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in OECD Member
Countries: An Inventory

Brigitte van Beuzekom

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BIOTECHNOLOGY STATISTICS IN OECD MEMBER COUNTRIES: AN INVENTORY**Brigitte van Beuzekom**

This document reflects recent efforts made by the OECD to obtain an accurate assessment of the current state of biotechnology statistics in OECD Member and Observer countries. The authors are grateful to Statistics Canada for the funding that made this project possible.

The inventory was prepared by Brigitte van Beuzekom of the OECD's Directorate for Science, Technology and Industry, and benefited from contributions from Bill Pattinson of the OECD Secretariat and delegates involved in the OECD Ad hoc Meeting on Biotechnology Statistics. This version of the inventory is provisional and subject to revisions; it is also available on Internet at http://www.oecd.org/s_t/biotech/stats/biotech_inventory.htm. Revisions will be posted on the Internet as they become available. Comments are welcome and should be sent by e-mail to Brigitte van Beuzekom [e-mail: brigitte.vanbeuzekom@oecd.org].

**STATISTIQUES DE LA BIOTECHNOLOGIE
DANS LES PAYS MEMBRES DE L'OCDE : INVENTAIRE****Brigitte van Beuzekom**

Ce document reflète les récents efforts de l'OCDE pour établir un état des lieux précis de la disponibilité des statistiques de la biotechnologie dans les pays membres de l'OCDE et dans les pays observateurs. Les auteurs remercient Statistique Canada sans le financement duquel ce projet n'aurait pas été réalisable.

Cet inventaire a été préparé par Brigitte van Beuzekom de la Direction de la science, de la technologie et de l'industrie de l'OCDE, avec les contributions de Bill Pattinson du Secrétariat de l'OCDE ainsi que celles des délégués impliqués dans la réunion Ad Hoc sur les statistiques de la biotechnologie. Cet inventaire est provisoire et sera sujet à révisions. Il est également disponible sur Internet : http://www.oecd.org/s_t/biotech/stats/biotech_inventory.htm. Les révisions de ce document seront apportées directement sur Internet. Tous commentaires sont les bienvenus et devront être adressés par e-mail à Brigitte van Beuzekom [e-mail: brigitte.vanbeuzekom@oecd.org].

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BACKGROUND

This Working Paper summarises the information gathered by the Secretariat as part of its work to obtain an accurate assessment of the current state of biotechnology statistics in OECD Member and Observer countries. The setting up of an inventory of data availability was a recommendation of the Ad hoc meeting of the Working Party on Science and Technology Indicators (NESTI) held on 8-9 March 2000. Subsequently, at the annual NESTI Working Party meeting held on 5-7 June 2000, the Secretariat's proposal to prepare an Inventory of Data Availability of Statistical Indicators of Biotechnology was approved.

The inventory has been compiled on the basis of information provided by officials in the relevant countries (or Organisations). It provides information about biotechnology statistics in each Member country and in the Observer countries present at the ad hoc meeting. The inventory also identifies situations where no information has been made available to date and where notification has been received that no such data exists in a country. In the latter case, the contact details of the respondent have been included for future reference.

The country profiles were developed using a standard format. A separate entry has been made for each data source in each of the countries covered by the exercise. The standard format includes details of the agency involved, a description of the collection or compilation in terms of its type, the data items included, its coverage, the frequency with which data have been (or are intended to be) collected, the time period for which data are available, the definitions and classifications used and the availability of published information. The format also includes a reference to the most appropriate Web sites at which additional information may be available.

Table 1 below summarises the availability of data reported in this paper and is intended to provide ready reference. In addition, the Annex presents a list of publications and Web sites of potential use to researchers and policy makers. The Annex is not intended to be comprehensive and incorporates only the references provided as part of this exercise.

The OECD aims to develop a set of biotechnology statistics across OECD Member countries and the inventory constitutes a first step in that process. The statistical compendium should be completed during 2001.

Table 1. Summary of available biotechnology statistics¹

	Official Data			Other Data Private Sources: Ernst & Young, Arthur Andersen etc	Comments
	Biotech Firm Survey	R&D survey	No Data		
Australia		As of '96: 2 variables.		x(E&Y)	R&D personnel, R&D expenditure and R&D cost - for public and private sectors by field of research.
Austria			x		
Belgium			x	x(E&Y)	
Canada	x	x		x(E&Y)	Long list of variables (Cf. Annex 1).
Czech Republic			x		
Denmark		As of '91: 4 variables			R&D units, R&D personnel, R&D expenditure and R&D cost - for public and private sectors.
Finland			x	Registry some data	Finnish Bioindustries has a registry.
France	x			x(AAnderson)	MENRT in collaboration with INRA. A survey for biotech firms with questions on the R&D expenditure, number of persons engaged, turnover, net income (Cf. Annex 1).
Germany		One-off survey ('92)		x(E&Y)	
Greece	<i>No information provided</i>				
Hungary			x	some for audit	IKU and FhGISI have done an audit of Biotech in Hungary
Iceland		x ('99)			
Ireland			x	BRI	BioResearch Ireland has collected some data
Italy		As of '91: 1 variable			R&D expenditure (%). Data have not been published.
Japan	x ('97,'98 and '99)	As of '95: 2 variables.		Nikkei Biotech, JBA and JAPIO	Number of persons engaged in gene recombination (rDNA) R&D as well as expenditure. Japan Bioindustry Association (JBA) has a survey which covers expenditure, revenues, number of companies. JAPIO the Japanese Patent Office has number of patents.
Korea	<i>No information provided</i>				
Luxembourg	<i>No information provided</i>				
Mexico			x		Institute of Engineering, National University of Mexico published a paper "Biotechnology in Mexico: a retrospective reflection 1982-1997." Data was gathered by visits to the research groups and consulting the WEB pages of each research centre.
Netherlands		One variable.			R&D-fte's in biotechnology.
New Zealand	x ('98/'99)				Plan to test pilot survey in May-June 2000.
Norway		x			
Poland			x		
Portugal		x			Not separately included in another category.
Spain			x	CINDOC-CSIC	CINDOC-CSIC has published a catalogue of Research groups and enterprises working in Biotechnology, '97.
Sweden			x		NUTEK use bibliometric and patent data in order to analyse the Biotechnology cluster.
Switzerland		x (2001)			
Turkey	<i>No information provided</i>				
United Kingdom		Govt R&D ('93-'99)		x(AAnderson)	
United States			x	x(E&Y)	Numerous private sources as well as EPO, USPTO, Trade data.
Israel				x	Venture capital data and Ministry of Commerce and Manufacturing has collected some data.
Slovak Republic			x		
South Africa			x		
European Commission				See comments	Inventory of Public Biotechnology R&D Programmes in Europe
EUROSTAT			x		

1. For all countries data from the national patent offices can be used to identify patent classes associated with biotechnologies.

COUNTRY PROFILES

1. AUSTRALIA

Collection/compilation agency: Australian Bureau of Statistics (ABS)

Collection/compilation type: R&D Survey.

Variables: R&D expenditure and human resources.

Scope: Business Enterprise, Higher Education, Private-Non-Profit and Government sectors.

Frequency: Annual for Business Enterprise sector; biennial for other sectors. Collection of R&D classified by Field of Research from the Business Enterprise sector only started with the survey for 1995-96.

Periodicity: Annual/biennial.

Classification used: Field of Research (FOR) replaced by Research Fields Courses and Disciplines (RFCD) in 2000.

Definition used: Biotechnology has been identified as particular class within the classification. Fields of Research: 060300, Industrial Biotechnology and Food Sciences and 080200, Genetics, Molecular Biology and Biotechnology

Output: N/A

Contact comments: Neither the old (FOR) or new (RFCD) classifications clearly identify biotechnology. The latter goes further in that a separate group has been set up under Biological Sciences, although biotechnology is also covered in a number of other fields.

Contact details: <http://www.abs.gov.au>

2. AUSTRALIA

Collection/compilation agency: Department of Industry, Science and Resources (ISR) in association with Australian Biotechnology Association and Ernst & Young

Collection/compilation type: N/A

Variables: N/A.

Scope: Any company, public or privately held, which is developing or commercialising biotechnology related products, or who provided expertise and supplies to biotechnology companies as a significant component of their business. Excluded are: not-for-profit enterprises, research institutions and corporate structures which are established for the purposes of administering research grant funds but have no commercial intent.

Frequency: Onetime study for 1999.

Periodicity: N/A

Classification used: N/A

Definition used: “Biotechnology” means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. Biotechnology is simply the use of micro-organisms, and plant and animal cells, to produce materials such as food, medicine and chemicals that are useful to mankind”.

Output:

- Australian Biotechnology Directory
- Ernst & Young, Australian Biotechnology Report 1999, 1999.

Contact comments: The Directory was produced in association with the Australian Biotechnology Association. The Australian Biotechnology Report was jointly produced by Ernst & Young and ISR and follows the style of reports produced by Ernst & Young overseas (e.g. for Canada).

Contact details:

<http://www.isr.gov.au>

<http://biotech.isr.gov.au> - The directory.

<http://www.aba.asn.au>

http://www.ey.com/global/gcr.nsf/Australia/Australian_Biotechnology_Report_1999

AUSTRIA

Collection/compilation agency: Austrian Central Statistical Office

Comments: No data on biotechnology are collected.

Contact details: <http://www.oestat.gv.at/>

BELGIUM

Collection/compilation agency: Federal Office for Scientific, Technical and Cultural Affairs (OSTC)

Contact comments: No data on biotechnology are collected.

1. CANADA

Collection/compilation agency: Statistics Canada

Collection/compilation type: Annex on biotechnology activities to the Federal Scientific Expenditures and Personnel Survey.

Sector covered: Government

Variables:

- Aggregate Federal Government S&T Expenditures on Biotechnology by Activity and Performer
- Federal Government S&T Expenditures on Biotechnology Activities, by selected Government Department or Agency and Performer
- Federal Government R&D Expenditures on Biotechnology Activities, by selected Government Department or Agency and Performer
- Federal Government S&T Expenditures compared to Biotechnology Expenditures, by selected Government Department or Agency and Performer
- Federal Government R&D Expenditures compared to Biotechnology Expenditures, by selected Government Department or Agency and Performer

Frequency: Annual

2. CANADA

Collection/compilation agency: Statistics Canada

Collection/compilation type: Research and Development in Canadian Industry Survey

Sector covered: Industry.

Variables:

- Biotechnology R&D expenditures
- Source of Funds: Government, national sources, foreign sources
- Division between capital and current expenditures
- R&D by sector (5 sectors)

Frequency : Annual

3. CANADA

The following section covers three Ad hoc surveys specific to biotechnology implemented by Statistics Canada.

Collection/compilation agency: Statistics Canada

Collection/compilation type: Survey of Biotechnology Use in Canadian Industries – 1996

Variables:

- Company information: operating revenue, sales, exports, employees
- Biotechnologies used: 22 biotechnologies, used in operations (yes/no), number of years in use, utilisation stage (4 choices), plan to use in next two years (yes/no), no plans to use (2 reasons)
- Capital investment in biotechnology equipment: cost category 6 by 3
 - 1) Selection and/or Modification of Biological Material
 - 2) Culture and/or Use of Biological Material
 - 3) Environmental Biotechnologies
- Ranking of positive influences associated with adoption of biotechnologies (9 categories)
- Ranking of difficulties experienced by firms in implementing biotechnologies (11 categories)
- Ranking of benefits associated with adoption of biotechnologies (15 categories)
- Ranking of impediments to biotechnology acquisition (20 categories)
- Sources of information (internal and external: 14 categories)
- Ranking of production technology vis-à-vis other Canadian producers and Producers abroad
- Information on alliances in Canada and abroad.

Frequency: 1996

Periodicity: Annual

Collection/compilation type: Biotechnology Firm Survey – 1997

Variables:

- Company information: biotechnology activities (yes/no)
- Biotechnologies used: 22 biotechnologies, used in operations (yes/no), principal use (3 choices), plan to use in next three years (yes/no)
- Choice of three bio-industry sectors that best describe firms activities (22 choices)
- Use new process in the last three years (yes/no)
- Plan to use new process in the next 3 years (yes/no)
- Company financial information: public/private, balance sheet, revenue, expense, exports, employees, sales

- R&D expenditures: (yes/no), applied for tax benefit (yes/no) if no why not (4 choices)
- Strategic alliances (choice of 13 reasons): yes/no, with Canadian partner or US, EU, Asia, South/Latin America, Other
- Human resources in biotech activities (choice of 7 positions): employed, unfilled, estimated employed in 2001
- Human resources: Education & training programme (yes/no) estimate expenditures
- Human resources: Co-op programs students from universities employed (yes/no)
- Full-time person employed for human resources (yes/no)
- Estimated staff turnover rate
- Problems recruiting business operations staff (yes/no) if yes choice of 4 specialities
- Problems recruiting technical/production/scientific/R&D staff (yes/no) if yes choice of 3 specialities
- Hired personnel from outside Canada (yes/no) if yes which areas (choice of 5) if yes successful (yes/no) if no why (4 reasons)
- Had to abandon biotech project because of IP rights (yes/no), if yes patent in Canada (yes/no)
- Litigation related to patent infringement (yes/no), if yes number of cases
- During last three years has firm *assigned* the right to use IP (four options) in Canada, outside Canada
- During last three years has firm *acquired* the right to use IP (four options) in Canada, outside Canada
- Problems for biotech commercialisation in Canada (choice of 3 issues amongst 6) and 5 types of regulations issues.
- Financing: Capital raised (yes/no), if yes: how much. Purposes (choice of 4). Sources (choice of 7). Plan to raise capital? (yes/no), if yes: how much. Purposes (choice of 4). Sources (choice of 7).
- Strategic decisions: Most important decisions made in 1997 and 1998 – 18 choices.

Frequency: 1997

Periodicity: Annual

Comments: So far, each of the biotech surveys was occasional. However, with the last survey, this may be beginning to stabilise and some more regular periodicity may be foreseen.

Industrial Classification used: See the following table. This ad hoc classification was developed to distribute firms across biotechnology application sectors

Category: Human Health - Bio	Category: Food Processing	Category: Forest Products
1. Diagnostics (e.g. immunodiagnostics, gene probes, biosensors)	9. Bioprocessing (e.g. using enzymes and bacteria culture)	16. Silviculture (e.g. ectomycorrhizae, tissue culture, somatic embryogenesis, genetic markers, genetic engineering)
2. Therapeutics (e.g. vaccines, immune stimulants, Biopharmaceuticals, rational drug design, drug delivery, combinatorial chemistry)	10 Functional Foods/Nutraceuticals (e.g. probiotics, unsaturated fatty acids)	17. (Cleaner) Industrial Bioprocessing (e.g. biopulping, biobleaching, biological prevention of sapstain)
3. Gene Therapy (e.g. gene identification, gene constructs, gene delivery)	Category: Aquaculture	Category: Environment
Category: Bio-Informatics	11. Fish health (e.g. diagnostics, therapeutics)	18. Biofiltration (e.g. treatment of organic emissions to air/water)
4. Genomics and Molecular Modelling (e.g. DNA/RNA/protein sequencing & databases for humans, plants, animals and microorganisms)	12. Broodstock genetics (e.g. tracking superior traits, genetic modification / engineering)	19. Bioremediation and Phytoremediation (e.g. cleanup of toxic waste sites using microorganisms)
Category: Ag - Bio	13. Bioextraction (e.g. karageenan from seaweed, antifreeze proteins from fish, flavours)	20. Diagnostics (e.g. detection of toxic substances using bioindicators, biosensors, immunodiagnostics)
5. Plant Biotechnology (e.g. tissue culture, embryogenesis, genetic markers, genetic engineering)	Category: Mining/Energy/Petroleum/Chemicals	Category: Other
6. Animal Biotechnology (e.g. diagnostics, therapeutics, embryo transplantation, genetic markers, genetic engineering)	14. Microbiologically enhanced petroleum/mineral recovery	21. Custom synthesis- chemical or biological (e.g. peptides, proteins, nucleotides, hormones, growth factors, biochemicals)
7. Biofertilizers/Biopesticides/Bioherbicides/Biological Feed Additives/Microbial pest control (e.g. bacteria, fungi, yeasts)	15. (Cleaner) Industrial Bioprocessing (e.g. biodesulphurization, bio-cracking, bio-recovery)	22. Other (please specify)
8. Non-Food Applications of Agricultural Products (e.g. fuels, lubricants, commodity and fine chemical feedstocks, cosmetics)		

Definition used: Rather than defining biotechnology Canada has established a list of 22 biotechnologies. A firm becomes a biotechnology user when it uses at least one biotechnology from a list of biotechnology activities. The list for the Biotechnology Firm Survey – 1997 is the following:

DNA Based	Genetic Engineering
	Gene Probes
	Bio-informatics/Genomics/Pharmacogenetics
	DNA Sequencing/Synthesis/Amplification
	Gene Therapy
Biochemistry/Immunochemistry Based	Vaccines/ Immune Stimulants/Drug Design & Delivery/Combinatorial Chemistry
	Diagnostics Tests/Antibodies
	Peptide/Protein Sequencing or Synthesis
	Cell Receptors/Cell Signalling/Pherormones/Three Dimensional Molecular Modelling/Structural Biology
	Biosensors
	Biomaterials
	Microbiology/Virology/Microbial Ecology
Bioprocessing Based	Cell/Tissue/Embryo Culture & Manipulation
	Fermentation/Bioprocessing/Biotransformation/Bioleaching/Biopulping/Bioleaching/Biodesulphurization
	Extraction/Purification/Separation
	Bioremediation/Phytoremediation/Biofiltration/Bioindicators
	Natural Product Chemistry

Collection/compilation type: Biotechnology Use and Development Survey - 1999

Variables:

- Biotechnologies used: 22 biotechnologies, used in operations (yes/no), principal use (3 choices), plan to use in next three years (yes/no)
- If firm does not use biotechnology - ranking of barriers to using (12 categories)
- Ranking of sources of information (internal and external: 12 categories)
- Ranking of benefits associated with adoption of biotechnologies (13 categories)
- Human resources in biotech activities: number of employees, number of employees with biotech-related responsibilities,
- Human resources in biotech activities (choice of 7 positions): full-time, part-time, estimated employed in 2002
- Human resources in biotech activities (choice of 7 positions): unfilled full-time and choice of three options for the reason
- Does your firm employ (either paid or unpaid) post-secondary students in biotechnology-related activities? Include co-op placements, part-time, and full-time positions (yes/no) - if yes: level of education (choice of three)
- Does your firm contract out any of the following biotechnology-related activities? (yes/no) (4 activities) if yes: value of contracts?
- Recruiting Practices: methods used to fill biotechnology-related positions (choice of 11)
- Hired personnel from outside Canada (yes/no) if yes which areas (choice of 5) if yes successful (yes/no) if yes how many
- Did biotechnology personnel leave your firm in 1999?
- Product/Process Development: Is your firm currently developing product that requires the use of biotechnologies? (yes/no)
- Is your firm currently developing processes that requires the use of biotechnologies? (yes/no)
- Does your firm consider biotechnology central to its activities? (yes/no)
- Biotechnology Products: Please provide the number of biotechnology products or processes your firm has at each stage of development. (Industrial Classification list similar to the one above) and by Number of biotechnology products/processes by development stage (choice of 4)
- Was your firm involved in biotechnology-related cooperative/collaborative arrangements with other companies or organizations? (yes/no) if yes how many
- For what purpose? (choice of 8 arrangement purposes)
- By geographic location: with Canadian partner or USA, EU, Asia, South/Latin America, Other and Partner category (5 types)
- Would you describe your firm as a 'spin-off'? (yes/no) if yes from (choice of 4)
- Ranking of Obstacles to Biotechnology Commercialization (15 choices)
- Patents: Existing and Pending by Geographic location
- Patent applications - choice of three patent offices and other

- Number of applications for plant breeders' rights your company submitted. - choice of three offices and other
- During last two years has firm assigned or acquired the right to use IP (four options) in Canada, outside Canada (three types of IP)
- Company information: operating revenue, sales, exports, imports
- Biotech Exports to what geographic locations (choice of 5)
- Biotech Imports from what geographic locations (choice of 5)
- Attempt to raise capital (yes/no) if yes source of capital (choice of 7)
- Intention to raise capital in 2002 (yes/no) if yes how much (choice of 3)
- Apply for tax benefit in past 5 years (yes/no) if no why not (choice of 4)
- Does your firm use internet (yes/no) if yes for what purposes (choice of 9)
- Strategic decisions: 14 choices

Frequency: 1999

Periodicity: Annual

Output:

Biotechnology Use by Canadian Industry – 1996, Working Paper ST-98-05.

Diffusion of Biotechnologies in Canada, Research Paper No. 6.

Biotechnology Scientific Activities in Federal Government Departments – 1997-98, Vol. 22, No. 4.

Biotechnology R&D in Canadian Industry – 1995, Vol. 21, No. 11.

Canadian Biotechnology Statistics, CBS Theme 9.

Contact details:

<http://www.statcan.ca/english/research/scilist.htm> – For papers and the survey for greater detail.

http://www.statcan.ca/francais/research/scilist_f.htm – French version

<http://strategis.ic.gc.ca>

4. CANADA

Collection/compilation agency: BIOTECCanada is the association representing companies and research organisations involved in all aspects of biotechnology in Canada.

Collection/compilation type: BIOTECCanada worked with Statistics Canada on the collection. Statistics Canada distributed the survey, collected and validated the data, and generated tables describing the survey results.

Variables: See Biotechnology Firm Survey – 1997 (3. Canada)

Scope: See Biotechnology Firm Survey – 1997 (3. Canada)

Frequency: Onetime survey.

Periodicity: Annual

Classification used: See Biotechnology Firm Survey – 1997 (3. Canada)

Definition used: Biotechnology is defined as “the application of science and engineering in the direct or indirect use of living organisms, in their natural or modified forms, in an innovative manner in the production of goods and services or to improve existing processes.” Various modern biotechnological tools have been included under this definition, including DNA-based technologies, biochemistry, immunochemistry and a series of advanced bioprocessing based technologies.

Output: BIOTECCanada, *Canadian Biotechnology '98; Success from Excellence*

Contact Comments: BIOTECCanada analysed the survey results in conjunction with the private sector partners in this project, Contact Canada, Ernst & Young and KPMG.

Contact details: <http://www.biotech.ca>

5. CANADA

Collection/compilation agency: Canadian Department of Foreign Affairs and International Trade has documents on biotechnology in different countries: Australia, Japan (<http://www.dfait-maeci.gc.ca/nika/scitech/biotech-e.asp>), Germany, Ireland, Korea, Mexico, the United Kingdom, the United States, etc.

Collection/compilation type: Market studies

Variables: Number of employees, predicted employment in 2000, useful Internet sites.

Scope: National

Frequency: N/A

Periodicity: N/A

Classification used: None

Definition used: N/A

Output: Documents on biotechnology in different countries.

Contact comments: Market studies with some basic data and the evolution of biotechnology for the countries are generally available.

Contact details: <http://www.dfait-maeci.gc.ca/>

CZECH REPUBLIC

Collection/compilation agency: Czech Statistical Office

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.czso.cz/>

DENMARK

Collection/compilation agency: Danish Institute for Studies in Research and Research Policy

Collection/compilation type: R&D survey.

Variables: R&D units, R&D personnel, R&D expenditure and R&D cost.

Scope: Public (includes university R&D) and private sectors.

Frequency: Biennial as of 1991.

Periodicity: Annual.

Classification used: N/A

Definition used: No explicit definition is given in the national R&D questionnaire.

Output: N/A

Contact comments: Data available for: 1991-97.

Contact details: <http://www.afsk.au.dk>

1. FINLAND

Collection/compilation agency: Statistics Finland

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.tilastokeskus.fi/>

2. FINLAND

Collection/compilation agency: Academy of Finland

Collection/compilation type: Onetime study for 1996.

Variables: Information requested from the research centres:

- Number of research groups and employees in 1995.
- Research areas of the unit.
- Publications and patents.
- Organisation and administration of the research unit.
- Funding of the unit and its research groups in 1994-95.
- Research strategy.
- Plans for the future development and recruitment policy.
- Impact of the research programs on industry.
- Most recent scientific evaluation and its report.
- Training programmes for graduate students and number of completed PhD degrees yearly in 1991-95.
- International and national collaborative projects in 1995.
- Research groups working in the area of biotechnology and molecular biology and their lines of research.

Scope: Research centres.

Frequency: Onetime study.

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output: *Evaluation of Molecular Biology and Biotechnology Research* (1996).

Contact comments: The Ministry of Education requested that the Academy of Finland organise an international evaluation of biotechnology and molecular biology research in Finland to assess the programme outcomes.

Contact details: <http://www.aka.fi>

3. FINLAND

Collection/compilation: Finnish Bioindustries

Collection/compilation type: Statistics collected directly from companies.

Variables: Turnover, personnel, year founded, activities, R&D activities, core technologies, production activities, types and amounts of R&D financing available.

Scope: Companies, organisations and science centres.

Frequency: Biannual. Statistics are available for 1998 and 1999 for the biotech industry in Finland.

Periodicity: Annual

Classification used: N/A

Definition used: Companies are divided into categories: Pharmaceuticals/Drug Development; Diagnostics; Biomaterials; Industrial enzymes; Environment; Food; Agro; Services.

Output: *Index of Biotechnology Companies, Organisations and Science Centres in Finland* (1.9.2000). More information is available on their Web site.

Contact comments: Finnish Bioindustries (FIB) is the industrial association of the biotechnology industry in Finland. Finnish Bioindustries represents a vast range of companies operating within the biotechnology; chemicals, food, pharmaceutical, biomaterial, diagnostics, forest and plant protection sectors. In 1998 they commissioned a survey on consumer opinions.

Contact details: <http://www.finbio.net>

1. FRANCE

Collection/compilation agency: MENRT (Ministère de l'éducation nationale, de la recherche et de la technologie – Bureau des études statistiques sur la recherche) and INRA/SERD (Institut National de la Recherche Agronomique)

Collection/compilation type: A biotechnology firm survey was developed in collaboration with INRA (Institut National de la Recherche Agronomique). Prior to this survey MENRT commissioned a study by Arthur Andersen to set up a register of enterprises.

Variables:

- Name of the firm and key top executives
- Main technologies developed and implemented by the company (list of 33 technologies)
- Main areas of business (markets) in which the company operates (list of 28 markets)
- Revenues, R&D expenditure, net earnings and work force over the last three years
- Patents used and owned by the company
- Quality certification
- Actual and targeted partnerships in fields of research, production and marketing

Scope: Public academic laboratories and private enterprises.

Frequency: Annual. Survey began in 1999. The 2000 survey has been completed.

Periodicity: Annual.

Classification used: See Definition used.

Definition used: Rather than defining biotechnology France has established a list of 35 biotechnologies (available in French only at present):

Amplification de gènes – PCR	Enzymologie	Modélisation moléculaire
ADN recombinant	Fermentation	Molécules antisens
Anticorps monoclonaux	Fonctionnalisation des gènes	Pharmacogénomique
Bioinformatique	Galénique	Protéomique
Bioprocess	Hormones et facteurs de croissance	Purification/séparation
Biopuces	Hybridation, fusion cellulaire	Séquençage
Bio-réacteur	Ingénierie des glucides	Synthèse des molécules
Chimie chirale	Ingénierie des lipides	Système de délivrance (vecteurs)
Chimie combinatoire	Ingénierie des protéines	Traitements des produits et substituts sanguins
Contrôle des procédés	Ingénierie des tissus	Transgénèse
Criblage de molécules haut débit	Instrumentation	Autres : préciser :
Culture des tissus ou des cellules	Isolation de peptides et synthèse	

Output:

Biofutur, *Bio-industry: the European Dream*, (February 2000)

INRA, *Is The Creation And Development Of Biotech SMEs Localised?*, by S. Lemarié, V. Magematin, A. Torre (2000)

INRA, *Strategies Of European SMEs In Biotechnology: The Role Of Size, Technology And Market?*, by S. Lemarié, M.-A. de Looze, V. Mangematin (2000)

Contact comments: France counts approximately 1 000 biotechnology units of which approximately 700 are public academic laboratories and the remainder private enterprises. The survey was sent out to these labs and enterprises.

Of all the companies to which the questionnaire was sent, less than 450 corresponded to the final criteria. It can therefore be considered that the sample analysed corresponds to around half of the biotech firms operating in France. The analysis was based on 194 firms, for which all the requested information was available.

Contact details: <http://www.education.gouv.fr/technologie/biotec/somm.htm>

<http://biotech.education.fr/web/fr/index.html>

2. FRANCE

Collection/compilation agency: ADEBIO (Association Française pour le Développement des Bio-industries et des biotechnologies)

Collection/compilation type: Directory

Variables: Name of establishment

Scope: Industries, Research Centres, Universities Transfer Centres, Technopoles, Public organisations

Frequency: Every other year.

Periodicity: N/A

Classification used: Every establishment, in the directory, is classified in one of the following activities and applications (available in French only at present).

Activities:

- agriculture, forêt, halieutique
- agro-alimentaire, alimentation humaine
- alimentation animale
- santé humaine et cosmétique
- santé animale
- environnement, dépollution, valorisation des déchets, énergie
- ingénierie, équipement, procédés
- milieu de culture, réactifs, produits chimiques et biologiques, diagnostic

Applications:

- production et conditionnement
- commercialisation
- recherche et développement
- service et documentation

Definition used: N/A

Output: *L'annuaire des Biotechnologies et des Bio-Industries* (forthcoming) a Directory.

Contact comments: The aim of this site is to improve the relationship between industry, venture capitalists and public research in order to develop applications of biotechnology.

Contact details: <http://www.adebio.org/>

3. FRANCE

Collection/compilation agency: FRANCE BIOTECH

Collection/compilation type: Directory

Variables: Name of members/contacts.

Scope: N/A

Frequency: N/A

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output: N/A

Contact comments: Members of FRANCE BIOTECH benefit from being able to access a unique network of biotechnology professionals. This is made up of:

- Biotechnology companies over a spectrum of activity stretching from innovative instrumentation to medical imaging, gene and cell therapy, functional genomics, genetically modified organisms and new biological vectors.
- Established financial players in biotechnology markets. They include venture capitalists, merchant banks and brokers.
- Service companies: auditors, communications consultants, patent lawyers and other legal firms specialised in the pharmaceutical and biotechnology sectors.

Contact details: <http://www.france-biotech.org>

1. GERMANY

Collection/compilation agency: Statistisches Bundesamt (Federal Statistical Office Germany)

Collection/compilation type: Special onetime voluntary surveys were conducted in 1992: by the Stifterverband for the Business Enterprise sector and by the Federal Statistical Office for the Higher Education sector. A mandatory survey covered the government research institutes and the PNP organisations.

Variables: For the Business enterprise sector: intramural expenditures by type of research activity, intramural expenditures by economic branches (industry), intramural expenditures by product group, extramural expenditures by business enterprises for biotechnological research.

For the Higher Education sector: proportion of total working time of academic personnel attributable to biotechnological research, expenditures by institutes of higher education for biotechnological research, expenditures by funding category, expenditures by fields of sciences, institutions of higher education involved in biotechnological R&D.

For the government research institutions and private non-profit organisations: expenditures for biotechnological research by government research institutions and private non-profit organisations.

Scope: Business enterprise sector, Higher Education sector, government research institutions and private non-profit organisations.

Frequency: Onetime study for 1992.

Periodicity: Annual

Classification used: See variables.

Definition used: "Biotechnological R&D is defined for the purposes of the survey as a systematic, creative work integrating biology, micro-biology, molecular biology and engineering sciences in order to utilise or to increase the potential of living organisms or their cellular or sub-cellular or molecular components for the development of products, processes and services. R&D in biotechnology was further subdivided into R&D in biotechnology (excluding genetic engineering) and R&D in genetic engineering."

Output: Statistisches Bundesamt, *Ausgaben für biotechnologische Forschung* (1995)

Contact comments: This study presents the results of the 1992 study the Federal Ministry of Education Science, Research and Technology commissioned Federal Statistical Office to undertake in order to assess biotechnological R&D expenditures in Germany.

Contact details: <http://www.statistik-bund.de>

2. GERMANY

Collection/compilation agency: Ernst & Young

Collection/compilation type: N/A

Variables: N/A

Scope: Business Enterprise sector.

Frequency: N/A

Periodicity: N/A

Classification used: N/A

Definition used: “The Ernst & Young definition of so-called “Entrepreneurial Life Sciences Companies” (ELISCO), that is commercial companies whose main business purpose is to research, develop and sell products, technologies and services on the basis of modern biotechnology. The fields of application lie in the field of healthcare (therapeutics and diagnostics), agriculture, food, biotechnology fine chemicals and basic goods production as well as environmental protection. These sectors are generally referred to collectively as the “Life Sciences Industry.”

Modern biotechnology means all innovative methods, processes or products which mainly involve the use of living organisms or their cellular and sub-cellular components and which use research results in the field of biochemistry, molecular biology, immunology, virology, microbiology, cell biology or environmental technology and process engineering within the framework of a causative interpretation.”

Output: Ernst & Young, *Germany’s Biotechnology Takes Off in 1998*, 1998.

Contact comments: Ernst & Young sends out surveys to the actors in the biotechnology community in order to collect the information needed to prepare the reports. However, they still rely heavily on other sources of information for the data used, in their tables and graphs, for analysis. Ernst & Young does not use a standard questionnaire for all countries.

Contact details: <http://www.ey.com/>

GREECE

No information is available at this time.

HUNGARY

Collection/compilation agency: IKU (Innovation Research Centre) and FhGISI (Fraunhofer Institute for Systems and Innovation Research)

Collection/compilation type: Audit.

Variables:

- Number of firms by size class: turnover (total and just bio)
(Using turnover size categories) export earnings (total and just bio)
export to advanced countries
R&D expenditure
- Number of firms* by size class: employment (total and just bio)
(Using employees size categories) R&D staff (total and just bio)
Scientific staff
Technical staff

* *And institutes*

- Firms and institutes ranking: Own contribution to biotechnological methods
Impeding factors to R&D in biotechnology
Existing and expected capabilities
Objectives for innovation in 1996
Domestic patent holders (at the beginning of 1996)
Importance of partners
Importance of external co-operation in R&D
Importance of external co-operation in R&D
Self-evaluation of in-house factors
Evaluation of external factors of competitiveness
R&D resources in comparison to main competitors
R&D output in comparison to main competitors
- Number of biotechnology-related contracts in OMFB bidding system, by sector (1991-96, January)
- Number of patent applications in Hungary
- First 30 filers of recombinant biotechnology in Hungary

Scope: Business Enterprise, Higher Education, Private-Non-Profit and Government sectors.

Frequency: Onetime 1996.

Periodicity: N/A

Classification used: N/A

Definition used: “For this project a rather broad understanding of biotechnology is used defining biotechnology as any technique that uses living organisms or parts thereof to make or modify products, to degrade substances to modify living organisms (plants, animals, micro-organisms) for specific uses, or for services (*e.g.* in analytical laboratories). Following this definition genetic engineering is not synonymous with biotechnology but rather one of the several methods which are used in biotechnology.”

Output: *Bio-Technology Audit in Hungary, Guidelines, Implementation, Results* Ulrike Bross- Annamária Inzelt-Thomas Reiss.

Contact comments: N/A

Contact details: IKU Innovation Research Centre Postal address:Hungary-1428 Pf.12

ICELAND

Collection/compilation agency: The Icelandic Research Council

Collection/compilation type: R&D survey

Variables: R&D expenditures on biotechnology, personnel, co-operation with others in field of biotech R&D (subdivided into six categories), objectives of the biotech R&D activities (subdivided into nine activities).

Scope: Business Enterprise.

Frequency: Annual. Questions were included for the first time in the 1999 survey.

Periodicity: Annual.

Classification used: See Definition used.

Definition used: Rather than defining biotechnology Iceland has established a list of 14 biotechnologies:

Category: Human Health	Category: Agriculture	Category: Industry
1. Diagnostics (e.g. immunodiagnostics, gene probes, biosensors)	4. Plant Biotechnology (e.g. tissue culture, embryogenesis, genetic markers, genetic engineering)	11. Bioprocessing (e.g. using enzymes and bacteria culture)
2. Therapeutics (e.g. vaccines, immune stimulants, Biopharmaceuticals, rational drug design, drug delivery, combinatorial chemistry)	5. Animal Biotechnology (e.g. diagnostics, therapeutics, embryo transplantation, genetic markers, genetic engineering)	12. Functional Foods/Nutriceuticals (e.g. probiotics, unsaturated fatty acids)
3. Genomics and Molecular Modelling (e.g. DNA/RNA/protein sequencing & databases for humans, plants, animals and microorganisms)	6. Biofertilizers/Biopesticides/Bioherbicides/Biological Feed Additives/Microbial pest control (e.g. bacteria, fungi, yeasts)	Category: Environment
	7. Fish health (e.g. diagnostics, therapeutics)	13. Environment
	8. Broodstock genetics (e.g. tracking superior traits, genetic modification / engineering)	Category: Other
	9. Bioextraction (e.g. karageenan from seaweed, antifreeze proteins from fish, flavours)	14. Other (please specify)
	10. Silviculture (e.g. ectomycorrhizae, tissue culture, somatic embryogenesis, genetic markers, genetic engineering)	

Output: Not yet released.

Contact comments: N/A

Contact details: <http://www.rannis.is/>

IRELAND

Collection/compilation agency: BioResearch Ireland (BRI)

Collection/compilation type: Administrative records; personal interviews.

Variables: Number of biotech companies by sector and number of staff, various public variables on public perception to biotechnology.

Scope: Public and private sectors.

Frequency: Occasional. Eight public opinion polls were undertaken by different initiatives to determine the public opinion on biotechnology during the 1996 to 1999 period (*cf.* third item in the Output category).

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output:

Nature, *Spotlight on the Irish Scientific Community*, (24 February, 2000)

Nature Biotechnology, *Ireland embraces biotechnology*, (18 March, 2000)

BRI, *Compilation of data for the Biodivulga Project: Public Perception of Biotechnology in Agriculture and the Food Industry in Ireland*, (June 2000)

This report presents the eight surveys undertaken in order to determine the public opinion in Ireland on biotechnology. Each survey summary is structured as follows:

- Aim
- Date
- Sector
- Groups surveyed
- Methodology
- Commissioned by
- Main conclusions
- More information

Contact comments: BRI, the national agency commercialising biotechnology, was established in 1988 as a partnership between government and Irish Universities. BRI facilitates the commercialisation of opportunities arising from Irish Biotechnology research.

Contact details: <http://www.biores-irl.ie/>

1. ISRAEL

Collection/compilation agency: Central Bureau of Statistics

Contact comments: No data on biotechnology are collected. However, the Central Bureau of Statistics hopes to include questions on biotechnology in the existing R&D survey in the next years.

2. ISRAEL

Collection/compilation agency: Ministry of Commerce and Manufacturing

Collection/compilation type: N/A

Variables: Revenue, exports

Scope: N/A

Frequency: 1988, 1990, 1992, 1993, 1995 and 1997.

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output: Article published by Chief Scientist of the Ministry

Contact comments: These data may be partial since the Ministry mainly has information on companies receiving support from the Ministry. Recently, however, this Ministry has also engaged a company (Monitor) to evaluate biotechnology in Israel.

Contact details: N/A

3. ISRAEL

Collection/compilation agency: Quarterly surveys are conducted by a firm of certified public accountants Kesselman and Kesselman in co-operation with the American firm Pricewaterhouse/Coopers (until 1999 with Coopers/Lybrand).

Collection/compilation type: N/A

Variables: Amounts invested by venture capital funds in enterprises (mainly start-ups) in biotechnology.

Scope: N/A

Frequency: Current

Periodicity: Quarterly

Classification used: N/A

Definition used: N/A

Output: Yearbooks with details on biotechnology as well as quarterly surveys:
<http://www.pwcmoneytree.com/pdfs/IsraelQ499web.pdf>.

Contact comments: N/A

Contact details: Joseph Fellus, Kesselman and Kesselman, Hamered St., Tel Aviv Israel, telephone 972 3 7954780, see Web site: <http://www.pwcglobal.com/il/eng/main/home/>

ITALY

Collection/compilation agency: National Institute of Statistics (ISTAT)

Collection/compilation type: R&D survey.

Variables: R&D expenditure (percentage)

Scope: Business Enterprises.

Frequency: Annual (data on biotechnologies are available since 1991).

Periodicity: Annual

Classification used: Just a few technological areas (including biotechnology) are mentioned in a question asking about the share of R&D expenditure related to some selected “high-tech” fields.

Definition used: “Percentage of R&D activities (expenditure) related to biotechnologies”.

Output: Data on the percentage of R&D activities related to biotechnologies have been never published.

Contact comments: N/A

Contract details: <http://www.istat.it/>

1. JAPAN

Collection/compilation agency: Statistics Bureau, Management and Co-ordination Agency of the Government of Japan

Collection/compilation type: R&D Survey on Life Sciences

Variables: Number of persons engaged in gene recombination (rDNA) R&D as well as expenditures.

Scope: Companies, Research institutes and Universities and colleges.

Frequency: Annual. Questions were incorporated in 1995.

Periodicity: Annual.

Classification used: N/A

Definition used: Gene recombination research and development (recombinant DNA research and development) means research and development relating to creation of cells having new genetic traits by recombining with a gene of a different species after cutting and joining genes from certain organisms (DNA, deoxyribo nucleic acid, chemical substance of a gene), using oxygen, and then transplanting it into a cell of a different species of organism. The results can be applied to basic research and development and medicine, agriculture, industry, and energy and environmental protection.

Output: *Report on the Survey of Research and Development*, Annual

Contact comments: N/A

Contact details: <http://www.stat.go.jp/english/1.htm>

2. JAPAN

Collection/compilation agency: Japan Bioindustry Association (JBA)

Collection/compilation type: Biotechnology Industry survey

Variables: Number of companies, revenues, employees and R&D expenditures.

Scope: Business enterprise

Frequency: Annual as of 1997.

Periodicity: Annual.

Classification used: Biotechnology is the technology that employs or imitates the ability of living organisms to change substances; exchange, treat, and transmit information; or convert energy. This technology is employed and put into practical application in the following fields:

1. Bio-chemical processes: useful substance production, energy generation, environmental cleansing, etc.
2. Creation of substances, materials, enzymes, microbes, and plant and animal matter with superior new functions.
3. Use of life phenomena: genetic therapy, diagnostic technology, artificial organs, etc.
4. Highly sensitive and discriminating detection, measurement, and data transmission technologies employing or imitating biologic functions: biosensors, biocomputers, etc.
5. Technology to evaluate and analyse useful substances: evaluation of medical drugs and other bio-active substances;
6. Research to elucidate life phenomena.

The biotechnology targeted in this survey includes not only the new biotechnology involved in such things as recombinant DNA technology, cell fusion, and cell culture of plant and animal cells, but also includes the existing technology used in fermentation and brewing, culturing, and mutation treatment technologies.

Concerning the biotechnology related products referred to in this survey, targeted are not only those products that employ biotechnology in their production, but also those products that use raw materials obtained through biotechnology, and also the instruments, facilities, plants, and further include the services related to biotechnology. "Biotechnology related products" is defined as follows, for the purposes of this survey.

1. Products, at your firm, that are produced using processes employing biotechnology.
2. Products that although are not produced using processes employing biotechnology in your firm, use materials that have been manufactured through biotechnology.
3. Products that although are not produced using processes employing biotechnology in your firm, but are using biotechnology as the main technology in the research and development stages.

4. Products purchased and sold, that were produced using biotechnology such as described in (1)-(3).
5. Instruments, machinery, facilities, plants involved in production processes using biotechnology or biotechnology-related research and development.
6. Service providers of analysis, testing, software, etc., which employ biotechnology

The definition of a company using biotechnology in this survey is wide, because the target of the survey was not limited to the products employing modern biotechnology, but also extended into the areas of brewing and fermented products from the old biotechnology area.

Output: N/A

Contact comments: Responsibility for this survey will be transferred to the Ministry of International Trade and Industry (MITI) - this is expected to increase the response rate.

Contact details: <http://www.jba.or.jp>

3. JAPAN

Collection/compilation agency: JAPIO (Japan Patent Information Organisation)

Collection/compilation type: Patent applications

Variables: Patent applications

Scope: All sectors

Frequency: N/A

Periodicity: N/A

Classification used: IPC

Definition used: IPC categories: AO1G, AO1H, A61K, C12N, C12P, and C12Q; aggregate of patents and petty patents

Output: N/A

Contact comments: N/A

Contact details: <http://www.european-patent-office.org/espacenet/help/paj/data1.htm>

4. JAPAN

Collection/compilation agency: Nikkei Biotechnology

Collection/compilation type: N/A

Variables: N/A

Scope: N/A

Frequency: N/A

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output: *Report on Bio-Industry in Japan* [<http://www.dfait-maeci.gc.ca/ni-ka/science/biotech-e.asp>]

Contact comments: N/A

Contact details: <http://biotech.nikkeibp.co.jp>

KOREA

No information is available at this time.

LUXEMBOURG

No information is available at this time.

MEXICO

Collection/compilation agency: National University of Mexico

Contact comments: Dr. Rodolfo Quintero-Ramirez, from the Institute of Engineering at the National University of Mexico, published a paper called “Biotechnology in Mexico: a retrospective reflection 1982-1997” in a Journal entitled: *Biotecnologia*, Vol. 3, No. 3, pp. 133-172, September 1998. This document is in Spanish. The method used to obtain the data included in the paper were visits to the research groups and consultations of Web pages of each research centre.

NETHERLANDS

Collection/compilation agency: Central Bureau of Statistics (CBS)

Collection/compilation type: R&D survey

Variables: R&D personnel (full-time-equivalents)

Scope: Business enterprise and research institutes

Frequency: Biennial.

Periodicity: Annual.

Classification used: Industry (2-digit NACE).

Definition used: Based on a classification of Field of Research and Technology developed by CBS: Research on genetic modification, cell fusion/biology, fermentation, development of proteins/enzymes, neuro biology, botanical improvement, bio catalyse.

Output: Statline on the Web site (see below); publication *Kennis en economie*.

Contact comments: N/A

Contact details: <http://www.cbs.nl/>

1. NEW ZEALAND

Collection/compilation agency: Ministry of Research, Science and Technology (MORST) and Statistics New Zealand (SNZ)

Collection/compilation type: Biotechnology firm survey

Variables:

- Biotechnology processes used by the business
- Stage of development of biotechnology processes
- Number of biotechnology processes used by the enterprise
- Type of biotechnology process used by the enterprise
- Industry sectors
- Percentage of sales represented by each industry sector
- Most important bioindustry sector
- Number of bioindustry sectors implemented in the last three years
- Number of bioindustry sectors planned to be implemented in the next three years
- Industry sectors that are expected to grow in the future
- New Zealand organisations on whose behalf research was carried out
- Overseas organisations on whose behalf research was carried out
- Strategic alliances – New Zealand organisations
- Strategic alliances – Foreign organisations
- Product and process sales
- Contract research revenue
- Royalty income
- Income from direct government subsidies and cash grants
- All other income
- Total income
- Raw materials and finished good opening stocks
- Raw materials and finished good closing stocks
- Research and development expenses
- Royalty payments
- Salaries and wages
- All other expenses
- Cost of raw materials sourced from New Zealand

- Cost of raw materials sourced from overseas
- Total expenses
- Total exports
- Total value of biotechnology exports
- Biotechnology exports to Australia
- Biotechnology exports to Asia
- Biotechnology exports to Europe
- Biotechnology exports to United States
- Biotechnology exports to other countries
- Number of projects abandoned due to inability to purchase IP rights
- Number of projects abandoned due to inability to licence IP rights
- Number of projects abandoned due to other reason
- Number of projects abandoned due to inability to access basic research
- Number of litigations
- Number of disputes
- Number of arrangements to share IP instruments
- Number of arrangements to share acquire IP instruments
- Number of successful biotechnology-related patent applications in the year ended 30 June 1999
- Number of successful biotechnology-related patent applications in the last five years
- Number of biotechnology-related articles published in refereed journals in the year ended 30 June 1999
- Number of conferences on biotechnology related subjects attended in the year ended 30 June 1999
- Total number of FTEs
- Number of FTEs involved in R&D
- Number of FTEs involved in quality assurance
- Number of FTEs involved in regulatory/legal/government affairs
- Number of FTEs involved in marketing and sales
- Number of FTEs involved in business development/finance
- number of FTEs involved in administration/human resources
- Head count of those involved in R&D
- Head count of those involved in quality assurance
- Head count of those involved in regulatory/legal/government affairs
- Head count of those involved in marketing and sales
- Head count of those involved in business development/finance
- Head count of those involved in administration/human resources
- Head count by qualification

- Number of enterprises who have recruited staff from overseas
- Problems for biotechnology commercialisation
- Countries from which employees were recruited
- Reasons why foreigners declined an offer of employment.

Scope: Firms, government and university units engaged in modern biotechnology activities. The survey excludes all industries which use traditional forms of biotechnologies such as bread-, wine-, beer-making.

Frequency: First survey in 2000.

Periodicity: Annual.

Classification used:

Industry:

- Australian and New Zealand Standard Industrial Classification (ANZSIC four-digit level)

Sector:

- New Zealand Institutional Sector Classification (NZISC)

Definition used: Modern biotechnology is defined as: The application of scientific and engineering principles to the processing of material by biological agents and the processing of biological materials to improve the quality of life by isolating, modifying and synthesising the genetic instructions responsible for actual biological processes.

Output:

- Standard tables, approximately 30 standard tables would be produced.
- Biotechnological statistics would also be released in Key Statistics, the Yearbook and various other publications produced by SNZ.
- Summary result tables should be released by end September 2000.

Contact comments: N/A

Contact details: <http://www.morst.govt.nz/>

2. NEW ZEALAND

Collection/compilation agency: New Zealand Biotechnology Association (NZBA) and Biotenz

Collection/compilation type: Register of biotech enterprises

Variables : Number of employees (in biotechnology, in biotechnology R&D), year established, type of company, mission statement, fields of activity, types of products sold, NZ and export markets.

Scope: Business enterprises

Frequency: Regular

Periodicity: N/A

Classification used: Industry sector and functional category

Definition used: “The application of scientific and engineering principles to the processing of material by biological agents and the processing of biological materials to improve the quality of life.”

Output: *The Industrial Biotechnology And Natural Product Sectors: 1998-2010*

Contact comments: N/A

Contact details:

<http://www.biotech.org.nz/>

<http://www.biotenz.org.nz/>

NORWAY

Collection/compilation agency: Statistics Norway (SSB) and Norwegian Institute for Studies in Research and Higher Education (NIFU).

Collection/compilation type: R&D Survey

Variables: Current R&D expenditures.

Scope: Statistics Norway (SSB) collect data for the private firms in the business enterprise sector. And the Norwegian Institute for Studies in Research and Higher Education (NIFU) collects data for the non-profit institutes in the business enterprise sector, higher education sector and government sector (including the very small PNP-sector in Norway).

Frequency: Biennial, the first time in 1985.

Periodicity: Annual.

Classification used: N/A

Definition used: Biotechnology is the use of microorganisms, plants and animal cells for making or modification of products, plants and animals or the development of microorganisms for specific use. Biotechnology concerning "aquaculture" is included.

Output: The data are not published on a regular basis. However, some of these data have been used in newsletters/booklets.

Contact comments: The wording of the definition has changed several times. In 1985, the definition included aquaculture. In 1987, this area was separated from biotechnology. From 1991, biotechnology related to aquaculture was excluded from the biotechnology category. However, in the latest R&D surveys (1997 and 1999), the above definition was used (*cf.* Definition used), *i.e.* aquaculture is included.

Contact details:

<http://www.nifu.no>

<http://www.ssb.no>

POLAND

Collection/compilation agency: State Committee for Scientific Research Department of Studies and Science Policy Division of Analysis and Statistics

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.kbn.gov.pl/>

PORTUGAL

Collection/compilation agency: Observatório das Ciências e das Tecnologias (from 1980 until 1992 the Junta Nacional de Investigação Científica e Tecnológica²).

Collection/compilation type: R&D Survey

Variables: R&D expenditures, human resources.

Scope: Government sector, higher education sector and PNP sector.

Frequency: Biennial, most recent 1997.

Periodicity: Annual.

Classification used: Classification by Fields of Science (CFOS) – revised in 1997 – in which Biotechnology is included the field of science category ‘Biochemical Engineering and Biotechnology’.

Output: N/A

Contact comments:

A series of new methodological procedures were implemented in the 1997 R&D Survey³ and the Classification by Fields of Science (CFOS) was revised. The previous Classification by Fields of Science used to be a very detailed classification (3-digit level) and biotechnology was considered under Engineering and Technology field of science, broken down into: *i*) basic biotechnology; *ii*) biochemical engineering; *iii*) vegetal biotechnology; *iv*) animal biotechnology; *v*) other (to be specified). This more detailed classification is no longer available.

Contact details: <http://www.oct.mct.pt/>

² This agency no longer exists.

³ These included: focusing on R&D (the previous surveys focused both on R&D and S&T related activities); updating concepts (according to Frascati Manual 1993 edition); revising classifications, which were considered to be obsolete; trying to have a more comprehensive perception and approach of the R&D units; and changing the questionnaire from paper to electronic.

SLOVAK REPUBLIC

Collection/compilation agency: INFOSTAT, Institute of Informatics and statistics

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.infostat.sk/>

SOUTH AFRICA

Collection/compilation agency: Department of Arts Culture Science and Technology

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.dacst.gov.za/>

1. SPAIN

Collection/compilation agency: Instituto Nacional de Estadística

Contact comments: No data on biotechnology are collected.

Contact details: <http://www.ine.es/>

2. SPAIN

Collection/compilation agency: CINDOC-CSIC (Consejo Superior de Investigaciones Cientificas Centro de Informacion y Documentacion CIENTIFICA)

Collection/compilation type: Questionnaire

Variables: Number of enterprises and research groups in the different market segments and the technology used

Scope: Research groups and enterprises

Frequency: Carried out in 1988 and 1997.

Periodicity: Annual.

Classification used: Data are classified by biotechnology primary market segments (eight categories) and the technology used (eight categories)

Definition used: N/A

Output: Catalogue of *Spanish Research groups and enterprises working in Biotechnology 1997*. Released as a book and CD-ROM

Contact comments: CINDOC-CSIC (Consejo Superior de Investigaciones Cientificas Centro de Informacion y Documentacion CIENTIFICA) published a catalogue of Spanish Research Groups and Enterprises Working in Biotechnology 1997. Released as a book and CD-ROM, the catalogue includes information on the technologies used by 766 groups and approximately 150 enterprises.

“The Catalogue of Research Groups and Enterprises Working in Spain in the field of Biotechnology includes those selected and financed during the last five years, either by the Spanish National Programmes on Biotechnology and related areas, Basic Sciences, especially Molecular and Cellular Biology, Structural Biology, or by the European Union Biotechnology Programmes (3rd and 4th Framework Programmes). In the case of enterprises, the original databases used were those of the National Programmes on Biotechnology and of the *Centro para el Desarrollo Tecnológico Industrial* (CDTI) and other sectoral programmes of the Ministry of Industry and Energy. The principal investigators of the groups and directors of the enterprises have responded to a questionnaire sent at the beginning of 1997 to collect actualised data on their physical co-ordinates and the aims of their work. The success in the number of responses obtained (>95%), due to very insistent and persuasive work, allows a high degree of confidence in the sense that most of the groups working in biotechnology in the academic world are included in the catalogue. However, there is no certainty as to the number of enterprises with biotechnology R&D programmes, although practically all those initially detected in the databases answered the questionnaire, since it is likely that not all the enterprises have been in contact with the national agencies.”

Contact details: <http://www.cindoc.csic.es/>

SWEDEN

Collection/compilation agency: NUTEK (Swedish National Board for Industrial and Technical Development)

Collection/compilation type: Mainly administrative records.

Variables:

- Swedish patenting in the US patent system (1986-97 could be extended to 1999)
- data on Swedish scientific publications (SCI) (1986-98 could be extended to 1999)
- lists of Swedish companies with biotech activities categorised according to their business and some data on their number of employees and turnover (1996-99 or 1996-98)
- public/semi-public financing of biotech research (1997)
- public seed financing (1997-99)
- Swedish venture capital companies investments in biotech industry (1999)
- The results of a questionnaire sent to the identified companies. The questionnaire mostly concerns collaboration with universities and other companies and driving forces and obstacles for innovations and growth in Sweden.

Scope: Firms, industrial research institutes, public research organisations and higher education.

Frequency: The project started January 1999 and will end January 2001 unless new funding is found. The time periods covered is listed under Variables and Output.

Periodicity: see above

Classification used:

Patents: A broad selection of patents using the classification system of the US Patent and Trademark Office was made according to the table below (Table 1). This selection was subsequently refined by using a new classification system (Table 2) thus omitting many patents identified in the initial selection.

Table 1. US Patent Class

Code	US Patent Class
424	Drug, Bio-Affecting and Body Treating Compositions
426	Food or Edible Material: Processes, Compositions, and Products
435	Chemistry: Molecular Biology and Microbiology
436	Chemistry: Analytical and Immunological Testing
514	Drug, Bio-Affecting and Body Treating Compositions
530	Chemistry: Natural Resins or Derivatives; Peptides or Proteins; Lignins or Reaction Products Thereof
800	Multicellular Living Organisms and Unmodified Parts Thereof
930	Peptide or Protein Sequence
935	Genetic Engineering: Recombinant DNA Technology, Hybrid or Fused Cell Technology, and Related Manipulations of Nucleic Acids

Table 2. Classification System for Biotechnology and Biotechnology-related Patents⁴

Classification System for Biotechnology and Biotechnology-related patents	
CLASSIFICATION	EXPLANATION OR EXAMPLES
Agriculture	
Agricultural technique	E.g. egg inoculation with living cells of micro-organism, feed optimisation, genetics, plant protection using micro-organisms.
Animal food	E.g. food additives such as growth hormones and bacteria.
Bioprocess	
Process	Production of chemicals (e.g. ethanol, carbohydrates, epoxy compound, esterification of glycosides etc) using bioprocesses.
Food	
Functional food	E.g. enzyme or bacteria addition to food stuff
Food technique	E.g. protein treatment, enzyme stabilisation in feed stuff, way of adding biologically active materials to foodstuff.
Wood, pulp and paper	
Wood, pulp or paper treatment	E.g. enzyme production for pulp treatment, biocides such as a pheromone, wood protection against fungi.
Biotech supplies	
Process	E.g. biomolecular production and analysis, bioseparation, DNA sequencing etc.
Laboratory equipment	Equipment for use specifically on biological systems.
Genomics and functional genomics	E.g. cloning, expression control, vectors, recombinant DNA techniques
Biosensors	E.g. biomolecules- detection and/or analysis
Transgenic animal	Animal model for helicobacter pylori infection.
Medical Technique	
Tissue treatment	E.g. removing micro-organisms from tissue and cleaning tissue using biomolecules, implant technique, dental technique, wound treatment, blood-collecting technique.
Pharmaceuticals and medicine	
Drugs and their preparation	Pharmaceuticals and vaccines for man or animal, consisting of biomolecules or micro-organisms and their preparation.
Drug delivery systems	Drug delivery systems for biopharmaceuticals
Diagnostics	Includes biomolecular diagnostics, immunoassays and antibodies.
Chemistry	
New or improved chemical or process	E.g. chemical synthesis, column material, separation and detection techniques, surfactants and cosmetic formulations as well as probable drugs and drug formulations (but not specified as such).

⁴ To be classified as a biotechnology patent one must develop, produce, analyse or use biological systems on a micro-, cellular or molecular level.

Classification system for Biotechnology and Biotechnology Related patents (continued)	
CLASSIFICATION	EXPLANATION OR EXAMPLES
Environmental	
Environmental technique	E.g. wastewater treatment and analysis
Food	
Functional food	E.g. addition of trace elements to foodstuff, "health drinks", dietary fibres etc
Food technique	E.g. milk treatment, fibre-production.
Quality control	E.g. control of microflora
Wood, pulp and paper	
Wood, pulp or paper treatment	E.g. lignin preparation, bleaching of pulp.
Laboratory technique	
Laboratory equipment	Equipment for general laboratory use.
Medical Technique	
Contrast agents	E.g. for magnetic resonance imaging or X-ray
Biological fluids	Blood plasma substitute or blood plasma treatment method (e.g. intravenous infusion for blood pressure control and re-administration of treated plasma), nutrient solutions for intravenous administration, blood material treatment and saliva substitute
Wound treatment	E.g. sore cleansing and dressings
Tissue treatment	e.g. adhesion prevention or promotion and implant preparation
Other	E.g. eye-surgical method, device of biocompatible material, sperm separation, ointments and pastes for controlling micro-organisms.
Pharmaceuticals and medicine	
Drugs and their preparation	New drugs and new drug compositions
Drug delivery systems	Drug delivery systems and galenic pharmacy
Diagnostics	Diagnostics not fitting the previous diagnostics description, e.g. patch test of allergy.

Scientific publications: The journal categories developed by the Institute for Scientific Information (ISI, Philadelphia, United States) were used. Included are the categories in Table 3 (*cf.* the first report under output for more information).

Table 3

CQ	Biochemistry & molecular biology
DA	Biophysics
DB	Biotechnology & applied microbiology
DR	Cell biology
DX	Chemistry, medical
MB	Mathematical methods, biology & medicine
NI	Immunology
QE	Materials science, biomaterials
QU	Microbiology
RU	Neuroscience
ZE	Virology

Industry: Companies having activities according to our chosen definition were categorised into the following categories: Pharmaceuticals and medicine (drug development, diagnostics, etc); Agrobiotech (GMO, biological plant protection, etc); Environmental biotech (bioremediation, waste treatment); Biotech supplies (instruments and equipment for bioseparation and analyses); Functional food (mainly probiotics); Bioproduction (biomolecular or microorganism production).

Definition used: An analysis of the Swedish Biotechnology Innovation System, is being undertaken, by which is meant: *The actors that develop, produce, analyse or use biological systems on a micro-, cellular or molecular level and the public and private institutions that affect their behaviour.*

The focus is on modern biotechnology and innovative use of classical biotechnology.

Output: In English:

NUTEK, *A study of the Swedish biotechnology innovation system using bibliometry*, January 2000.

(Forthcoming) *The Swedish biotechnology innovation system, driving forces and obstacles for innovations and growth.* The report will include: patenting based on the US patent system (1986-97), data on scientific publications (SCI) (1986-98), lists of companies with biotech activities categorised according to their business and some data on their number of employees and turnover (1996-99 or 1996-98), public financing of biotech research (1997) and public seed financing (1997-99) as well as some data on Swedish venture capital companies investments in biotech industry (1999). The results of a questionnaire sent to the identified companies will also be included. Much of the expected content of this report already exists in a Swedish version.

Contact comments: N/A

Contact details: <http://www.nutek.se/>

SWITZERLAND

Collection/compilation agency: Swiss Federal Statistics office

Collection/compilation type: R&D survey.

Variables: R&D objectives: percent spent on biotechnology.

Scope: Private enterprises.

Frequency: Questions may be incorporated in the 2001 survey, dependent on the results of testing in 2000.

Periodicity: Every 4 years, as the R&D survey.

Classification used: Same as the R&D survey, as the Biotech elements will be a part of the survey.

Definition used: Intend to use the official definition not yet determined by the OECD, followed by a list of possible activities in Biotechnology for the requested fields.

Output: None will be available until after 2001.

Contact comments: Collection has not yet been confirmed.

Contact details: <http://www.statistik.admin.ch/>

TURKEY

No information is available at this time.

1. UNITED KINGDOM

Collection/compilation agency: Office of National Statistics (ONS)

Collection/compilation type: Government R&D Survey

Variables: Budget-provisions of central governmental R&D expenditure

Scope: Government sector.

Frequency: Annual. Data are available from 1993 onwards.

Periodicity: Annual.

Classification used: A NABS (Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets) analysis of net R&D expenditure – further broken down into biotechnology, information technology, international collaborative projects and payments to firms.

Definition used: Biotechnology is defined as the application of biological organisms, systems and processes to manufacturing or service industries.

Output: N/A

Contact comments: These data are supplied to EUROSTAT (*cf.* EUROSTAT submission).

Contact details: <http://www.statistics.gov.uk/>

2. UNITED KINGDOM

Collection/compilation agency: Arthur Andersen

Collection/compilation type: Proprietary survey

Variables: For sector overall and by sub-sector: number of companies, number of employees – current & two-year forecast, product development pipeline, number of strategic alliances & details of partners, R&D spend, revenues by category – current & forecast, finance raised & required

Scope: Private sector UK biotechnology companies

Frequency: Every two or three years

Periodicity: Annual data

Classification used: See definition used.

Definition used: A list of 13 biotechnologies is used in their latest report.

Animal healthcare	Application of molecular & cellular biology to veterinary drugs & vaccines, feed additives, & animal improvement (but excluding pharming)
Bioprocessing	Supply of fermentation, culture, separation & purification expertise and methods for manufacturing (including pharming)
Chemicals	Development of biological products or processes for the fine, specialty & bulk chemical (including pharmaceutical) industry
Contract research	Fee-for-service R&D, including CROs
Crop agriculture & horticulture	Application of molecular & cellular biology to plants
Database development & management	Bioinformation generation, storage & handling tools
Diagnostics	Development of products for defining status or susceptibility in any applications sector (health, food, environment etc)
Environmental	Application of molecular & cellular biology directly to restoration or preservation of a healthy environment or to the avoidance of adverse environmental effects
Food technology	Development & supply of enzymes & other processing aids (excluding upstream processing through eg genetic modification of plants)
Human healthcare	Application of molecular & cellular biology to biopharmaceuticals and medical device development. Includes drug delivery companies but excludes diagnostics & CROs
Reagent & equipment suppliers	For R&D purposes
Technology service providers	Companies whose main business is in developing tool sets to aid the R&D efforts of other companies
Other	

The UK Biotechnology sector is defined as “those companies whose primary commercial activity depends on the application of biological organisms, systems or processes.”

Output:

Arthur Andersen, *UK Biotech '94 – The Way Ahead*, 1994

Arthur Andersen, *UK Biotech '97 - Making the Right Moves*, 1997

Arthur Andersen, *Technology Transfer in the UK Life Sciences*, 1998 (excluding sector statistics)

Arthur Andersen, *Managing Risk, Building Value – Risk Management in the UK Life Sciences*, forthcoming

Contact comments: Keith Binding at AAUKReport@dial.pipex.com

Contact details: <http://www.arthurandersen.com/>

3. UNITED KINGDOM

Collection/compilation agency: The BioIndustry Association exists to encourage and promote a financially sound and thriving sector of the UK economy built on developments across the biosciences to create wealth, employment and an expanding skills base.

Collection/compilation type: N/A

Variables: N/A

Scope: N/A

Frequency: N/A

Periodicity: N/A

Classification used: N/A

Definition used: N/A

Output: N/A

Contact comments: N/A

Contact details: <http://www.bioindustry.org/>

1. UNITED STATES

Collection/compilation agency: The National Science Foundation (NSF) and U.S. Census Bureau

Collection/compilation type: R&D survey.

Variables: None.

Contact comments: Biotechnology R&D data are not generally available from official statistics. Neither the National Science Foundation (NSF) nor the U.S. Census Bureau are able to document industry's biotechnology R&D activities for a variety of reasons, the most important being that biotechnology is not a separate industry code in the government's Standard Industrial Classification (SIC) system. The U.S. Census Bureau (the collection agent for NSF's survey of industrial R&D expenditure data) is currently undertaking a special study to determine where the biotechnology companies are classified.

Output: None

Contact details:

<http://www.nsf.gov/sbe/srs/stats.htm>

<http://www.nsf.gov/sbe/srs/seind00/start.htm>

<http://www.nsf.gov/>

2. UNITED STATES

Collection/compilation agency: U.S. Patent and Trademark Office (USPTO)

Collection/compilation type: Administrative records.

Variables: Issued Patents.

Scope: All patents issued by the USPTO.

Frequency: Regular

Periodicity: Annual

Classification used: International Patent Classification (IPC)

Definition used: N/A

Output:

- USPTO Patent Bibliographic Database
- NSF, *Science and Engineering Indicators 2000*, 2000

Contact comments: U.S. Patent and Trademark Office periodically identifies patent classes associated with biotechnologies and reports patent activity by U.S. and foreign resident inventors. NSF/SRS did fund a study of international patent activity (performed by Moge Research & Analysis Associates) in several technology areas using the Derwent World Patent Index Database. Biotechnology was one of the areas examined with patent activity in genetic engineering used as a representative of biotechnology. Those data were presented in *Science & Engineering Indicators* and in a separate issue brief released by NSF/SRS.

Contact details:

<http://www.nsf.gov/sbe/srs/issuebrf/sib99351.htm>

<http://www.uspto.gov>

3. UNITED STATES

Collection/compilation agency: U.S. Census Bureau

Collection/compilation type: Administrative records.

Variables: Exports, imports and balance of trade.

Scope: Trade of goods.

Frequency: Regular

Periodicity: Annual

Classification used: Advanced Technology Products (ATP): Approximately 500 of the Harmonised Tariff Schedule of the United States Annotated for Statistical Reporting Purposes (HTSUSA) and Schedule B commodity classification codes.

Definition used: The medical and industrial application of advanced genetic research toward the creation of new drugs, hormones, and other therapeutic items for both agricultural and human uses.

Output:

- Interactive Tariff and Trade Data Web (Database)
- NSF, *Science and Engineering Indicators 2000*, 2000

Contact comments: N/A

Contact details: <http://www.census.gov/foreign-trade/www/sec2.html#hs>

4. UNITED STATES

Collection/compilation agency: Non-government biotechnology data collection

- **Biotechnology R&D data** available from the Biotechnology Industry Organisation (a trade association for biotechnology firms). <http://www.bio.org/welcome.html>.
- **Biotechnology firm data** (counts and research focus) from the Institute for Biotechnology Information (Research Triangle Park database). <http://www.biotechinfo.com/>.
- **Venture capital funds:** Venture Economics, Inc, Newark New Jersey, a private data collector that compiles data on the U.S. venture capital industry. It classifies much of those data by technology areas, one of which is biotechnology. NSF/SRS routinely purchases data from this company and reports those data in a variety of publications. <http://www.ventureeconomics.com/>
- **Newly formed companies** already operating by technology areas: CorpTech Directory of Technology Companies, located in Woburn, Mass., maintains a somewhat incomplete database of new technology companies operating in the U.S. Biotechnology is one of the technology areas listed in its classification system. NSF/SRS routinely purchases data from this company and reports those data in a variety of publications. <http://www.corptech.com/>.
- **Data on alliances** by technology drawn from an extensive database compiled in the Netherlands— the Maastricht Economic Research Institute on Innovation and Technology's (MERIT 1999) Co-operative Agreements and Technology Indicators (CATI) database—on literally thousands of inter-firm co-operative agreements. The CATI database collects only agreements that contain arrangements for transferring technology or joint research. These counts are restricted to strategic technology alliances, such as joint ventures for which R&D or technology sharing is a major objective; research corporations; and joint R&D pacts. CATI is a literature-based database. Its key sources are newspapers, journal articles, books, and specialised journals that report on business events. Its main limitations are that data are limited to activities publicised by the firm, agreements involving small firms and certain technology fields are likely to be underrepresented, reports in the popular press are likely to be incomplete, and it probably reflects a bias because it draws primarily from English-language materials. CATI information should therefore be viewed as indicative and not comprehensive. These data have been presented in Science & Engineering Indicators: 2000.
- **Data on Foreign-owned R&D facilities** in the United States, by selected industry, including drugs and biotechnology, and country for 1998 and earlier years are available from the U.S. Department of Commerce/ Technology Administration. <http://www.ta.doc.gov/Reports.htm>

EUROPEAN COMMISSION

Collection/compilation agency: European Commission

Collection/compilation type: Interviews or postal inquiries.

Variables: Public R&D spending, biotech-related programmes and sub-programmes, research infrastructure, participation in EU programmes, promotion of industry links, number of researchers, policy targets in relation to biotechnology, non-profit organisations involved in R&D etc.

Scope: Publicly-funded biotechnology R&D stimulation programmes in 17 European countries. Excluding research carried out at universities and private laboratories.

Frequency: Onetime study terminated in 1999.

Periodicity: Study covered the 1994-98 period.

Classification used: “The widely recognised OECD definition of biotechnology (The application of scientific and engineering principles to the processing of materials by biological agents to provide goods and services) together with the European Federation of Biotechnology one (“The integrated use of natural sciences and engineering sciences by the application of biosystems – cells of microbial, plant and animal origin, parts thereof and molecular analogues – in bioindustries”) have been used. However, some Member States might have applied different concepts, reflecting the various ways biotechnology is used in each country (EC, DGXII, *Biotechnology R&D in Europe: National Files*, 1996).

Output:

Inventory of Public Biotechnology R&D Programmes in Europe: Volume 1 - 1999: an analytical report.

Inventory of Public Biotechnology R&D Programmes in Europe: National Reports Volume 2. - 1999.
Austria-Ireland

Inventory of Public Biotechnology R&D Programmes in Europe: National Reports Volume 3. - 1999.
Italy-United Kingdom + Index

Contact comments:

Each national file, included in Volumes 2 and 3, is structured as follows:

- Background: setting the national scene.
- The national system for biotech funding: policy and instruments.
- National competencies and priorities.
- Public and private biotech infrastructure.
- References and people interviewed.

Contact details: <http://europa.eu.int/comm/dg12/biotech/biot-pg-pdf.html>

EUROSTAT

Collection/compilation agency: EUROSTAT

Collection/compilation type: Survey on Government Budget Appropriations on R&D – GBAORD

Variables: Research and Development: Government R&D Appropriations

Scope: Government sector (appropriations)

Frequency: Annual

Periodicity: Annual

Classification used: NABS (Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets)

Output: NEWCRONOS database

Contact comments: The following Member States report data on biotechnology: Denmark, Germany, Greece, Spain, Ireland, Italy, United Kingdom

Contact details: <http://europa.eu.int/comm/eurostat/>

ANNEX: LIST OF EXTERNAL SITES AND PUBLICATIONS

The following section provides an overview of the types of sites that are accessible to the wider public as well as reports prepared by consulting firms. This list is by no means exhaustive or sorted in any particular order. The descriptive paragraph that follows each Web site reference has been drawn directly from the respective sites.

<http://www.ey.com/>

Ernst & Young consulting has produced numerous reports that track developments in the biotechnology field. These publications include statistical data. They have produced reports for Europe, the United States, Germany and Belgium (forthcoming – in conjunction with the Belgian Biotechnology Association) as a “marketing leadership initiative to demonstrate our commitment to the sector and our knowledge of the sector.” The US report is in its 14th year of publication and the European in its 7th year.

- **Publications:**

Ernst & Young LLP, *Bridging the Gap*, 1999 (USA).

Ernst & Young, *Australian Biotechnology Report 1999*, 1999.

Ernst & Young LLP, *European Life Sciences*, 1999.

Ernst & Young LLP, *New directions '98*, 1998 (USA).

Ernst & Young, *Germany's Biotechnology Takes Off in 1998*, 1998.

Ernst & Young LLP, *European Life Sciences*, 1998.

Ernst & Young LLP, *Canadian Biotech '97, Coming of Age*, 1997.

- **Definition:** “The Ernst & Young definition of so-called “Entrepreneurial Life Sciences Companies” (ELISCO), that is commercial companies whose main business purpose is to research, develop and sell products, technologies and services on the basis of modern biotechnology. The fields of application lie in the field of healthcare (therapeutics and diagnostics), agriculture, food, biotechnology fine chemicals and basic goods production as well as environmental protection. These sectors are generally referred to collectively as the “Life Sciences Industry.”

Modern biotechnology means all innovative methods, processes or products which mainly involve the use of living organisms or their cellular and sub-cellular components and which use research results in the field of biochemistry, molecular biology, immunology, virology, microbiology, cell biology or environmental technology and process engineering within the framework of a causative interpretation”.

(E&Y, *Germany's Biotechnology Takes Off in 1998*, 1998).

<http://www.biotechknowledge.com/>

The Knowledge Center, sponsored by Monsanto. This site is an evolving collection of news items, technical reports, fact sheets, speeches and other documents. The site assembles material representing many varying points of view. The principal aim is to promote a deeper understanding of food biotechnology and other life sciences and the many issues associated with them.

<http://www.nuffield.com/bioethics/>

New developments in medicine and biology raise important ethical issues. The Nuffield Council on Bioethics is required, in its terms of reference, to consider these issues.

The Nuffield Council on Bioethics is an independent body established by the Trustees of the Nuffield Foundation in 1991. The Council is jointly funded by the Nuffield Foundation, The Wellcome Trust and the Medical Research Council.

<http://www.biocompass.com/>

Biotechnology Transfer Services (BTS), established in 1986, is a US-based management consulting firm providing global biotechnology business development services, with historical emphasis in Asia-Pacific and the US. Recent expansion now provides for coverage of Europe.

<http://www.biocentury.com/>

Newsletters, conferences and research services, analysis, interpretation and commentary relating to biotechnology industry development, corporate strategy and shareholder value. This site also provides a page of biotechnology links to industry organisations, government agencies, press release sources, financial resources, newsgroups and scientific journals.

[http://www.oecd.org/ehs/biolinks.htm#National Biotechnology Web Sites](http://www.oecd.org/ehs/biolinks.htm#National%20Biotechnology%20Web%20Sites)

This site includes a list of links to Other Biotechnology or Biosafety Resources on the Web.

<http://www.bio.org/welcome.html>

BIO represents more than 830 companies, academic institutions and state biotechnology centres in 47 states and 26 nations. Its members are involved in the research and development of health care, agricultural, industrial and environmental biotechnology programmes.

<http://www.biotechinfo.com>

IBI provides strategic business information to the biotechnology, pharmaceutical and life science communities. Services provided include market research, competitor analysis, and informational studies. Access available upon payment.