

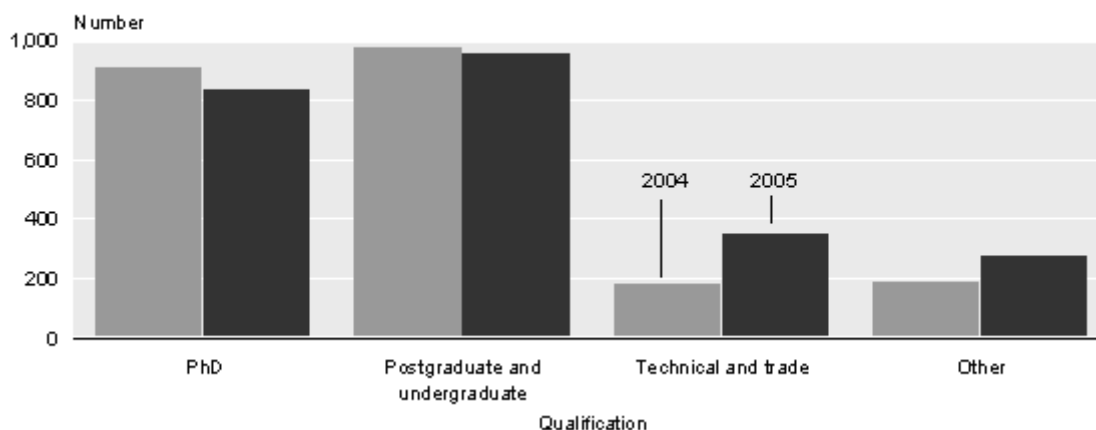
Embargoed until 10:45 am – 05 April 2006

Biotechnology Survey: 2005

Highlights

- Biotechnology income was valued at \$811 million in the 2005 financial year.
- Biotechnology expenditure was valued at \$642 million for the same period.
- Sixty-six percent of biotechnology techniques being used in New Zealand have been used in the R&D development stage in the last two years.
- New Zealand organisations were granted 190 biotechnology-related patents in the two years to 30 June 2005.
- New Zealand organisations employed 2,464 biotechnology employees in the year to 30 June 2005.

Qualification of Biotechnology Employees



Brian Pink
Government Statistician

5 April 2006
Cat 70.915 Set 05/06 – 168

Commentary

Biotechnology Survey 2005

The Biotechnology Survey 2005 measures the use of biotechnologies and their contribution to the New Zealand economy. The survey also looks at the characteristics of biotechnology organisations, including the use of strategic alliances, information sharing and constraints to biotechnology work.

A full report on the Biotechnology Survey 2005 will be released in June 2006. A copy of *Biotechnology in New Zealand 2004*, which analyses the results of the Biotechnology Survey 2004, can be found on the Statistics New Zealand website (refer www.stats.govt.nz).

Guide to interpreting the data

The following summary highlights the main points to consider when analysing the Biotechnology Survey 2005 results. A full technical description is contained in the Technical notes of this release.

Definition of biotechnology

The definition of biotechnology which is used in this survey is consistent with the Organisation for Economic Co-operation and Development (OECD) recommendations outlined in the draft Biotechnology Statistical Framework (refer www.oecd.org).

The OECD defines biotechnology as "the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services."

The following list of techniques was published by the OECD in 2004 as an indicative guideline of what biotechnology includes:

DNA – the coding: genomics, pharmaco-genetics, gene probes, DNA sequencing/synthesis/amplification, genetic modification

Proteins and molecules – the functional blocks: protein/peptide sequencing/synthesis, lipid/protein glyco-engineering, proteomics, hormones, and growth factors, cell receptors/signalling/pheromones

Cell/tissue culture and engineering: cell/tissue culture, tissue engineering, hybridisation, cellular fusion, vaccine/immune stimulants, embryo manipulation

Process biotechnologies: bioreactors, fermentation, bioprocessing, bioleaching, bio-pulping, bio-bleaching, biodesulphurisation, bioremediation, and biofiltration

Sub-cellular organisms: gene therapy, viral vectors

Other: bioinformatics, nanobiotechnologies, other.

Data collection

The Biotechnology Survey 2005 was conducted as a postal survey of all known organisations that were thought to be involved in biotechnology. Further information on the selection and size of the population can be found in the Technical notes of this release.

Use of biotechnologies in New Zealand

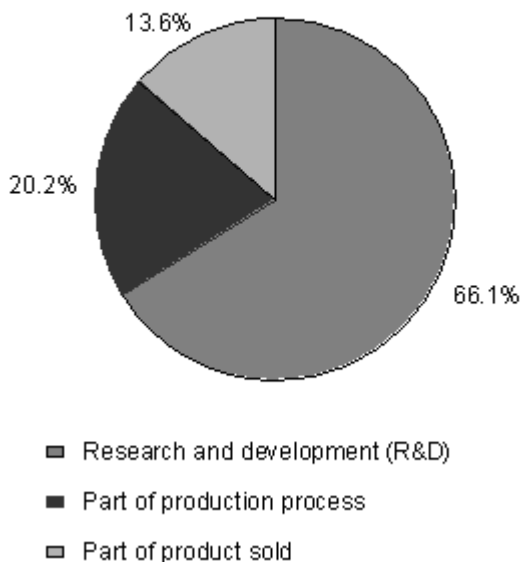
In 2005, 135 organisations indicated that they had used one or more biotechnology techniques in the previous two years. Of these 135 organisations, 126 currently used, or would continue in the next two years to use, these biotechnology techniques. This compares with 110 organisations in 2004.

The use of biotechnology techniques can be broken down into three categories, according to which development stage the technique was used in. The development stages are:

- research and development (R&D)
- part of a production process
- part of the product sold.

Of the biotechnology techniques used by New Zealand organisations in 2005, 66 percent were being used at the research and development stage, 20 percent were as part of a production process and 14 percent as part of the product sold.

Biotechnology Use in New Zealand
2005



These results are consistent with findings in the Biotechnology Survey 2004, where the R&D development stage was also by far the largest use of biotechnology techniques, making up 62 percent of all uses.

Specific uses of biotechnology techniques

The most common type of biotechnology technique being used in the R&D development stage was DNA sequencing/synthesis/amplification, with 51 organisations utilising this technique. This has increased from 39 organisations in 2004, where it was the equal-largest technique in use.

Biotechnology Techniques used in R & D		
Within previous two years		
Biotechnology technique	Number of organisations	
	2004	2005
DNA sequencing/synthesis/amplification	39	51
Gene probes	27	42
Protein/peptide sequencing, synthesis	30	42
Bioinformatics	33	42
Cell/tissue culture, tissue engineering	39	42
Genomics, pharmaco-genetics	27	36
Fermentation, bioprocessing	33	33
Hormones and growth factors	24	33
Cell receptors/signalling/pheromones	24	30
Vaccine/immune stimulants	21	30
Proteomics	21	30
Genetic modification	..	27

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Biotechnology area of application

The most common area of biotechnology application in New Zealand was the environmental area, with 39 organisations utilising biotechnology techniques in this area. The next most common area was animal health/nutrition, with 33 organisations.

Biotechnology Area of Application	
Within previous two years	
Area of application	Number of organisations in 2005
Environmental	39
Animal health/nutrition	33
Plant health/protection	30
Functional foods/nutraceuticals	30
Immunological diseases/parasitology	30
Infectious diseases	30

Plant improvement	27
Food production technologies	27
Biomanufacturing	27
Biosecurity/pest control technologies	27
Biodiversity/ecology/evolution	27
Oncology/cancer	27

Biotechnology income and expenditure

The figures for income and expenditure attributable to biotechnology in 2005 now include data from universities. Data on this was not published in 2004, due to methodology difficulties related to the collection of this type of data. Statistics New Zealand has improved this area for the Biotechnology Survey 2005.

Figures on biotechnology income and expenditure are subject to large variation and are the most difficult to collect reliable time-series data on. This is most commonly because of varying interpretations of the definition of biotechnology among respondents. Data has been released as, despite its variation at the unit record level, it continues to offer the best possible estimate of income and expenditure on biotechnology, and the questionnaire is consistent with the OECD and international best practice.

Biotechnology income in New Zealand for the 2005 financial year was valued at \$811 million, of which \$135 million can be attributed to the higher education sector. In 2004, biotechnology income (excluding universities) was measured at \$675 million.

This compares in size with the fishing industry, which had a total income of \$978 million, as reported in the *Annual Enterprise Survey: 2004 financial year (provisional)*.

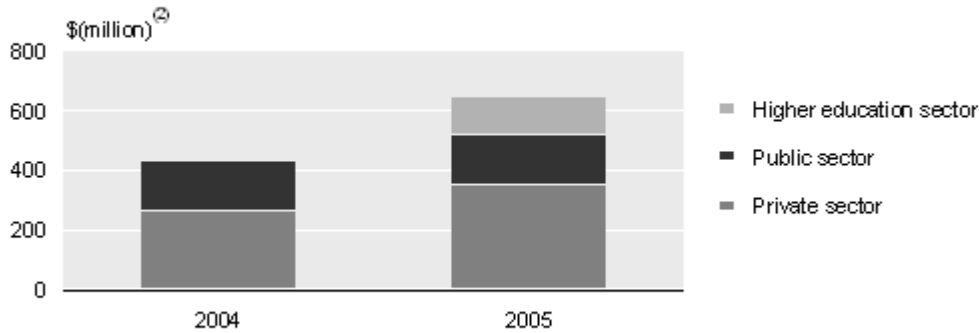


1 Income figures for 2004 exclude university data.

2 Figures are rounded to nearest million dollars.

Biotechnology expenditure in New Zealand for the 2005 financial year was valued at \$642 million. Of this, \$125 million was spent by the higher education sector. This compares with biotechnology expenditure (excluding universities) of \$430 million in 2004.

Biotechnology Expenditure^① By sector



1 Income figures for 2004 exclude university data.

2 Figures are rounded to nearest million dollars.

Biotechnology research and development (R&D)

The R&D Survey 2004 collected information about biotechnology R&D expenditure. This differs from total income and expenditure on biotechnology, as not all expenditure recorded in the Biotechnology Survey is on research and development. The R&D Survey 2004 was the first time that information on biotechnology R&D had been measured in the New Zealand economy, and it used the same definition of biotechnology as the Biotechnology Survey 2005.

Results from the R&D Survey 2004 showed that total biotechnology R&D expenditure amounted to \$363 million for the 2004 reference year, equivalent to 23 percent of total R&D expenditure in New Zealand. When breaking this figure down by sector, business accounted for \$141 million, government \$136 million and universities the remaining \$86 million.

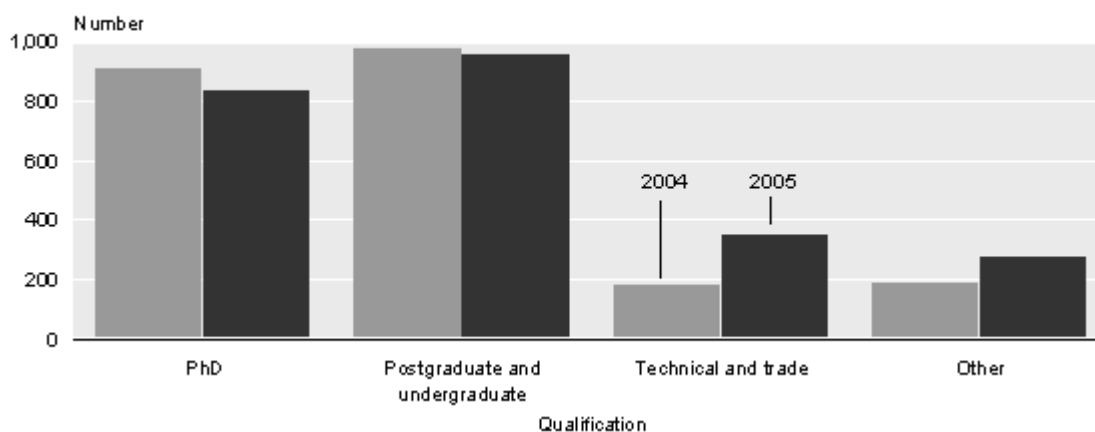
Biotechnology employment and qualifications

In 2005, the biotechnology sector employed 2,424 people in New Zealand. This compares with 2,264 (revised figure) in 2004.

A large proportion of employees in the biotechnology sector are highly qualified. In 2005, 34 percent of biotechnology employees held a doctorate, while a further 39 percent held a postgraduate or undergraduate qualification.

Although there has been an increase in biotechnology employment between 2004 and 2005, there has been a decrease in the number of employees with a doctorate qualification (836 PhD-qualified employees in 2005, compared with 913 in 2004). The overall increase in employment is due to greater employment of those with Technical and trade, or Other, qualifications.

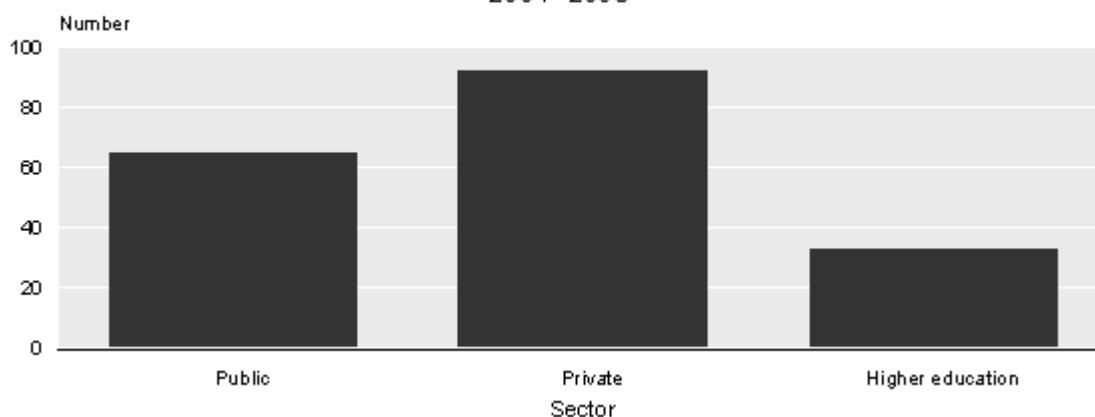
Qualification of Biotechnology Employees



Biotechnology patents

In the two years ended 30 June 2005, 190 biotechnology-related patents were granted to New Zealand organisations. The private sector was responsible for the highest number of these patents (92).

Biotechnology Patents 2004–2005



Constraints to biotechnology R&D

The most common constraint to biotechnology R&D faced by organisations was access to capital, with 54 organisations seeing this as a constraint. This is consistent with the 2004 survey, where access to capital was also considered the largest constraint to biotechnology R&D work.

The next-largest constraints were access to qualified biotechnology research and technical experts, and access to suitably experienced research and technical experts (both 30 organisations).

Constraints Affecting Biotechnology R & D				
Within previous two years				
Constraint	2004		2005	
	Number of organisations	Percentage of organisations	Number of organisations	Percentage of organisations
Access to capital	45	41	54	43

Access to management experts	9	8	9	7
Access to qualified biotechnology research and technical experts	21	19	30	24
Access to suitably experienced biotechnology research and technical experts	24	22	30	24
Access to biotechnology research data and/or information	9	8	6	5
Access to technology	21	19	18	14
Lack of distribution and marketing channels	..	..	6	5
Public perception	..	..	12	10
Patent rights held by others/high licensing costs	..	..	9	7
Regulations	36	33	27	21
Implications of the Treaty of Waitangi	15	14	12	10
Other	3	3	6	5

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Technical notes

This section provides a technical description of the data that has been used to compile this report. It focuses on the data quality and the definitions and processes used for data collection and analysis.

Survey background

The Biotechnology Survey 2005 measures the use of biotechnologies and their uptake by organisations. The survey also asked respondents about the characteristics of their organisations, including the use of strategic alliances, information sharing and constraints to biotechnology work.

Data collection

The Biotechnology Survey 2005 was a postal survey of all organisations meeting the population selection criteria. There were two ways in which an organisation could meet the criteria. The first was if certain biotechnology-specific keywords were found to match those in an organisation name on the Statistics NZ Business Frame. Statistics NZ then supplemented this population with lists from New Zealand Government funding agencies and New Zealand biotechnology associations, as well as the indicator in the Research and Development Survey 2004.

The majority of the questionnaire uses a two-year reference period. Financial information was requested from respondents for the 2005 financial year. The survey was posted out in August 2005.

Comparison between the 2004 and 2005 surveys

A number of changes have taken place between the 2004 and 2005 surveys. The key changes are described below.

For all questions in the survey not relating to the last financial year, the reference period has changed from the three-year period used in the Biotechnology Survey 2004, to the two-year reference period in the Biotechnology Survey 2005. This coincides with the survey becoming biennial from 2005.

In 2005 a new framework was used to determine the areas of application of biotechnology techniques being used. This framework is based on the work of the Ministry of Research, Science and Technology (MoRST), and New Zealand Trade and Enterprise. For this reason, no comparisons can be made with the previous year's data.

The Biotechnology Survey 2005 captures data specifically on biotechnology commercialisation (new products/services introduced to the market).

Care needs to be taken when making comparisons between data from the Biotechnology Survey 2004 and the Biotechnology Survey 2005, due to the change in reference periods.

Measurement errors

Given the nature of the data collected, there are limitations on the level of accuracy that can be expected from the Biotechnology Survey 2005. For many enterprises in New Zealand, biotechnology represents only a small portion of their operations, and for this reason it is hard to separate out biotechnology work from other work. Detailed definitions of what should and should not be included as biotechnology were provided on the questionnaire, and phone-in help was available to respondents.

Revisions have been made to headcount data from the Biotechnology Survey 2004, based on responses received from the Biotechnology Survey 2005.

Target population

The population selection methodology was similar to that used by Statistics NZ in the Biotechnology Survey 2004. The only modification was the addition to the population of enterprises that reported biotechnology R&D in the Research and Development Survey 2004 and which were not already captured through any of the keyword searches or organisational lists.

Organisations that reported they did not use biotechnology techniques in the 2004 survey were generally excluded from the population for 2005.

The selection unit for inclusion in the population was set at the enterprise level.

Criterion 1

The population included enterprises whose predominant activity was likely to be modern biotechnology.

This category included:

(a) All enterprises on the Statistics NZ Business Frame with any of the following keywords in their legal and/or trading names:

- Bioinformatics
- Bioprocessing
- Bioreagent
- Biotechnology
- Biotransformation(s)
- Chromatography
- Clonal
- Concentrates
- Extract
- Extraction
- Fluid extraction
- Functional foods
- Genetic(s)
- Genomic(s)
- Industrial microbiology
- Monoclonal

- Nutraceutical(s)
- Proteomic(s)
- Supercritical
- Transgenic.

(b) Enterprises on the New Zealand Biosphere membership list.

(c) All institutions on the 2004 Foundation for Research, Science and Technology lists of applicants receiving funding to carry out biotechnology-related research and/or development activities.

(d) Local authority sewerage treatment facilities.

(e) All Crown research institutes.

(f) University departments that have an interest in biotechnology.

(g) Microbiology units in metropolitan hospitals.

(h) The New Zealand Blood Service.

(i) All enterprises reporting biotechnology R&D in the Statistics NZ and MoRST's Research and Development Survey 2004.

Criterion 2

The second part of population selection attempted to identify enterprises whose predominant activity was not modern biotechnology, but were considered likely to engage in some modern biotechnology activity. This category includes all enterprises on the Statistics New Zealand Business Frame with any of the following key words in their legal and/or trading names:

- Biological
- Bioscience(s)
- Diagnostics
- Health
- Life science(s)
- Pharmaceutical(s)
- Pharmaceutics
- Science(s)
- Scientific
- Serum.

The third part of the population selection process involved selecting all enterprises that have geographical units on the Statistics NZ Business Frame with one of the following ANZSIC codes:

A0301 Forestry

B1101 Black coal mining

B1200 Oil and gas extraction

C2121 Milk and cream manufacturing

C2129 Dairy product manufacturing

C2161 Bread manufacturing

C2182 Beer and malt manufacturing

C2183 Wine manufacturing

C2331 Pulp, paper and paperboard manufacturing

C2543 Medicinal and pharmaceutical product manufacturing

C2544 Pesticide manufacturing

L7810 Scientific research

L7829 Technical services nec

O8431 Higher education

O8611 Hospitals

Enterprises were removed from criterion 2 population selection if they had GST sales of less than \$5 million.

Response rate

The target overall response rate for the Biotechnology Survey 2005 was 90 percent. The survey achieved an actual response rate of 93 percent, including a 100 percent response rate of enterprises which were identified as being key to the survey.

The population for the Biotechnology Survey 2005 consisted of 400 enterprises.

Imputation

No imputation was conducted for the Biotechnology Survey 2005.

Definitions

ANZSIC: Australia and New Zealand Standard Industrial Classification system – New Zealand version 1996.

Biotechnology: The application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

The following list of techniques was published by the OECD in 2004 as an interpretative guide as to what biotechnology includes:

DNA – thecoding: genomics, pharmaco-genetics, gene probes, DNA sequencing/synthesis/amplification, genetic engineering

Proteins and molecules – the functional blocks: protein/peptide sequencing/synthesis, lipid/protein glyco-engineering, proteomics, hormones, and growth factors, cell receptors/signalling/pheromones

Cell and tissue culture, and engineering: cell/tissue culture, tissue engineering, hybridisation, cellular fusion, vaccine/immune stimulants, embryo manipulation

Process biotechnologies: bioreactors, fermentation, bioprocessing, bioleaching, bio-pulping, bio-bleaching, biodesulphurisation, bioremediation, and biofiltration

DNA and RNA vectors: gene therapy, viral vectors.

Other: bioinformatics, nanobiotechnologies, other.

Enterprise: A business or service entity operating in New Zealand. It can be a company, partnership, trust, estate, incorporated society, producer board, local or central government organisation, voluntary organisation or self-employed individual.

Goods and services tax (GST): Respondents are asked to exclude GST if possible in the financial figures provided in the questionnaire. If they have not, Statistics New Zealand takes out GST to make all enterprises comparable.

Research and development (R&D): Research and experimental development comprising creative work undertaken on a systematic basis in order to increase the stock of knowledge. Any activity classified as R&D is characterised by originality. Investigation is a primary objective.

Statistics New Zealand Business Frame: A register of all businesses operating in New Zealand..

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Next release ...

Biotechnology in New Zealand: 2005 will be released in June 2006.

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Tables

The following tables can be downloaded from the Statistics New Zealand website in Excel 97 format. If you do not have access to Excel 97 or higher, you may use the [*Excel file viewer*](#) to view, print and export the contents of the file.

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