of drug plants
- Testing of human and veterinary drugs
- Monitoring of health status of population and disease control
- Networking (BIONET)

85/86 Biotechnology Expenditures: $369.5K
85/86 Person-Years: 28.2 PY (an additional 25-40 PY's are involved in direct regulatory activities of new biotechnology products).

NATIONAL RESEARCH COUNCIL

Activity: - Plant Biotechnology Institute, Saskatoon: Plant research (control and genetic alteration) $4.2M (93 PY)

- Biotechnology Research Institute, Montreal: Generic research (cell fusion, enzyme technology, genetic engineering, fermentation, biochemical and process engineering) $7.25M (49 PY)

NATIONAL RESEARCH COUNCIL (cont'd)

- Division of Biological Sciences, Ottawa: Fundamental research (molecular genetics, immuno-chemistry, microbiology, physiology, molecular biophysics and biochemistry, biomathematics) $4.4M (188 PY)

- Atlantic Research Laboratory, Halifax: Marine Aquacultural Biotechnology $0.6M (23 PY)

- Funding: IRAP (no new biotechnology projects will be funded by IRAP after mid-1985 - new projects will be administered by PILP) 85/86: $2.3M
  PILP as of June 1985, PILP has contributed to 64 biotechnology projects, totalling $6.2M

85/86 Biotechnology Expenditures: $25.0M
85/86 Person-Years: 353 PY

B. GOVERNMENT GRANTING BODIES

EXTERNAL AFFAIRS

Activity:
- Support and coordination of international activities
- Catalytic Seed Fund $87,350 (1983-85)
  - established to stimulate international collaboration in science and technology
  - the fund has encouraged relations in biotechnology in particular with Japan, F.R.G., France, U.S.A., Australia and Belgium
- Chairing of the ICISTR sub-committee on biotechnology

DEPARTMENT OF REGIONAL INDUSTRIAL EXPANSION (DRIE)

Activity:
- Financial support to industry for commercial developments
- Special expenditures for biotechnology facilities in Halifax, Vancouver, Montreal (PAPRICAN)

85/86 Biotechnology Expenditures: est. $1.5M

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC)

Activity: - Support of research designed to adapt science and technology to the needs of developing countries
- Since 1981, 41 biotechnology related activities supported at $3.8M (9 Canadian universities have been involved in 18 of these projects)
- Agriculture, medicine, waste treatment, biomass, basic research projects supported

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MEDICAL RESEARCH COUNCIL (MRC)

Activity: - Three formal mechanisms to encourage research and training in biotechnology:
1) The Biotechnology Training Centre Award
85/86: six universities supported (Dalhousie, Sherbrooke, Queen's, Toronto, Calgary, B.C.)
: 18 post docs, 12 students
: $504,006
2) The Biotechnology Development Grant
85/86: $387,000 (2 grants)
3) Biotechnology Retraining Award
85/86: $86,000 (3 awards)
4) Grants approximately $20M

85/86 Biotechnology Expenditures: approx. $20.77M

MINISTRY OF STATE FOR SCIENCE AND TECHNOLOGY (MOSST)

Activity: - Strategic Technologies Branch, Biotechnology Section promotes the better management and coordination of government programmes that assist industry to develop and exploit new technologies, and improved linkages between government, industry and academic institutions.
- Biotechnology Funds are used to support Strategy
1) PILP - Programs for Industry/Laboratory Projects through the NRC.
2) National Biotechnology Advisory Committee
3) Networking and interdepartmental committees

85/86: Biotechnology expenditures: $9.4M

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL (NSERC)

Activity: - Support for the development of research capability, enhancement of research infrastructure, research training and specific projects in biotechnology through a number of grant and scholarship programmes. The dissemination of research results and the improvement of university-industry interactions are encouraged through support for conferences, workshops and seminars.

1) Operating grants (spectrum of basic to applied research) $9,320K (297 awards)

2) Infrastructure grants (maintenance and operation of specialized research resource) $222K (4 awards)

3) Strategic grants (defined projects - basic to applied research) $4,452K (82 awards)

4) Grants to University Research Fellows (young researchers) $413K (20 awards)

5) University-Industry Program $932K (6 research chairs), $377K (4 projects)

6) Research Development Program $50K (2 awards)

85/86: Biotechnology expenditures: $15.8M

APPENDIX 1

Future Activity in Biotechnology

Most departments foresee increased activity in the field of biotechnology; however, few departments anticipate recruiting more personnel for their biotechnology programmes. Some departments foresee increased activity through redirection and the reallocation of personnel, whereas other departments do not anticipate a significant increase in such activity at a time of financial restraint. The National Council is an exception to these generalizations because of the staffing requirements to enable the Biotechnology Research Institute in Montréal to become fully operational by 1989.

Agriculture Canada will continue to apply biotechnology to improve production efficiency in all Agri-Food sectors. Technology development will be directed towards new and broader applications of the technologies. Greater emphasis will be placed on biological alternatives and applications in crop and animal production.

The **Canadian Forestry Service** will focus on micropropagation of forest species and genetic screening of the propagules, and DNA characterization. Strong emphasis is being placed upon the development of new and more effective biorational pesticides.

Energy, Mines and Resources will continue to work with industry, and through the BIOMINET Network, to evaluate the potential of biotechnology, particularly regarding mineral leaching and waste treatment. Additional contracts to assess state-of-the-art and feasibility of biotechnological processes will be supported. The Energy Research Labs are now addressing surface active phenomena such as the mechanics of bioemulsifiers and their effect on oil in organic and inorganic systems.

Environment Canada will use biotechnology, in the treatment of complex industrial wastes, spill cleanups and will address the regulation of biotechnology products.

The **Department of Fisheries and Oceans,** operating within the National Strategy since 1983, has successfully isolated the growth hormone from trout, verified its identification and has completed preliminary investigations on methods of transferring foreign DNA into fish cells, specifically on fertilized eggs and embryos. Work continues on accelerating growth though DNA, vertebrate growth hormones, chromosome set manipulation and viable techniques for the incorporation of endogenous gene constructs into the eggs of fish.

For **Health and Welfare** their direction will point to modern analytical techniques and methodologies; the assessment and safety of drugs and new therapeutic agents; new approaches to disease control; quality control and policy in support of regulations for health care products; and, toxicology testing and analysis.

At the **National Research Council,** R&D at the Biotechnology Research Institute (Montreal) is focused on industrial biotechnology; hence, there will be an increasing focus on bioprocess engineering in joint programmes with industry. The Institute will move into its new laboratory and pilot plant facilities in the summer of 1986, and should be fully operational by fall. It is expected that the research staff will increase to about 240 persons by 1989 with an operational budget in excess of $20 million.

While the PBI in Saskatoon has already undergone drastic program revision in the last three years, continuous change is likely to occur in the future in two areas particularly. There will be greater emphasis on cell and molecular biology and on forefront methods and techniques; and greater emphasis on joint PBI-Industry Projects under written agreements. As of July 1985, however, there is a plan for no-growth budgets and therefore there will be some reductions in programme scope.

In the Biological Sciences, protein and enzyme engineering are being expanded while research related to renewable energy is being reduced to expand work on industrially significant microbial processes.

In Halifax the ARL is placing greater emphasis on marine biotechnology in cell and protoplast manipulation as well as in molecular genetics. Depending on funding, it is hoped that 6-8 additional persons will be added to staff.

NRC administers the PILP-Biotechnology Program in support of industry-university projects and also supports other industrial biotechnology projects through its IRAP programme.

APPENDIX 2

POST-SECONDARY EDUCATIONAL BACKGROUND OF BIOTECHNOLOGY SCIENTIFIC TECHNICAL PERSONNEL

Discipline	Post-Secondary Level of Biotechnology Personnel *							
	B.Acr B.Sc.	M.Sc.	Ph.D	M.D.	** P.D.F.	Dip.	Grad. Stdnt.	Totals
BIOLOGICAL SCIENCES								
Agricultural Bacteriology			1					1
Agricultural Microbiology			1					1
Agriculture	2	1	1					4
Bacteriology		1						1
Biochemistry	5	4	33		(3)	8		**50**
Biochemistry-Biophysics			1					1
Biological Chemistry	1		1					2
Biology	5	5	12		(1)	1		**23**
Biology-Biochemistry	1							1
Cell Biology	3	2	2		(2)			7
Conifer Biotechnology			1					1
Ecotoxicology			1			1		2
Endocrinology			1					1
Environmental Biology	1		1					2
Environmental Health			1					1
Environmental Science			2					2
Enzymology			1					1
Genetics			4					4
Immunology	1		2					3
Immunology-Bacteriology			1					1
Medical Biophysics			3					3
Medicine				2				2
Microbiology	7	8	14		(1)			**29**
Microbiology-Biochemistry	1		1					2
Microbiology-Immunology	4	3	4			4		**15**
Molecular Biology			4					4
Molecular Biophysics			1					1
Molecular-Immunology			1			1		2
Mycology			1					1
Neurobiology			1					1

(continued)

APPENDIX 2
(cont'd)

Discipline	Post-Secondary Level of Biotechnology Personnel *							
	B.Sc.	M.Sc.	Ph.D	M.D.	P.D.F.	Dip.	Grad. Stdnt.	Totals
Pathology			1					1
Phycology			1					1
Physiology	1		5					6
Plant Biochemistry			1					1
Plant Biology		1						1
Plant Genetics	1							1
Plant Molecular Biology	11		33			21		65
Plant Phsiology			2					2
Plant Science			1					1
Veterinary Microbiology -Immunology			1					1
Virology			4					4
Zoology			1					1
CHEMISTRY								
Agricultural			1					1
Analytical			1					1
Bio-organic			1					1
Chemical Physics			1					1
Chemistry	5		18			1		24
Chemistry-Biochemistry			1					1
Organic	1	1	15					17
Physics-Organic			1					1
Theoretical			1					1
Toxicology			2					2
ENGINEERING								
Biochemical		1	8				4	13
Bioengineering		1						1
Chemical	2	1	12		(2)			15
Civil	1		1					2
Electrical		1	1					2
Genetic			2		(1)		6	8
Metallurgical		1						1
Sanitary		1						1

(continued)

APPENDIX 2
(cont'd)

Discipline	Post-secondary Level of Biotechnology Personnel *							
	B.Sc.	M.Sc.	Ph.D	M.D.	P.D.F.	Dip.	Grad. Stdnt.	Totals
OTHER								
Animal Care						1		1
Applied Mathematics			1					1
Aquatic Toxicology						1		1
Chemical Technology						6		6
Crystallography			2					2
Electronic Technology						6		6
Food Science	1		1					2
Geology			1					1
Horticultural Science			1					1
Life Sciences	1							1
Mathematics	2		2					4
Medical Technology						1		1
Pharmacokinetics			1					1
Pharmacology			2					2
Physics		1						1
Science	1							1
Soil Science		1						1
Water Resources Technology						1		1
Unspecified Technologies						68	12	80
TOTALS	58	34	224	2	(10)	121	22	**461**
	Support Staff							
Agriculture Canada	94		77		(24)			**171**
TOTAL PY								**632**

* Due to the extent of its biotechnology programmes Agriculture Canada was unable to provide a breakdown of personnel by discipline.

** Post-Doctoral Fellows are shown in parenthesis and are not included in person-year totals.

APPENDIX 3

Index of Contacts in Federal Biotechnology Units and Granting Bodies

1. Agriculture Canada - Research Branch

   (i) Dr. Ian L. Stevenson
   Special Advisor, Biotechnology
   Research Branch, Agriculture Canada
   K.W. Neatby Building
   Room 2115
   Ottawa, Ontario
   K1A 0C6
   (613) 995-9357

   (ii) Dr. Ian de la Roche
   Director, Plant Research Centre
   Research Branch, Agriculture Canada
   Building 55, Room 106
   Ottawa, Ontario
   K1A 0C6
   (613) 995-5287

   (iii) Dr. J.M. Deschênes
   Deputy Director
   Plant Research Centre
   Research Branch, Agriculture Canada
   Building 55
   Ottawa, Ontario
   K1A 0C6
   (613) 995-8775

   (iv) St-Hyacinthe Food Research Institute
   Director: Dr. R.R. Riel
   Agriculture Canada
   Research Branch
   3100, boul. Laframboise
   St-Hyacinthe, Québec
   J2S 4Z4
   (514) 773-5771

2. Canadian Forestry Service

   (i) Dr. D.M. Shrimpton
   Scientific Advisor, Biotechnology
   Place Vincent Massey
   19th Floor
   351 St. Joseph Blvd.
   Hull, Québec
   K1A 1G5
   (613) 997-1107

3. Energy, Mines and Resources

(i) Mineral Sciences Laboratories
CANMET, Energy, Mines and Resources
Mr. Michael C. Campbell
Manager, Extractive Metallurgy Laboratory
555 Booth Street
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K1A 0G1
(613) 996-2929

(ii) Bioenergy Development Program
Renewable Energy Division
Coal and Alternative Energy Branch
R.D. (Doug) Hayes, P. Eng.
Manager, Bioenergy Technology Development
580 Booth St.
Ottawa, Ontario
K1A 0E4
(613) 995-9447

(iii) CANMET Energy, Mines and Resources
Dr. T. David Brown
Director, Coal Research Laboratories
P.O. Bag 1280
Devon, Alberta
T0C 1E0
(403) 987-8214

(iv) CANMET
Energy Research Laboratories
Hydrocarbon Conversion Section
Dr. David P.C. Fung
555 Booth Street
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K1A 0G1
(613) 995-6401

4. Environment Canada
Conservation and Protection Service

(i) Dr. M.J. Boddington
Chief, Biotechnology Centre
Commercial Chemicals Branch
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(ii) Dr. F.G. Hurtubise
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Technology Development and Technical Services Branch
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(iii) Mr. Al Townshend
Chief, Program Development
Technology Development and Technical Services Branch
Place Vincent Massey
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(613) 997-1823

(iv) Water Quality Branch
Dr. D. B. Carlisle
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(v) Wastewater Technology Centre
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(vi) Wastewater Technology Centre
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(vii) Mr. T. Bridle
Head
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(viii) Canadian Wildlife Service
Dr. Martin Lis
Chief, Environmental Conservation Service
Wildlife Toxicology and Pathology Division
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(ix) Environmental Protection - Québec
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1179 de Bleury Street
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5. Department of Fisheries and Oceans

Dr. G. I. Pritchard
Director
Aquaculture and Resource Development Branch
Fisheries Research Directorate
200 Kent Street
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K1A 0E6
(613) 990-0275

6. Health and Welfare

(i) Bureau of Drug Research
Director: Dr. Keith Bailey
Sir Frederick G. Banting Bldg.
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Tunney's Pasture
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(613) 993-7301

(ii) Food Directorate
Director General: Dr. S.W. Gunner
Room 120, Health Protection Branch
Holland Avenue Bldg.
Tunney's Pasture
Ottawa, Ontario
K1A 0L2
(613) 990-8879

(iii) Laboratory Centre for Disease Control
Bureau of Microbiology
Dr. Peter Gill
Director
Holland Avenue
Tunney's Pasture
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(613) 990-8962

7. National Research Council

(i) Dr. L. Visentin
Coordinator, Biotechnology Program
Bldg. M-58
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(613) 993-6371

(ii) Division of Biological Sciences
Dr. C.T. Bishop
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(iii) PILP
Dr. John R. Vose
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(iv) IRAP-P
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(v) Plant Biotechnology Institute (PBI)
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(vi) Biotechnology Research Institute (BRI)
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8. Dept. of Regional Industrial Expansion (DRIE)

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10. Natural Sciences and Engineering Research Council (NSERC)

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(iii) Ms. Louise McArthur
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12. International Development Research Centre

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13. Ministry of State for Science and Technology (MOSST)

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APPENDIX 4

MOSST STUDY OF THE
CANADIAN GOVERNMENT'S INVOLVEMENT IN BIOTECHNOLOGY

In support of the National Biotechnology Strategy, the Ministry of State for Science and Technology (MOSST) is surveying federal government activity in biotechnology. Of interest to MOSST is information pertaining to R&D activities, budgets and expenditures, funding of contracts and grants and human resources.

Please note that the information obtained from this questionnaire will be used by MOSST in preparation of a National Sourcebook of Biotechnology. The sourcebook will provide an inventory of R&D activities and contacts in the Canadian community. In this regard, please indicate if any of the data that you supply should be treated as confidential. Also, please provide appropriate references if some or all of the data has recently been published in a similar form.

For the purpose of this study, biotechnology will be defined as "the application of science and engineering to the direct or indirect use of living organisms or parts of organisms or products of organisms, in their natural or modified forms, for the production of goods or the provision of services".

Focus of Activity

1i) Please use Table I (p. 57) in answering question 1i).

Under the "Project" heading in Table I, list and briefly outline those areas of biotechnology which your department/division/branch has been involved with since 84/85. The following list, although not considered exhaustive, may be useful in identifying specific areas of biotechnology.

- basic research (e.g. genetics, biochemistry, microbiology, physiology, cytology, physics, biomathematics, etc.)
- technology development (e.g. genetic engineering, enzymes and enzyme systems, cell fusion, cell cultures, process and biochemical engineering, software development, instrumentation)
- process applications (e.g. nitrogen fixation, novel aspects of cellulose utilization, health care, treatment and utilization of wastes, mineral leaching, selective methods of biological pest control, feed-stuffs, novel methods of crop fertilization and plant breeding, production of fuels from renewable resources).

- product development (e.g. new plant strains, chemicals, pest-control agents, pharmaceuticals, liquid and gaseous fuels, single cell protein (SCP), health care products, pheromones).

- research in support of regulations.

- regulation

- industry support programs

- educational initiatives

- policy

Please identify any other areas of biotechnology with which your organization is involved.

ii) What structure provides scientific/program guidance in your organization? (e.g. industry board of directors, internal board or committee, science board, peer review).

iii) Do you foresee changes in activity in biotechnology within your organization? If so, in what areas of biotechnology are these changes likely to occur, and what level of funding can you anticipate?

iv) What area(s) of biotechnology do you feel will be of importance for the future?

Expenditures

2. Please use Table II in answering questions 2 i) to iii).

i) What were the expenditures on biotechnology programs for the fiscal years 81/82, 82/83, 83/84, and 84/85?

ii) What is the budgeted expenditure for 85/86?

iii) What were the total annual values of contracts and grants for biotechnology?

Table II - Expenditures on Biotechnology Programs

Year	Total Expenditures* on In-house Programs	Total $ Value of Contracts	Total $ Value of Grants
81/82			
82/83			
83/84			
84/85			
85/86 (Budgeted)			

* Exclude salaries

iv) Under the "Expenditures" heading in Table 1 (p. 57), indicate actual and forecast expenditures for those projects listed.

v) For which of the following reasons were contracts made or grants given in 84/85:

a) commercial purposes
b) industrial purposes
c) to complement in-house work
d) to advance innovation
e) other (please specify)

vi) Please complete the following table in reference to biotechnology contracts made in 84/85.

Contractor	Project	Duration of Project	Contract Value

vii) Please complete the following table in reference to biotechnology grants given in 84/85

Grant Recipient	Project	Duration of Project	Grant Value

viii) How much was alloted for travel for biotechnology conferences, meetings, courses, etc. in 84/85?

Human Resources

3. i) Please indicate under the "Human Resources" heading in Table I (p. 57) the number of person-years (P.Y.) devoted to those projects listed.

ii) Below, list the levels of post-secondary education and major areas of study of those employees involved directly in biotechnology programs. (Please use a separate sheet, if necessary).

Level	Area of Study
(e.g. Ph.D.	Microbiology)

iii) Have any of your employees taken leave, been enrolled in training courses or received in-house training to acquire additional skills/knowledge in the field of biotechnology? If so, please indicate what new skills/knowledge were acquired and where the courses and/or leave were taken?

iv) Since 83/84, have you recruited scientific, technical or managerial personnel for your biotechnology programs? If so, how many?

v) Do you anticipate recruiting more scientific, technical or managerial personnel for your biotechnology programs? If so, how many?

vi) In what specific qualifications and fields were you and/or would you be interested?

vii) Is there a management training program available to promising scientific managers of biotechnology? If so, what are the programs?

4. Comments:

Please complete the following:

Name:

Mailing Address:

Department:

Division/Section:

Telephone:

For further information regarding this study, please contact Laura Wardlaw, Ministry of State for Science and Technology at 990-6150.

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Please use the following table when answering questions 1i), 2iv) and 3i).

TABLE I - BIOTECHNOLOGY PROGRAMS

PROJECT	EXPENDITURES (excluding salaries)		HUMAN RESOURCES**						
	84/85	85/86 (Budgeted)	Scien-tists	Engi-neers	PDF*/ Research Assoc.	Grad. Stu-dents	Tech-nical Support	Mana-gerial	Other

* PDF = Post-doctoral Fellow

** Indicate number of P.Y.'s