



Australian Government

Department of Education, Science and Training

National survey of research commercialisation

Years 2001 and 2002

**Selected measures of commercialisation activity in universities
and publicly funded research agencies**

October 2004

© Commonwealth of Australia 2004

ISBN 0 642 77455 2

ISBN 0 642 77456 0 (online version)

DEST No. 7205.HERCO4A

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Foreword

Innovation is the key to Australia's future prosperity. The global economy is changing at unprecedented speed. With every passing year, our economic success depends less on our capacity to produce goods and services, and more on our ability to produce, apply and sell the ideas that underpin them.

The Government is determined to build a world-class innovation system in Australia. The \$3 billion it committed to *Backing Australia's Ability* in 2001 was, at the time, the largest single investment in Australian science and innovation. In the 2004–05 budget, through *Backing Australia's Ability – Building Our Future through Science and Innovation*, it has committed a further \$5.3 billion, creating an integrated \$8.3 billion funding commitment over the 2001–11 period.

Through this commitment, the Government is building Australia's capacity to generate ideas and, critically, promoting the conversion of ideas into innovative new products, processes and services. In a relentlessly competitive global economy, we cannot hope to maintain our living standards without a world-class capacity to convert knowledge into economic value.

The survey reported here is playing an important role in helping us to track our performance in one key strategy through which public research can yield economic benefit, namely the identification and successful exploitation of intellectual property by our universities and other publicly funded research organisations.

I extend my sincere thanks to all of the organisations and individuals who have contributed the information on which this report is based. I congratulate them for what they have achieved to date and offer them my best wishes for their future success.

The Hon. Brendan Nelson MP
Minister for Education, Science and Training

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Acknowledgements

The *National Survey of Research Commercialisation Years 2001 and 2002* was commissioned by the Department of Education, Science and Training (DEST).

The Australian Institute for Commercialisation converted the survey instrument into a web-based questionnaire, collected and analysed the data, and contributed substantially to the drafting of the survey report. The product-related stories that appear in the report were prepared by Coretext.

DEST wishes to thank staff in the respondent universities, medical research institutes (MRIs), cooperative research centres (CRCs), and in the Australian Institute of Marine Science (AIMS), Australian Nuclear Science and Technology Organisation (ANSTO), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Defence Science and Technology Organisation (DSTO) for their participation in the survey.

A steering committee was established to oversee the survey. Members of the steering committee were:

Dr Claire Baxter	Steering Committee Chair and Director, Business Liaison Office, the University of Sydney
Dr Evan Arthur	Group Manager, Innovation and Research Systems Group, DEST
Dr Greg Ash	Director, Biotechnology Expert Committees and Performance Management Section, Centre for Compliance and Evaluation, National Health and Medical Research Council (NHMRC)
Mr David Gallagher	Manager, Innovation Commercialisation, Innovation Division, Department of Industry, Tourism and Resources
Dr Michael Hirshorn	Chief Executive, St George Innovation Fund, Nanyang Ventures Pty Ltd
Professor Chris Marlin	Pro Vice-Chancellor, The Flinders University of South Australia (Australian Vice-Chancellor's Committee representative on the steering committee in 2004)
Dr Andrew Pik	General Manager, Cooperative Research Centre Engagement, CSIRO
Mr Simon Sedgley	Director, Policy and Planning Unit, Australian Research Council (ARC)
Professor Fred Smith	Deputy Vice-Chancellor (Research), La Trobe University (Australian Vice-Chancellor's Committee representative on the steering committee in 2003)

The steering committee was supported by staff in DEST who were responsible for liaison with consultants and management of the project. This staff team consisted of Sandy Stevenson, Petra Kavunenko and Ian Lucas. Gillian Romano and Ajith Weeraratne also assisted with the project.

DEST acknowledges the work of the Association of University Technology Managers (AUTM), the Australian Research Council, the National Health and Medical Research Council and the Commonwealth Scientific and Industrial Research Organisation on the National Survey of Research Commercialisation Year 2000 on which this survey and report builds.

Acronyms

ABS – Australian Bureau of Statistics

AGI – adjusted gross income

AIMS – Australian Institute of Marine Science

ANSTO – Australian Nuclear Science and Technology Organisation

ARC – Australian Research Council

AUTM – Association of University Technology Managers

CRC – cooperative research centre

CSIRO – Commonwealth Scientific and Industrial Research Organisation

DEST – Department of Education, Science and Training

DSTO – Defence Science and Technology Organisation

FTE – full-time equivalent

GDP – gross domestic product

LOA – licences, options, assignments (usually referred to as licences or licence agreements)

MRI – medical research institute

NHMRC – National Health and Medical Research Council

OECD – Organisation for Economic Cooperation and Development

PFRA – publicly funded research agency

R&D – research and development



This report provides a number of measures of the commercialisation activity carried out by publicly funded research organisations in 2001 and 2002. It is based on information reported by them in surveys commissioned by the Department of Education, Science and Training (DEST) and conducted on its behalf between October 2003 and February 2004 by the Australian Institute of Commercialisation. It updates information relating to the Year 2000 survey that was reported in September 2002 by the Australian Research Council (ARC), the National Health and Medical Research Council (NHMRC) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The survey for the Year 2000 provided a number of measures of commercialisation activity undertaken in universities, medical research institutes (MRIs) and CSIRO. For the 2001 and 2002 surveys, coverage was extended to include the Australian Institute of Marine Science (AIMS), the Australian Nuclear Science and Technology Organisation (ANSTO) and the Defence Science and Technology Organisation (DSTO) – referred to collectively throughout this report as ‘other publicly funded research agencies (other PFRAs)’.

In addition, the 2001 and 2002 surveys collected data directly for the first time from cooperative research centres (CRCs). Separate figures for CRCs are provided in the report. Given that CRCs are collaborative ventures between universities, MRIs, PFRAs and industry, the outputs attributed to CRCs are outputs from the collaborating partners in addition to the ones directly attributed to them.

Overall, 113 organisations responded to the 2001 survey (with a response rate of 70 per cent) and 124 to the 2002 survey (with a response rate of 75 per cent), up from 50 responses for the 2000 survey. The extra responses reflect the extension of survey coverage noted above together with a significant increase in the number of responses received from MRIs, up from 15 responses for 2000 to 33 for 2001 and 35 for 2002.

The report presents information provided by all the organisations which responded in 2001 and 2002. It also presents results for 2000, 2001 and 2002, relating to those 45 organisations which responded to the surveys for all three years, to provide an indication of changes in the level of commercialisation activity over time.

The report benchmarks the level of patenting, licensing and start-up company formation activity carried out by Australia’s universities against that of their counterparts in other countries, drawing on the results of similar surveys conducted overseas. For the Year 2000, the comparisons related to the United States and Canada. For 2001 and 2002, some comparisons are also provided with the United Kingdom.

Key findings

Summary Table 1 below presents key results relating to the 45 institutions that responded to each of the 2000, 2001 and 2002 surveys. These results provide an indication of overall shifts in the level of commercialisation activity measured by this survey over those three years.

Summary Table 2 presents the same measures for all respondents to the 2001 and 2002 surveys, both in total and by respondent group (universities, MRIs, CSIRO, CRCs and other PFRAs). This provides an indication of the aggregate level of commercialisation activity and how it is distributed across respondent groups. Because of differences in response rates, caution needs to be exercised in interpreting differences between respondent groups.

Summary Table 1: Summary of selected survey metrics for the 45 institutions that responded for 2000, 2001 and 2002

	2000	2001	2002
Patent activity (encompassing patents and plants breeder rights)			
Inventions disclosed	527	622	559
Total Australian and United States patent applications filed ^a	813	622	587
Total patents issued worldwide	493	261	269
Licensing activity (encompassing licences, options and assignments)			
Licences executed	404	374	435
Licences yielding income	476	585	585
Licence income			
Adjusted gross income from licences (\$'000) ^b	95,191	64,738	63,716
Start-up companies			
Start-up companies formed	46	61	53
% of companies with their headquarters in Australia	89%	95%	81%
Companies operational at the end of the year ^c	86	110	116
% of companies in which equity was held at the end of the year	78%	72%	80%
Equity holdings			
Value of equity holdings (\$'000)	104,762	124,235	108,770

^a Initially, some survey respondents included patent applications filed worldwide, rather than only Australia and the United States. The overall figures for patent applications filed in 2001 and 2002 dropped significantly when corrected figures were supplied. If this error was also made in the Year 2000 survey, then this may explain the drop between 2000 and 2001 in the number of patent applications filed.

^b In the Year 2000, a single transaction comprised \$50 million of reported licence income.

^c CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Country comparisons

Data collected in the survey for Australian universities was compared to data from similar surveys of commercial activities in United States, Canadian and United Kingdom universities.

Indicators used to undertake the country comparisons were:

- United States patents issued
- licences executed
- adjusted gross income from licences
- start-up companies formed.

The comparisons express activity against each of these measures in relation to the overall research expenditure reported by responding universities (Summary Table 3) and to each country's gross domestic product (GDP) (Summary Table 4)¹. The top 20 per cent of survey respondents for Australia, United States and Canada in terms of their reported licence income in the 2002 Australian and AUTM surveys are shown in Summary Table 5.

¹ The figures in brackets seek to make an adjustment based on differences in response rates to the surveys undertaken in each country. The accuracy of comparisons based on GDP is uncertain, as the assumption that the samples of institutions in each survey are equally representative of the level of commercial activity cannot be confirmed. For discussion of the methodology, see the section in country comparisons on commercial activity relative to gross domestic product.

Summary Table 2: Summary of selected survey metrics by sector for 2001 and 2002

	2001						2002					
	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
	n=35	n=33		n=41	n=3	n=113	n=38	n=35		n=47	n=3	n=124
Research expenditure												
Research expenditure (\$m)							2,921.23	282.18	807.50	250.06 ^a	275.67	4,536.63
Patent activity (encompassing patents and plants breeder rights)												
Inventions disclosed	560	129	34	39	25	787	521	167	21	76	56	841
United States and Australian patent applications filed	402	82	188	30	16	718	462	95	138	77	48	820
Patents issued	101	23	150	21	6	301	123	15	148	26	7	319
Licensing activity (encompassing licences, options and assignments)												
Licences executed	179	48	158	28	8	421	225	39	188	48	7	507
% of exclusive licences	65%	74%	13%	43%	13%	45%	56%	58%	7%	41%	29%	37%
Licences yielding income	270	47	294	14	7	632	297	61	279	32	6	675
Licence income												
Adjusted gross income from licences (\$m)	44.70	12.82	15.22	1.74	0.65	75.13	46.58	16.87	10.20	3.79	0.99	78.43
Start-up companies												
Start-up companies formed	46	8	10	7	0	71	45	13	3	5	1	67
% of companies with their headquarters in Australia	93%	100%	100%	100%	n/a	96%	91%	46%	100%	80%	100%	82%
Companies operational at the end of the year	99	9	7 ^a	5	0	120	111	13	3 ^b	8	1	136
% of companies in which equity was held at the end of the year	71%	89%	86%	100%	n/a	74%	82%	92%	33%	88%	0%	82%
Equity holdings												
Value of equity holdings (\$m)	91.16	6.25	29.83	2.85	n/a	130.08	85.95	10.69	18.99	7.55	0	123.18

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

^a CRCs are funded by a mix of cash and in-kind contributions. Figures on research income for 2002 provided by CRCs to DEST suggest that in responding to the survey question on research expenditure many CRCs may not have included expenditure of in-kind contributions such as provision of salaries and overheads by other institutions for researchers engaged on CRC projects. Total resources available to the 47 respondent CRCs (as reported separately to DEST) were around \$410 million in 2001–02 and \$450 million in 2002–03.

^b CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Summary Table 3: Commercialisation activity for universities per US\$ billion research expenditure for Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada ^a	United Kingdom
2000				
United States patents issued	33	127	105	n/a
Licences executed	114	140	223	n/a
Adjusted gross income (US\$m) from licences	31	42	17	n/a
Start-up companies formed	16	14	46	n/a
2001				
United States patents issued	10	115	93	n/a
Licences executed	85	120	188	332
Adjusted gross income (US\$m) from licences	16	30	25	10
Start-up companies formed	22	15	40	68
2002				
United States patents issued	13	98	87	n/a
Licences executed	105	118	188	n/a
Adjusted gross income (US\$m) from licences	16	30	17	n/a
Start-up companies formed	21	11	25	n/a

^a Canadian figures include some non-university respondents in year 2000.

Summary Table 4: Commercialisation activity for universities per US\$100 billion in gross domestic product for Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada ^a	United Kingdom
(Figures in brackets are adjusted for response rate) ^b				
2000				
US patents issued	13 (10)	33	17 (25)	n/a
Licences executed	46 (34)	37	36 (53)	n/a
Adjusted gross income (US\$m) from licences	12 (9)	11	3 (4)	n/a
Start-up companies formed	6 (5)	4	7 (11)	n/a
2001				
US patents issued	4 (3)	31	17 (25)	n/a
Licences executed	34 (23)	33	34 (49)	56 (44)
Adjusted gross income (US\$m) from licences	6 (4)	8	5 (6)	2 (1)
Start-up companies formed	9 (6)	4	7 (10)	11 (9)
2002				
US patents issued	5 (3)	30	18 (27)	n/a
Licences executed	41 (28)	36	38 (59)	41 (29)
Adjusted gross income (US\$m) from licences	6 (4)	9	3 (5)	2 (2)
Start-up companies formed	8 (6)	4	5 (8)	10 (7)

^a Canadian figures include some non-university respondents in year 2000.

^b The figures in brackets seek to make an adjustment based on differences in response rates to the surveys undertaken in each country. The accuracy of comparisons based on GDP is uncertain, as the assumption that the samples of institutions in each survey are equally representative of the level of commercial activity cannot be confirmed. For discussion of the methodology, see the section in country comparisons on commercial activity relative to gross domestic product.

Summary Table 5: Licence income received by the top 20 per cent of licence income earners in Australia, United States and Canada in 2002 (ranked by adjusted gross income from licences)

Australia (total Australian survey respondents = 124)				United States (total United States survey respondents = 180)				Canada (total Canadian survey respondents = 31)			
	2002 Adjusted Gross Income from Licences ¹ (US\$ equivalent) ²	2002 Research Expenditure (US\$ equivalent)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure
The University of Queensland	\$20,534,565	\$204,062,285	10.1%	Columbia University	\$155,653,442	\$407,405,270	38.2%	University de Sherbrooke	\$9,989,499	\$31,843,766	31.4%
CSIRO	\$7,502,348	\$593,747,059	1.3%	University of California System	\$82,048,000	\$2,417,638,000	3.4%	University of British Columbia	\$7,435,623	\$165,340,018	4.5%
The University of New England	\$4,279,190	\$32,901,679	13.0%	New York University	\$62,700,209	\$179,727,000	34.9%	UTI, Inc./University of Calgary	\$1,720,675	\$109,618,573	1.6%
Walter and Eliza Hall Institute of Medical Research	\$3,251,404	\$40,963,913	7.9%	Sloan Kettering Institute for Cancer Research	\$54,430,602	\$131,346,508	41.4%	University of Manitoba	\$1,565,004	\$43,127,859	3.6%
The University of Melbourne	\$2,742,029	\$266,984,921	1.0%	Florida State University	\$52,077,120	\$154,705,048	33.7%	University of Alberta	\$1,343,267	\$174,035,669	0.8%
Ludwig Institute for Cancer Research	\$2,601,577	\$12,401,425	21.0%	Stanford University	\$50,176,009	\$573,416,214	8.8%	University of Toronto	\$992,711	\$163,853,322	0.6%
Austin Research Institute	\$2,329,412	\$4,624,265	50.4%	University of Rochester	\$42,095,533	\$260,093,000	16.2%	Average for top 20%	\$3,841,130	\$114,636,534	3.4%
Eye Research and Technology (CRC)	\$1,628,676	\$17,987,500	9.1%	City of Hope National Medical Ctr. & Beckman Research Inst.	\$39,384,067	\$93,628,000	42.1%				
Garvan Institute of Medical Research	\$1,369,853	\$16,415,441	8.3%	W.A.R.F./University of Wisconsin Madison	\$32,060,854	\$662,100,000	4.8%				
Murdoch Childrens Research Institute	\$1,259,082	\$21,012,161	6.0%	University of Florida	\$31,597,753	\$369,246,830	8.6%				
University of Wollongong	\$1,213,015	\$40,044,658	3.0%	Michigan State University	\$29,758,071	\$289,787,000	10.3%				
The University of Sydney	\$1,113,206	\$191,271,162	0.6%	Emory University	\$29,557,917	\$250,719,041	11.8%				
Macquarie University	\$802,941	\$35,319,853	2.3%	Massachusetts General Hospital	\$28,579,181	\$357,222,000	8.0%				
Defence Science and Technology Organisation (DSTO)	\$730,882	\$170,766,912	0.4%	Massachusetts Institute of Technology (MIT)	\$26,346,992	\$898,989,000	2.9%				
The University of Adelaide	\$641,473	\$82,250,735	0.8%	University of Minnesota	\$25,870,843	\$494,265,000	5.2%				
The University of New South Wales	\$637,024	\$138,121,415	0.5%	University of Washington/ Washington Research Foundation	\$22,956,137	\$683,748,627	3.4%				
Telethon Institute for Child Health Research	\$594,118	\$7,611,029	7.8%	Research Corporation Technologies	\$22,570,384	n/a	n/a				
Discovery of Genes for Common Human Diseases (CRC)	\$463,235	\$4,641,963	10.0%	Wake Forest University	\$17,878,920	\$107,500,000	16.6%				
Distributed Systems Technology Centre Pty Ltd (CRC)	\$436,136	\$4,421,171	9.9%	SUNY Research Foundation	\$17,598,746	\$565,095,951	3.1%				

continued over

Summary Table 5: continued

Australia (total Australian survey respondents = 124)				United States (total United States survey respondents = 180)				Canada (total Canadian survey respondents = 31)			
	2002 Adjusted Gross Income from Licences ¹ (US\$ equivalent) ²	2002 Research Expenditure (US\$ equivalent)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure
Howard Florey Institute	\$404,412	\$8,088,235	5.0%	Harvard University	\$15,488,149	\$522,104,100	3.0%				
The Australian National University	\$331,329	\$177,647,059	0.2%	University of Massachusetts	\$14,851,000	\$293,039,000	5.1%				
Royal Melbourne Institute of Technology	\$318,519	\$66,339,574	0.5%	Vanderbilt University	\$11,881,160	\$231,300,000	5.1%				
University of South Australia	\$263,303	\$25,014,795	1.1%	Tulane University	\$11,642,803	\$102,998,000	11.3%				
Queensland University of Technology	\$255,159	\$62,568,130	0.4%	California Institute of Technology	\$11,218,000	\$384,000,000	2.9%				
James Cook University	\$173,932	\$19,431,404	0.9%	Iowa State University	\$10,826,616	\$212,100,000	5.1%				
Average for top 20%	\$2,235,073	\$89,785,550	2.5%	University of Texas Southwestern Medical Centre	\$10,477,669	\$263,958,410	4.0%				
				Baylor College of Medicine	\$9,739,476	\$382,147,291	2.5%				
				Children's Hospital Boston	\$8,999,374	\$106,000,000	8.5%				
				Brigham & Women's Hospital, Inc.	\$8,719,112	\$287,842,000	3.0%				
				Johns Hopkins University	\$8,139,408	\$1,349,899,924	0.6%				
				University of Iowa Research Foundation	\$7,932,531	\$288,808,000	2.7%				
				Mayo Foundation for Medical Education and Research	\$7,308,129	\$323,600,000	2.3%				
				University of Illinois, Chicago, Urbana	\$6,646,908	\$687,026,000	1.0%				
				University of Cincinnati	\$6,527,700	\$115,945,506	5.6%				
				University of Pennsylvania	\$6,435,685	\$655,000,000	1.0%				
				Texas A&M University System	\$6,423,356	\$436,681,000	1.5%				
				Average for top 20%	\$27,405,496	\$431,641,159	6.3%				

Source: United States and Canadian data from AUTM Licensing Survey: FY 2002.

¹ Adjusted gross income from licences is gross income from licences minus licence income paid to other institutions. The subtraction of licence income paid to other institutions from gross income on licences removes a possible double count in licence income data that may occur from the reporting of the same income by more than one institution.

² Australian figures for adjusted gross income from licences have been converted to US\$ equivalents by dividing A\$ by the purchasing power parity used in the report (PPP = 1.36, see Table 34 in report).

Key messages

The survey provides measures of Australia's commercialisation of research across the publicly funded research sector, through time and in comparison with the United States, Canada and (where data are available) the United Kingdom.

The stock of income-yielding licences held by Australia's publicly funded research organisations has increased, as has the active stock of start-up companies formed by them and the overall value of organisations' equity holdings. Employment of commercialisation and commercialisation support staff is increasing. Income earned from licences has remained reasonably steady, after taking account of a single, very large transaction reported in the 2000 survey which inflated the figure reported for that year. The number of new invention disclosures grew between 2000 and 2002, but there were declines in the number of new patents applied for and issued.

In Australia, the university sector earned about 59 per cent of total licence income in 2002, compared with medical research institutes (22%), CSIRO (13%), CRCs (5%) and other PFRAs (1%). Licence income as a proportion of research expenditure was higher for medical research institutes (6%) than for the publicly funded research sector as a whole (1.7%). A striking feature of the results is that across all sectors and all measures used, a small number of organisations accounted for the bulk of the commercialisation activity reported.

Overall, the international comparisons of patenting, licensing and start-up company formation activity suggest that, relative to their peers in the United States, Canada and the United Kingdom, and taking into account differences in levels of research expenditure and countries' GDP, Australia's universities:

- have fewer United States patents issued to them than the United States or Canada
- execute fewer licences than the United States, Canada and the United Kingdom
- earn income from licences at a rate which is greater than the United Kingdom, roughly comparable to Canada but less than the United States
- form more start-up companies than the United States, but fewer than Canada or the United Kingdom.

The data collected in the survey represent an early effort to measure the commercial benefits flowing from public investment in research. They are subject to a range of qualifications and they do not capture the full range of commercial benefits flowing from publicly funded research. Further work on commercialisation metrics is currently underway under the aegis of the Government's Coordinating Committee on Science and Technology. This work will feed into the development of the Quality and Accessibility Frameworks for publicly funded research, which was announced by the Government in the 2004–05 Budget as part of *Backing Australia's Ability – Building our Future through Science and Innovation* (Commonwealth of Australia 2004). The international commercialisation community shares the view that further work is needed to develop commercialisation metrics.

1. Introduction



This report builds on the findings of the first National Survey of Research Commercialisation conducted for the year 2000 (Australian Research Council, National Health and Medical Research Council and Commonwealth Scientific and Industrial Research Organisation 2002). It presents new data for the years 2001 and 2002 and provides time series data for that subset of institutions which responded in all three years. Comparisons of the level of commercialisation activity in the university sector are made with the United States, Canada and the United Kingdom. The report also includes a number of commercialisation success stories to illustrate the impact of research commercialisation on our daily lives.

Methodology

A survey was conducted using the same survey instrument as the Year 2000 survey undertaken in Australia by ARC, NHMRC and CSIRO, which was based on the methodology used in the annual licensing survey conducted in the United States and Canada by the Association of University Technology Managers (AUTM).

Data was collected electronically by the Australian Institute for Commercialisation between October 2003 and February 2004 using a web-based survey questionnaire. Information was sought on:

- research commercialisation staff employed
- research expenditure (this data was collected to allow comparisons of the level of commercialisation activity to be made, taking into account the differing sizes of the responding organisations)
- invention disclosures, patent applications filed and patents issued
- licences executed and income arising from licensing
- start-up companies formed.

While the same information was sought as for the Year 2000 survey, the coverage was significantly extended. The year 2000 survey covered universities, the CSIRO and medical research institutes (MRIs). For 2001 and 2002, the coverage was extended to include: a wider range of MRIs; other publicly funded research agencies (PFRAs) – the Australian Institute of Marine Science (AIMS), the Australian Nuclear Science and Technology Organisation (ANSTO) and the Defence Science and Technology Organisation (DSTO); and Cooperative Research Centres (CRCs). Given that CRCs are collaborative ventures between universities, MRIs, PFRAs and industry, the outputs attributed to CRCs are outputs from the collaborating partners in addition to the ones directly attributed to them.

In 2002 124 organisations responded to the survey, up from 50 for the Year 2000 survey. Table 1 below summarises responses received and response rates. A list of respondents for the surveys is provided at Appendix 1.

Data from the 45 organisations which responded to each of the 2000, 2001 and 2002 surveys has been used in the report to provide an indication of trends in commercialisation activity.

Table 1: Response rates for 2001 and 2002

Organisation type	Responses sought	Responses received 2001		Responses received 2002	
		Number	Response rate	Number	Response rate
University	38	35	92%	38	100%
MRI	54	33	61%	35	65%
CSIRO and Other PFRA's	4	4	100%	4	100%
CRC	66	41	62%	47	71%
All organisations	162	113	70%	124	77%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

This report

Section 2 of the report summarises the survey results. Results for 2001 and 2002 are provided as snapshots, with time series data for the 45 organisations which responded to each of the 2000, 2001 and 2002 surveys.

Section 3 compares the level of patenting, licensing and start-up company formation activity occurring in Australia with that of the United States, Canada and the United Kingdom, as measured through similar surveys in those countries.

Section 4 outlines conclusions arising from the survey findings.

Section 5 provides selected product success stories. These give depth to the statistics reported in the previous sections and provide an insight into the people and processes associated with research commercialisation.

Appendixes provide the following information:

Appendix 1: Survey respondents for 2001 and 2002, and institutions in the time series subset

Appendix 2: The survey questionnaire

Appendix 3: The explanatory memorandum and definitions for the survey. (These notes are important in the interpretation of the reported data and also provide definitions of terms used throughout the survey and report.)

Appendix 4: Data tables at institution level

Appendix 5: Start-up companies formed in 2001 and 2002

Qualifications

In interpreting the data provided in this report it is important to bear in mind that:

- In relation to international comparisons of commercialisation performance:
 - There are differences in the structure of the research systems in each country.
 - There are differences in the structure of the samples from which results are drawn. Data in the AUTM survey is skewed towards universities with the largest research expenditures, and thereby provides a picture of commercialisation performance in those universities. On the other hand, the Australian and United Kingdom surveys are based on what is effectively a census of the whole university sector.

- North American research organisations may benefit from a home ground advantage in terms of United States patents, weakening the power of United States patents issued as a comparative measure.
- Licence earnings figures may vary significantly from year to year and can be influenced strongly by one-off transactions. For example, most of the reported licence income in the Australian Year 2000 survey was derived from a single transaction.
- The measures of patent activity used in the survey do not capture the financial returns generated from patenting and tend to be activity-based rather than value-based. Many patents never return the costs of applying for them, and according to United Kingdom and Organisation for Economic Cooperation and Development (OECD) studies, most top performing international organisations owe their performance to one or two ‘blockbuster’ patents rather than the size of their patent portfolio per se.

Context for interpreting the data

The survey produces a simple set of activity-based indicators which are an important first step in measuring commercialisation performance. But additional context is required to produce a deeper understanding of Australia’s progress in commercialisation. For instance:

- Number of patent applications filed
 - The propensity to patent is influenced by many factors. Where patents and citations are used as measures of excellence in institutions for staff promotion and reward cases, there may be a tendency to over-patent relative to the potential worth or need for the patent. According to UK and OECD studies, top performing international organisations in terms of licensing revenue income almost always do so on the basis of one or two ‘blockbuster’ patents which return the lion’s share of total return for the organisations. Thus more patents do not necessarily mean better performance nor do they necessarily lead to more commercialisation income or value creation.
- Number of start-up companies formed
 - The survival rate of start-up companies across the world is not high. Many start-ups fail because they were formed prematurely or attracted insufficient capital and/or inexperienced leadership. Institutions face a choice as to whether they spin-off technologies into start-ups rather than into existing companies.
 - Additional metrics such as jobs created or capital attracted by start-ups need to be captured to assess the real value of new company formation.

It is possible therefore for organisations to be improving their commercialisation performance while registering declines in terms of some of the measures used in this survey. For example, there is anecdotal evidence that some institutions are becoming more discriminating in their patenting activity, seeking protection only for intellectual property that has a high probability of achieving commercial returns for the institution. In such institutions, declines in the quantity of patenting may be more than offset by gains in quality. In the same way, some organisations may take the view that better commercialisation outcomes can be achieved by creating and focusing resources on a small number of start-up companies with a high probability of success, rather than spreading their resources across a larger number of start-ups with a lower probability of success.

2. Commercial activity – the survey findings



Research commercialisation staff

The survey sought information from institutions about the number of staff involved in commercialisation activities – that is, those whose duties include specific involvement with the protection and exploitation of intellectual property through activities such as patenting and licensing in either a full-time or fractional full-time equivalent (FTE) capacity. Licensing activity includes licensee solicitation, technology valuation, marketing of technology, licence agreement negotiation and drafting, and company start-up activities.

The survey also sought information about the number of other staff whose duties are to provide professional, administrative or staff support to commercialisation activities. These duties include management, compliance reporting, licence maintenance, contract management, and accounting and general office activity.

Commercialisation and support staff may be employed within an office dedicated to commercialisation activities, a commercialisation company or within other functional units within the institution, including those dedicated primarily to research or teaching and research. A commercialisation company is a company that is wholly owned by an institution and established to undertake the commercialisation activities of the institution.

Responses are summarised in Tables 2 and 3 below and provided in full at Appendix 4.

Key points – Research commercialisation staff

Respondents reported employing around 500 full-time equivalent commercialisation staff in 2002. Of these, 194 were in universities and 185 were in CSIRO.

Of the 124 organisations responding in 2002, 54 (9 universities, 20 medical research institutes, 23 cooperative research centres and 2 publicly funded research agencies) did not report employing any commercialisation staff.

For the 45 organisations reporting for each of the three survey years, the number of commercialisation staff grew significantly (by 40 per cent) between 2000 and 2002.

Table 2: Research commercialisation staff (full-time equivalent) in 2001 and 2002

Research commercialisation staff	Universities	MRIs	CSIRO	CRCs	Other PFRA	Total
2001	n=35	n=33		n=41	n=3	n=113
Employed in commercialisation	113	15	107	36	2	273
Employed in commercialisation support	56	22	46	17	0	141
Total commercialisation and commercialisation support staff	169	37	153	53	2	414
Respondents not reporting that they employ any commercialisation staff	9	21		23	2	55
2002	n=38	n=35		n=47	n=3	n=124
Employed in commercialisation	135	20	133	69	4	361
Employed in commercialisation support	59	15	52	15	1	142
Total commercialisation and commercialisation support staff	194	35	185	84	5	503
Respondents not reporting that they employ any commercialisation staff	9	20		23	2	54

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 3: Research commercialisation staff (full-time equivalent) for institutions that responded for 2000, 2001 and 2002

Research commercialisation staff	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
Employed in commercialisation				
2000	88	5	97	189
2001	113	10	107	230
2002	129	11	133	273
Employed in commercialisation support				
2000	52	0	39	91
2001	56	9	46	111
2002	58	8	52	118
Total commercialisation and commercialisation support staff				
2000	140	5	136	280
2001	169	19	153	341
2002	187	19	185	391

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Research expenditure

The survey sought information about the research expenditures made by institutions for the Year 2002 in support of their research activities. Institutions were asked to report this information according to the reporting guidelines for the Australian Bureau of Statistics (ABS) survey of Research and Experimental Development. The biennial ABS survey is conducted in accordance with guidelines promulgated by the OECD and forms the basis of international comparisons of research and development (R&D) expenditure for higher education, government research organisations, and business organisations.

The purpose of collecting the data was to enable comparisons to be made of the level of commercialisation performance between institutions and countries after taking into account their differing levels of research expenditure (see Section 3 of this report). As data is only collected every two years, estimates of research expenditure for 2001 were interpolated from the 2000 and 2002 data.

Responses are summarised in Tables 4 and 5 below and provided in full at Appendix 4.

Table 4: Research expenditure in 2002 (\$'000)

	Universities n=38	MRIs n=35	CSIRO	CRCs ^a n=47	Other PFRA's n=3	Total n=124
Research expenditure	2,921,225	282,184	807,496	250,056	275,667	4,536,627

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

^a CRCs are funded by a mix of cash and in-kind contributions. Figures on research income for 2002 provided by CRCs to DEST suggest that in responding to the survey question on research expenditure many CRCs may not have included expenditure of in-kind contributions such as provision of salaries and overheads by other institutions for researchers engaged on CRC projects. Total resources available to the 47 respondent CRCs (as reported separately to DEST) were around \$410 million in 2001–02 and \$450 million in 2002–03.

Table 5: Research expenditure for institutions that responded for 2000 and 2002 (\$'000)

Research expenditure	Universities n=32	MRIs n=12	CSIRO	Total n=45
2000	2,619,050	118,289	754,500	3,491,840
2002	2,742,363	174,097	807,496	3,723,957

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Invention disclosures and patents

Invention disclosures

The survey sought information from institutions about all invention disclosures made in 2001 and 2002.

An invention disclosure occurs when a device, substance, method or process that is apparently new, useful and involves an inventive step is made known to staff within an institution who have responsibility for managing the institution's research activities. The purpose of disclosure is to place inventions under assessment for their commercial potential. In some instances, patent protection might be sought at a future date for the technologies described in these disclosures, however this strategy is not always appropriate for all disclosures.

Procedures for logging invention disclosures vary from institution to institution. While in some instances a disclosure might be logged without any prior due diligence, in other instances disclosures are not logged until sufficient investigation is undertaken to confirm that the technology is indeed novel and has commercial potential. As a result, care should be taken in comparing the absolute number of disclosures between respondents.

Responses are summarised in Tables 6 and 7 below and provided in full at Appendix 4.

Key points – Invention disclosures

Respondents reported 841 invention disclosures in 2002. Of these, 521 disclosures were in universities and 167 were in medical research institutes.

A small proportion of respondents accounted for a large proportion of disclosures. In 2002 three universities accounted for 48 per cent of all university disclosures; one MRI accounted for 42 per cent of all MRI disclosures; and one CRC accounted for 79 per cent of all CRC disclosures.

75 respondents (11 universities, 23 MRIs, 40 CRCs and one PFRA) did not report any invention disclosures in 2002.

For the 45 organisations reporting for each of the three survey years, there was an increase in the number of disclosures between 2000 and 2002.

Table 6: Invention disclosures in 2001 and 2002

Invention disclosures	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
2001	n=35	n=33		n=41	n=3	n=113
Total disclosures	560	129	34	39	25	787
Largest number of disclosures by a single respondent	104	70		30	15	
Respondents with 10 or more disclosures	13	3	1	1	1	19
Respondents not reporting any disclosures	9	22		35	0	66
2002	n=38	n=35		n=47	n=3	n=124
Total disclosures	521	167	21	76	56	841
Largest number of disclosures by a single respondent	95	70		60	45	
Respondents with 10 or more disclosures	16	4	1	1	2	24
Respondents not reporting any disclosures	11	23		40	1	75

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 7: Invention disclosures for institutions that responded for 2000, 2001 and 2002

Invention disclosures	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000	434	31	62	527
2001	560	28	34	622
2002	489	49	21	559

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Patents

Patents establish legally enforceable protection of rights over intellectual property associated with inventions. They provide surety and security of ownership as a basis for any investment in commercialising the inventions. For an invention to be patented, it must be judged to be new and useful, involve an inventive step and be a 'manner of manufacture' (a legal term used to distinguish inventions that are patentable from those that are not).

A patent application may be made in a year different from that of the relevant invention disclosure and not all inventions disclosed are patented. Further, given the time elapsed between application, examination and issue of patent, it is not possible to map a direct relationship between disclosures, applications and issue of patents.

Patent applications filed and patents issued

The survey sought information from institutions about the number of patent applications filed and the number of patents issued to them in 2001 and 2002.

Patent applications filed included provisional applications, provisional applications that were converted to regular applications and applications for certificates of plant variety. Patents issued included patents issued or reissued and plant breeders' rights.

Reponses are summarised in Tables 8 and 9 below and provided in full at Appendix 4.

Key points – Patent applications filed and patents issued

Respondents for 2002 reported filing a total of 820 patent applications (new and continuations). They reported having 319 patents issued worldwide, including 146 in Australia and 70 in the United States.

A small proportion of respondents accounted for a large proportion of patents applied for and issued in 2002 (6 universities accounted for 64 per cent of all university Australian and United States patent applications, and 3 accounted for 62 per cent of all university patents issued worldwide; 3 MRIs accounted for 46 per cent of MRI patent applications, and 3 accounted for 67 per cent of MRI patents issued; 4 CRCs accounted for 70 per cent of CRC patent applications and 2 accounted for 61 per cent of CRC patents issued).

58 respondents (10 universities, 18 MRIs and 30 CRCs) did not report making any patent applications in 2002 and 87 (20 universities, 28 MRIs, 38 CRCs and 1 PFRA) did not report having any patents issued.

For the 45 organisations reporting for each of the three survey years 2000–02, the results show declines in both the number of patent applications made and the number of patents issued. Anecdotal evidence suggests that this may reflect more discriminating patent practices in our institutions, resulting in the pursuit of patent protection for only the most promising inventions. It is possible that the apparent decline in patent applications reflects errors in respondents' interpretations of the relevant survey questions.²

² Initially, some survey respondents included patent applications filed worldwide, rather than only Australia and the United States. The overall figures for patent applications filed in 2001 and 2002 dropped significantly when corrected figures were supplied. If this error was also made in the Year 2000 survey, then this may explain the drop between 2000 and 2001 in the number of patent applications filed.

Table 8: Patent applications filed (new and continuations) and patents issued in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
Patent applications filed						
2001	n=35	n=33		n=41	n=3	n=113
Total – Australia and United States (new and continuations)	402	82	188	30	16	718
Australia (new)	236	47	107	25	8	423
United States (new)	48	9	8	4	4	73
Patent Cooperation Treaty	113	25	69	15	8	230
Largest number of patent applications filed by a single respondent	62	19		6	8	
Respondents filing 10 or more patent applications	12	3	1	0	0	16
Respondents not reporting filing any patent applications	10	19		28	0	57
2002	n=38	n=35		n=47	n=3	n=124
Total – Australia and United States (new and continuations)	462	95	138	77	48	820
Australia (new)	279	52	108	60	16	515
United States (new)	64	14	9	13	13	113
Patent Cooperation Treaty	142	34	50	17	6	249
Largest number of patent applications filed by a single respondent	67	17		23	23	
Respondents filing 10 or more patent applications	13	3	1	3	2	22
Respondents not reporting filing any patent applications	10	18		30	0	58
Patents issued						
2001	n=35	n=33		n=41	n=3	n=113
Worldwide	101	23	150	21	6	301
Australian	35	15	37	12	2	101
United States	22	12	32	11	2	79
Largest number of patent applications filed by a single respondent	37	5		11	4	
Respondents filing 10 or more patent applications	3	0	1	1	0	5
Respondents not reporting filing any patent applications	19	24		34	1	78
2002	n=38	n=35		n=47	n=3	n=124
Worldwide	123	15	148	26	7	319
Australian	72	9	27	35	3	146
United States	27	7	24	9	3	70
Largest number of patent applications filed by a single respondent	31	4		10	4	
Respondents filing 10 or more patent applications	3	0	1	1	0	5
Respondents not reporting filing any patent applications	20	28		38	1	87

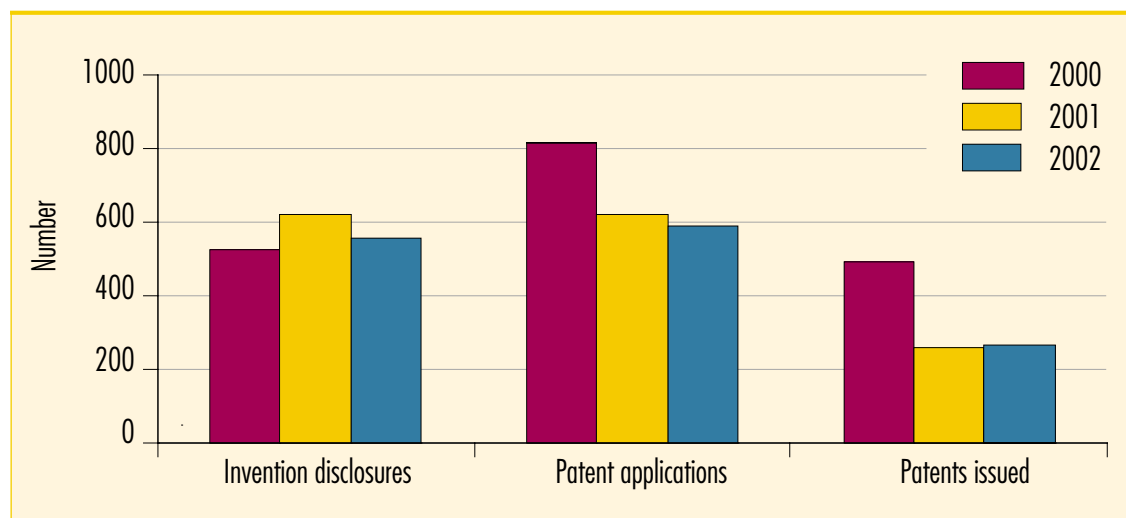
Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 9: Patent applications filed (new and continuations) and patents issued for institutions that responded for 2000, 2001 and 2002

	Universities n=32	MRIs n=12	CSIRO	Total n=45
Patent applications filed				
2000	573	62	178	813
2001	402	32	188	622
2002	411	38	138	587
Patents issued				
2000	214	22	257	493
2001	101	10	150	261
2002	117	4	148	269

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Figure 1: Invention disclosures, patent applications filed and patents issued for the 45 institutions that responded for 2000, 2001 and 2002



Legal fees expenditures and reimbursements

The survey sought information from institutions about the legal fees expended and reimbursed in 2001 and 2002 associated with the management of statutory protection of intellectual property under patents and copyright.

Legal fees expenditures include all amounts spent by an institution in external legal fees in relation to patent, copyright and trademark prosecution, maintenance and interference, as well as minor litigation expenses that are included in everyday office expenditures.

Legal fees reimbursements include all amounts reimbursed by third parties including licensees to an institution for legal fees expenditures.

Responses are summarised in Tables 10 and 11 below and provided in full at Appendix 4.

Key points – Legal fees expenditures and reimbursements

Respondents for 2002 reported just over \$18 million in legal fees expenditures.

On average, survey respondents consistently achieved a recovery rate of expenditures in reimbursements in the vicinity of 30 per cent over the period 2000 to 2002. The university sector has the highest rate of recovery of legal fees at around 40 per cent.

For the 45 organisations reporting for each of the three survey years, the results show that expenditures on legal fees grew between 2000 and 2002.

Table 10: Legal fees in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	PFRAAs	Other Total
2001	n=35	n=33		n=41	n=3	n=113
Expenditures (\$'000)	6,825	1,661	4,979	575	279	14,319
Reimbursements (\$'000)	2,743	499	979	65	25	4,312
% reimbursed	40%	30%	20%	11%	9%	30%
Respondents reporting legal expenditures, but no reimbursements	13	12		11	1	37
Respondents not reporting any legal expenditures	10	17		26	1	54
2002	n=38	n=35		n=47	n=3	n=124
Expenditures (\$'000)	7,951	2,438	5,944	1,312	429	18,074
Reimbursements (\$'000)	3,096	745	1,539	58	15	5,453
% reimbursed	39%	31%	26%	4%	3%	30%
Respondents reporting legal expenditures, but no reimbursements	15	12		18	1	46
Respondents not reporting any legal expenditures	10	16		26	1	53

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 11: Legal fees for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Expenditures (\$'000)	5,596	412	4,720	10,728
Reimbursements (\$'000)	2,276	93	739	3,108
% reimbursed	41%	23%	16%	29%
2001				
Expenditures (\$'000)	6,824	897	4,979	12,701
Reimbursements (\$'000)	2,743	240	979	3,963
% reimbursed	40%	27%	20%	31%
2002				
Expenditures (\$'000)	7,483	1,408	5,944	14,835
Reimbursements (\$'000)	2,852	515	1,539	4,906
% reimbursed	38%	37%	26%	33%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Licences

The survey sought information on the number of licences executed by institutions.

The term 'licensed technology' refers to a technology that becomes a product to be sold or to a technology that is a process that is put into commercial use.

For the purposes of this survey, licence, option and assignment (LOA) agreements were defined as follows:

- A licence agreement formalises the transfer of technology between two parties, where the owner of the technology (the licensor) permits the other party (the licensee) to share the rights to use the technology.
- An option agreement grants the potential licensee a time period during which it may evaluate the technology and negotiate the terms of a licence agreement. An option agreement is not constituted by an option clause in a research agreement that grants rights to future inventions, until an actual invention has occurred that is subject to that option.
- An assignment agreement conveys all right, title and interest in and to the licensed subject matter to the named assignee.

Licence, option and assignment agreements are hereafter referred to collectively as licence agreements or licences.

Responses are summarised in Tables 12 and 13 below and provided in full at Appendix 4.

Key points – Licences executed

Respondents for 2002 reported executing 507 licences in 2002. Of these, 81 per cent were executed by universities and CSIRO.

Licensing activity was highly concentrated. In 2002, CSIRO accounted for 37 per cent of all licences; six universities were responsible for 72 per cent of licences executed by universities; four MRIs were responsible for 72 per cent of licences executed by MRIs; and one CRC accounted for 52 per cent of all licences executed by CRCs.

76 respondents (including 16 universities, 23 MRIs and 35 CRCs) did not report executing any licences in 2002.

For the 45 organisations reporting for each of the three survey years 2000–02, there was a reasonably steady trend in the number of licences being executed each year. Compared to 2000, the number of licences they executed in 2001 was slightly down and the number they executed in 2002 was slightly up.

Table 12: Licences executed in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRAs	Total
2001	n=35	n=33		n=41	n=3	n=113
Licences executed	179	48	158	28	8	421
Largest number of licences executed by a single respondent	28	29		9	7	
Respondents with 10 or more licences executed	7	1	1	0	0	9
Respondents not reporting any licences executed	11	24		33	1	69
2002	n=38	n=35	n=1	n=47	n=3	n=124
Licences executed	225	39	188	48	7	507
Largest number of licences executed by a single respondent	43	9		25	7	
Respondents with 10 or more licences executed	7	0	1	1	0	9
Respondents not reporting any licences executed	16	23		35	2	76

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRAs – Publicly Funded Research Agency

Table 13: Licences executed for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000	228	8	168	404
2001	179	37	158	374
2002	221	26	188	435

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Exclusivity patterns

The survey sought information from institutions for 2001 and 2002 about:

- the number of licences executed that were either exclusive or non-exclusive
- the number of licences executed that were executed with start-up, small, medium or large companies (for definitions of company type, see Appendix 3).

Responses are summarised in Tables 14 and 15 below and provided in full at Appendix 4.

Key points – Licence exclusivity patterns

Respondents for 2002 reported that 37 per cent of licences were executed exclusively. A slight majority of licences executed by universities and MRIs were exclusive, whereas a majority of licences issued by CSIRO, CRCs and other PFRAs were non-exclusive.

There was no clear trend in exclusivity patterns between 2000 and 2002.

Table 14: Licences executed – exclusive and non-exclusive in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
2001	n=35	n=33		n=41	n=3	n=113
Total licences ^a	179	61	158	28	8	434
Exclusive	117	45	20	12	1	195
% of total	65%	74%	13%	43%	13%	45%
Non-exclusive	62	16	138	16	7	239
% of total	35%	26%	87%	57%	87%	55%
2002	n=38	n=35		n=47	n=3	n=124
Total licences ^a	227	48	188	46	7	516
Exclusive	127	28	14	19	2	190
% of total	56%	58%	7%	41%	29%	37%
Non-exclusive	100	20	174	27	5	326
% of total	44%	42%	93%	59%	71%	63%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

^a This number may differ from the total number of licences executed in Table 12, as there were inconsistencies in the total number of licences executed and the number stated to be exclusive and non-exclusive.

Table 15: Licences executed – exclusive and non-exclusive for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Total	202	8	168	378
Exclusive	97	7	41	145
% of total	48%	88%	24%	38%
Non-exclusive	105	1	127	233
% of total	52%	12%	76%	62%
2001				
Total	179	38	158	375
Exclusive	117	38	20	175
% of total	65%	100%	13%	47%
Non-exclusive	62	0	138	200
% of total	35%	0%	87%	53%
2002				
Total	225	20	188	433
Exclusive	127	19	14	160
% of total	56%	95%	7%	37%
Non-exclusive	98	1	174	273
% of total	44%	5%	93%	63%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Responses to licensing activity to start-up, small, medium or large companies are summarised in Tables 16 and 17 below and provided in full at Appendix 4.

Key points – Licences executed to company type

Respondents reported that 50 per cent of their licences in 2001 and 45 per cent in 2002 went to large companies. Start-up and small companies received about 30 per cent in each of 2001 and 2002.

Table 16: Licences executed – to start-up, small, medium and large companies in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRA ^a s	Total
2001	n=35	n=33		n=41	n=3	n=113
Total licences ^a	179	61	158	28	8	434
Licences executed to start-up companies	37	10	4	9	0	60
% of total	21%	16%	3%	32%	0%	14%
Licences executed to small companies	32	2	30	4	3	71
% of total	18%	3%	19%	14%	38%	16%
Licences executed to medium companies	28	21	26	7	4	86
% of total	16%	34%	16%	25%	50%	20%
Licences executed to large companies	82	28	98	8	1	217
% of total	46%	46%	62%	29%	13%	50%
2002	n=38	n=35		n=47	n=3	n=124
Total licences ^a	227	48	188	46	7	516
Licences executed to start-up companies	35	8	0	4	0	47
% of total	15%	17%	0%	9%	0%	9%
Licences executed to small companies	42	1	58	11	3	115
% of total	19%	2%	31%	24%	43%	22%
Licences executed to medium companies	45	12	52	11	2	122
% of total	20%	25%	28%	24%	29%	24%
Licences executed to large companies	105	27	78	20	2	232
% of total	46%	56%	41%	43%	29%	45%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

^a This number may differ from the total number of licences executed in Table 12, as there were inconsistencies in the total number of licences executed and the number stated to be executed to company type.

Table 17: Licences executed – to start-up, small, medium and large companies for institutions that responded for 2000, 2001 and 2002

	Universities n=32	MRIs n=12	CSIRO	Total n=45
2000				
Total licences	228	8	168	404
Licences executed to start-up companies	33	4	18	55
Licences executed to small companies	47	0	14	61
Licences executed to medium companies	21	3	14	38
Licences executed to large companies	97	1	71	169
2001				
Total licences	179	37	158	374
Licences executed to start-up companies	37	8	5	50
Licences executed to small companies	32	1	29	62
Licences executed to medium companies	28	16	26	70
Licences executed to large companies	82	13	98	193
2002				
Total licences	221	26	188	435
Licences executed to start-up companies	35	5	0	40
Licences executed to small companies	41	1	58	100
Licences executed to medium companies	45	4	52	101
Licences executed to large companies	104	10	78	192

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

The patterns of licensing by exclusivity pattern and by company type are shown in Table 18.

Table 18: Percentage of licences executed by exclusivity pattern and company type in 2001 and 2002

Licences executed	To start-up companies		To small companies		To medium companies		To large companies	
	Exclusive	Non-exclusive	Exclusive	Non-exclusive	Exclusive	Non-exclusive	Exclusive	Non-exclusive
2001 (n=434)	93%	7%	56%	44%	41%	59%	30%	70%
2002 (n=516)	96%	4%	41%	59%	30%	70%	26%	74%

Research funding from licences

Respondents were asked to quantify the amount of research funding that was generated by their licence income.

Responses are summarised in Tables 19 and 20 below and provided in full at Appendix 4.

Key points – Research funding from licences

Respondents reported that licensing activity generated about \$60 million in research funding in 2001 and about \$76 million in 2002.

For the 45 organisations reporting for each of the three survey years, there was a slight decline between 2000 and 2002 in the amount of research funding contributed by licence income.

Table 19: Research funding from licences in 2001 and 2002 (\$'000)

	Universities	MRIs	CSIRO	CRCs	Other PFRAs	Total
2001	n=35	n=33		n=41	n=3	n=113
Research funding from licences	44,045	11,218	n/a	4,052	645	59,960
2002	n=38	n=35		n=47	n=3	n=124
Research funding from licences	46,191	10,132	14,156	4,754	994	76,227

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRAs – Publicly Funded Research Agency

Table 20: Research funding from licences for institutions that responded for 2000, 2001 and 2002 (\$'000)

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000	64,323	4,074	n/a	68,397
2001	44,045	7,248	n/a	51,293
2002	45,691	5,361	14,156	65,208

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Income patterns

The survey sought information from institutions about income received from licences, the number of licences yielding income in 2001 and 2002; and the type of income received from licences.

Income from licences

Information provided includes: the gross income from licences; the amount of licence income paid to other institutions and the adjusted gross income³ from licences which, in order to avoid double counting, subtracts the amount of licence income paid to other institutions from the gross income from licences.

Responses are summarised in Tables 21 and 22 below and provided in full at Appendix 4.

³ Adjusted gross income from licences is gross income from licences minus licence income paid to other institutions. The subtraction of licence income paid to other institutions from gross income on licences removes a possible double count in the licence income data that may occur from the reporting of the same income by more than one institution.

Key points – Income from licences

Respondents reported gross income from licences of \$81 million in 2001 (from 632 licences) and adjusted gross income of \$75 million. For 2002, they reported gross income from licences of \$86 million (from 675 licences) and adjusted gross income of \$78 million.

A small number of institutions accounted for a large proportion of income from licences. In 2002, 3 universities accounted for 82 per cent of total university adjusted gross income from licences, 5 MRIs accounted for 88 per cent of total MRI adjusted gross income from licences and 3 CRCs accounted for 87 per cent of CRC adjusted gross income from licences.

76 of the 124 organisations responding in 2002 did not report receiving any licence income.

Among the 45 respondents to the 2000, 2001 and 2002 surveys, there was an overall decline in adjusted gross licensing income between 2000 and 2002. There was a 32 per cent decline in income received from 2000 to 2001, then a relative levelling off in income received across the total respondent population. Income received by the MRIs and CSIRO was relatively stable.

Most of the decline between 2000 and 2001 reflects a 45 per cent reduction in licence income to universities over that period. This in turn was mainly due to the receipt of a large, one-off payment to one of the respondent institutions in 2000. Once this payment is accounted for, income received is relatively stable across the time period.

Table 21: Income from licences in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRAs	Total
2001	n=35	n=33		n=41	n=3	n=113
Gross income from licences (\$'000)	45,704	15,577	17,115	1,737	654	80,787
Licence income paid to other institutions (\$'000)	1,005	2,757	1,900	0	0	5,662
Adjusted gross income from licences (\$'000)	44,699	12,820	15,215	1,737	654	75,125
Licences yielding income	270	47	294	14	7	632
Highest level of adjusted gross income from licences from a single institution (\$'000)	27,518	3,000		717	654	
Respondents not reporting adjusted gross income from licences	15	21		34	2	72
2002	n=38	n=35		n=47	n=3	n=124
Gross income from licences (\$'000)	48,525	20,173	12,110	3,788	994	85,590
Licence income paid to other institutions (\$'000)	1,949	3,306	1,906	0	0	7,162
Adjusted gross income from licences (\$'000)	46,576	16,867	10,203	3,788	994	78,428
Licences yielding income	297	61	279	32	6	675
Highest level of adjusted gross income from licences from a single institution (\$'000)	27,927	4,421		2,215	994	
Respondents not reporting adjusted gross income from licences	14	20		40	2	76

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 22: Income from licences for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Gross income from licences (\$'000)	82,606	5,053	11,620	99,279
Licence income paid to other institutions (\$'000)	537	1,371	2,180	4,088
Adjusted gross income from licences (\$'000)	82,069	3,681	9,440	95,191
Licences yielding income	241	15	220	476
2001				
Gross income from licences (\$'000)	45,704	4,734	17,115	67,553
Licence income paid to other institutions (\$'000)	1,005	0	1,900	2,905
Adjusted gross income from licences (\$'000)	44,789	4,734	15,215	64,738
Licences yielding income	270	21	294	585
2002				
Gross income from licences (\$'000)	47,293	8,169	12,110	67,571
Licence income paid to other institutions (\$'000)	1,949	0	1,906	3,856
Adjusted gross income from licences (\$'000)	45,344	8,169	10,203	63,716
Licences yielding income	280	26	279	585

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Income type

Respondents were asked to provide information on the income received from licences in the form of running royalties, cashed-in equity and all other income. 'All other income' may include licence issue fees, payments under options, annual minimums, termination payments, software and biological material end-user licence fees equal to \$1000 or more, up-front licence fees and milestone payments.

Responses are summarised in Tables 23 and 24 below and provided in full at Appendix 4.

Key points – Income type

Generally speaking, the proportion of licensing income derived from cashed in equity was low. The university figures for this income type were heavily influenced by one single exit in the university sector.

In 2001, 33 per cent of licence income was derived from running royalties and 5 per cent from cashed in equity.

In 2002, 44 per cent of licence income was derived from running royalties and 5 per cent from cashed in equity.

For the 45 organisations reporting for each of the three survey years 2000, 2001 and 2002, there was an increase in the proportion of income received from running royalties between 2000 and 2002.

Table 23: Income from licences by income type in 2001 and 2002 (\$'000)

	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
2001	n=35	n=33		n=41	n=3	n=113
Total gross income from licences	45,704	15,577	17,115	1,737	654	80,787
Running royalties	9,073	5,630	10,676	765	654	26,798
% of total ^a	20%	36%	62%	44%	100%	33%
Cashed-in equity	1,085	3,000	0	0	0	4,085
% of total ^a	2%	19%	0%	0%	0%	5%
All other income	35,546	5,277	6,439	972	0	48,234
% of total ^a	78%	34%	38%	56%	0%	60%
2002	n=38	n=35		n=47	n=3	n=124
Total gross income from licences	48,525	20,173	12,110	3,788	994	85,590
Running royalties	12,660	11,303	10,432	2,395	984	37,774
% of total ^a	26%	56%	86%	63%	99%	44%
Cashed-in equity	682	3,168	0	0	0	3,850
% of total ^a	1%	16%	0%	0%	0%	5%
All other income	35,178	5,537	1,678	1,393	10	43,796
% of total ^a	73%	27%	14%	37%	1%	51%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre;
PFRA – Publicly Funded Research Agency

^a In some cases incomplete information was given about the allocation of gross licence income received to categories of income type, therefore the category percentages do not always add to 100 per cent.

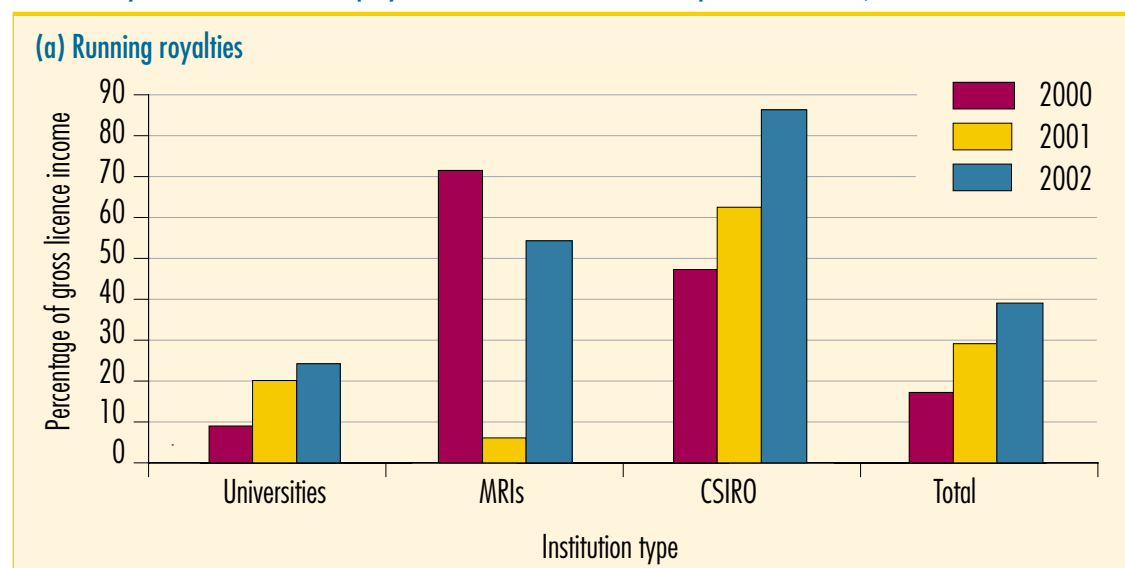
Table 24: Income from licences by income type for institutions that responded for 2000, 2001 and 2002 (\$'000)

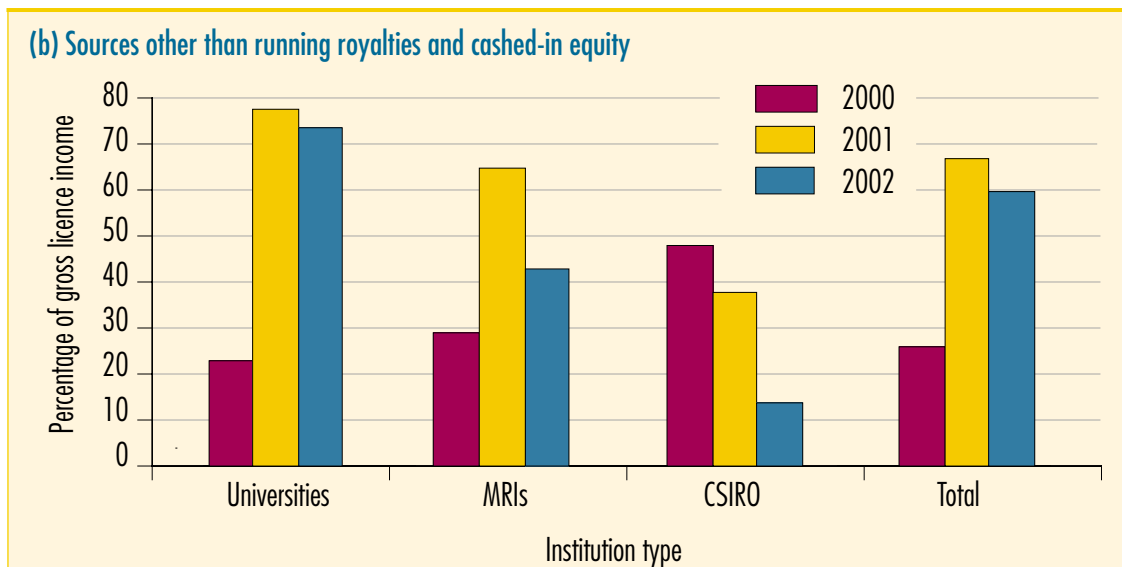
	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Total gross income from licences	82,606	5,053	11,620	99,279
Running royalties	7,643	3,572	5,455	16,670
% of total ^a	9%	71%	47%	17%
Cashed-in equity	52,342	0	600	52,942
% of total	63%	0%	5%	53%
All other income	18,780	1,481	5,565	25,826
% of total	23%	29%	48%	26%
2001				
Total gross income from licences	45,704	4,734	17,115	67,553
Running royalties	9,076	300	10,676	19,752
% of total ^a	20%	6%	62%	29%
Cashed-in equity	1,085	0	0	1,085
% of total	2%	0%	0%	2%
All other income	35,546	3,063	6,439	45,048
% of total	78%	65%	38%	67%
2002				
Total gross income from licences	47,293	8,169	12,110	67,542
Running royalties	11,525	4,451	10,432	26,409
% of total ^a	24%	54%	86%	39%
Cashed-in equity	584	0	0	584
% of total	1%	0%	0%	1%
All other income	35,178	3,553	1,668	40,399
% of total	74%	43%	14%	60%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

^a In some cases incomplete information was given about the allocation of gross licence income received to categories of income type, therefore the category percentages do not always add to 100 per cent.

Figure 2: Percentage of gross licence income derived from (a) running royalties and (b) sources other than running royalties and cashed-in equity for the 45 institutions that responded for 2000, 2001 and 2002





Inventor involvement in licensing

The survey sought information from respondents about the degree of inventor involvement in the commercialisation of each of their licences.

Responses are summarised in Figure 3 below and provided in full at Appendix 4.

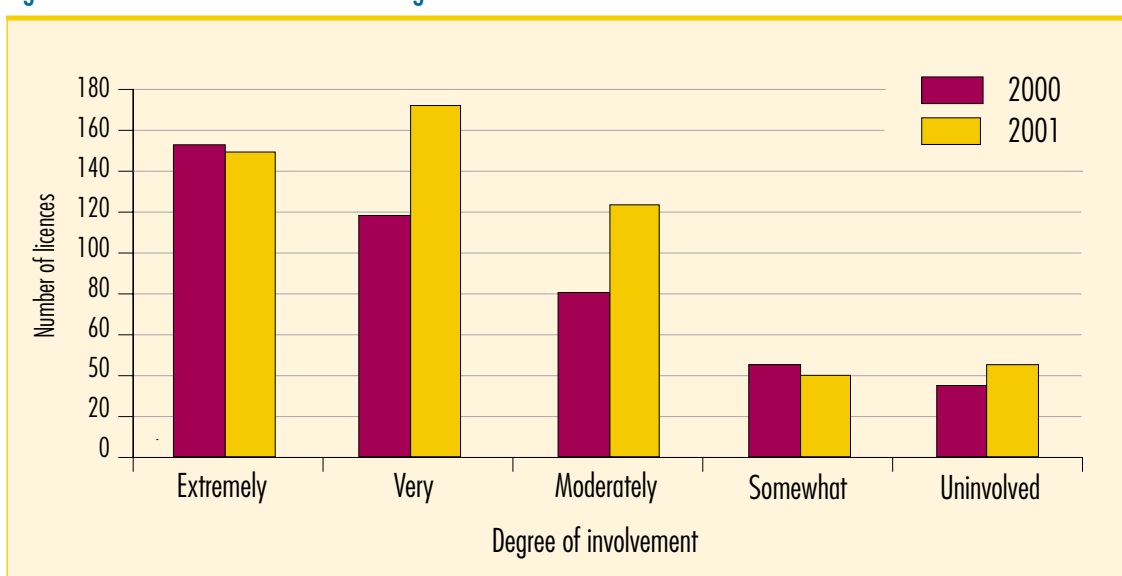
Key points – Inventor involvement in licensing

Inventor involvement in licensing activities appears to be high in most respondent groups and this observation has not changed substantially over time.

In 63 per cent of cases in 2001 and 61 per cent in 2002, inventors were either extremely involved or very involved in licensing activities.

In only 8 per cent of cases were inventors uninvolved in licensing activities in 2001 and 2002.

Figure 3: Inventor involvement in licensing in 2001 and 2002



Research areas from which licences originated

The survey sought information about the areas of research from which licences originated. Institutions were asked for cumulative data, representing the number of licences executed up to and including 2001, and then up to and including 2002.

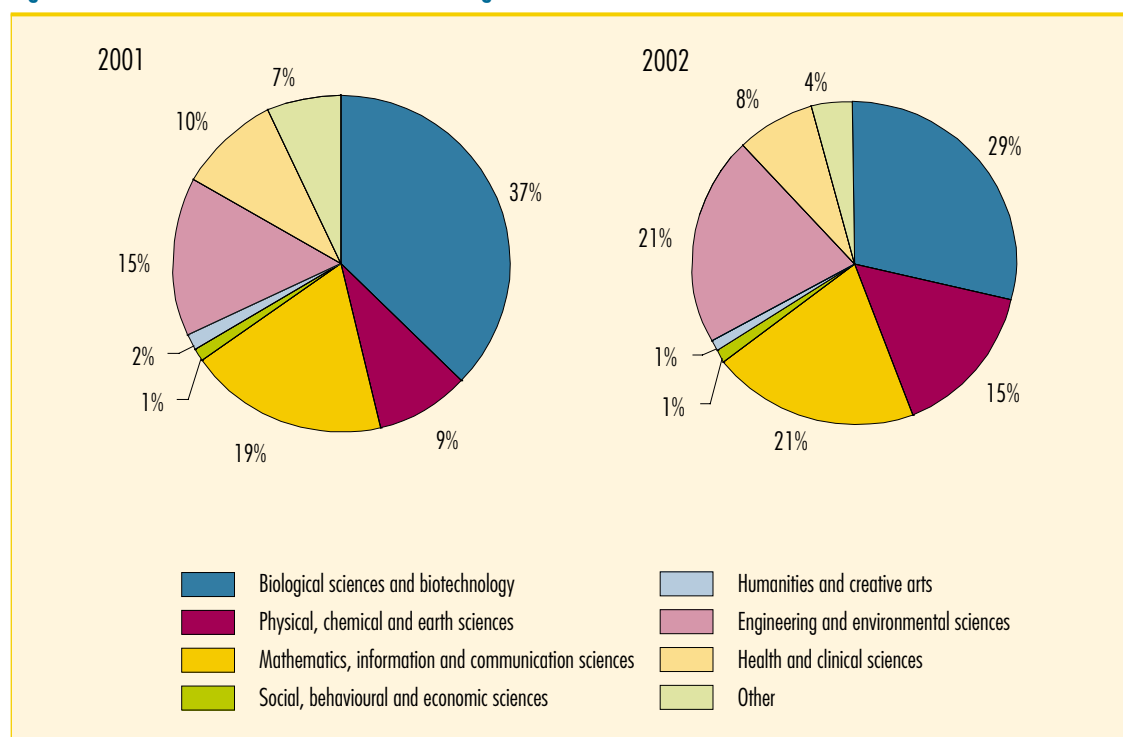
Responses are summarised in Figure 4 and provided in full at Appendix 4.

Key points – Research areas

Almost half of all licences originate from the biological sciences and biotechnology and the physical, chemical and earth sciences areas.

There has been growth in the proportion of licences originating from the physical, chemical and earth sciences area and from engineering and environmental sciences.

Figure 4: Research areas from which licences originated in 2001 and 2002



Start-up companies

As used in this survey, 'start-up companies' refers to companies or traders as persons engaged in businesses that were dependent, for their formation, upon licensing or assignment of technology by the institutions that were the subject of this survey.

Companies formed

The survey sought information from institutions for 2001 and 2002 about:

- the number of start-up companies that were formed; and
- the number of these start-up companies which had their headquarters located in Australia.

Responses are summarised in Tables 25 and 26 and Figure 5 provided in full at Appendix 4.

Key Points – Start-up companies formed

In 2001, 71 start-up companies were formed as the result of licensing of technologies by respondent institutions and 67 in 2002.

The vast majority of these start-up companies were headquartered in Australia.

For the 45 organisations reporting for each of the three survey years, responses indicate an increase in the rate of start-up company formation in universities and MRIs between 2000 and 2002.

Table 25: Start-up companies formed in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRAAs	Total
2001	n=35	n=33		n=41	n=3	n=113
Start-up companies formed	46	8	10	7	0	71
Headquartered in Australia	43	8	10	7	n/a	68
Highest number of start-up companies formed by a single respondent	13	3		3	0	
Respondents reporting at least one start-up company formation	19	5		4	0	28
Respondents not reporting start-up company formation	16	28		37	3	84
2002	n=38	n=35		n=47	n=3	n=124
Start-up companies formed	45	13	3	5	1	67
Headquartered in Australia	41	6	3	4	1	55
Highest number of start-up companies formed by a single respondent	9	8		1	1	
Respondents reporting at least one start-up company formation	19	4		5	3	31
Respondents not reporting start-up company formation	19	31		42	2	94

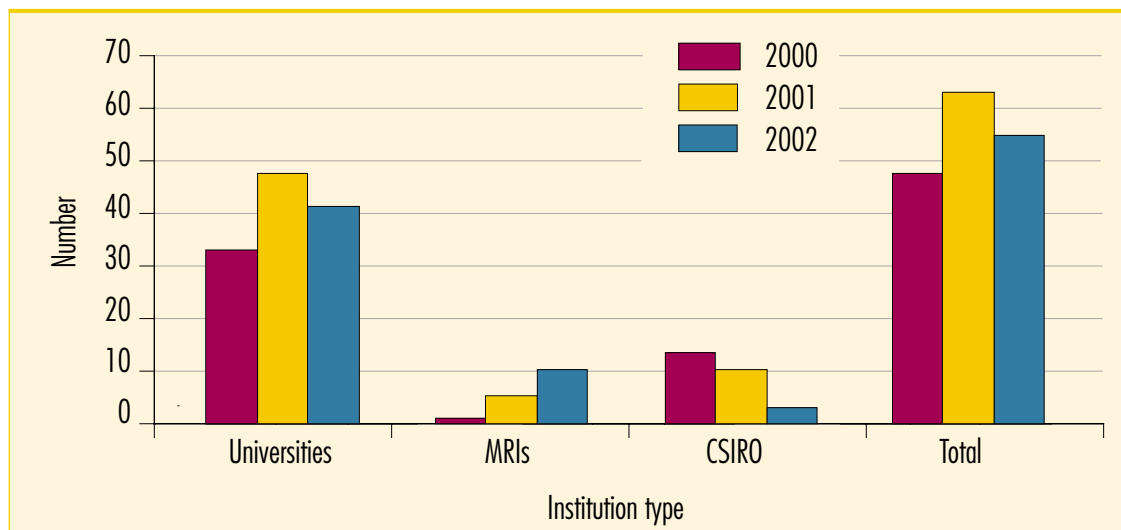
Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 26: Start-up companies formed for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Start-up companies formed	32	1	13	46
Headquartered in Australia	29	1	11	41
2001				
Start-up companies formed	46	5	10	61
Headquartered in Australia	43	5	10	58
2002				
Start-up companies formed	40	10	3	53
Headquartered in Australia	37	3	3	43

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

Figure 5: Start-up companies formed by the 45 institutions that responded for 2000, 2001 and 2002



Operational status

The survey sought information from institutions about:

- the number of start-up companies (formed at any time) that were operational as of the last day in the year
- the number of start-up companies (formed at any time) that had become non-operational as of the last day in the year.

A start-up company is considered to be operational if it possesses sufficient financial resources and expends those resources to make progress toward stated business goals. The company must also be diligent in its efforts to achieve these goals.

Responses are summarised in Tables 27 and 28 and provided in full at Appendix 4.

Key Points – operational status of start-up companies

In 2001, 120 start-up companies were operational at the end of the year and 8 start-up companies became non-operational during the year.

In 2002, 133 start-up companies were operational at the end of the year and 9 start-up companies became non-operational during the year.

Table 27: Start-up companies – operational status in 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
2001	n=35	n=33		n=41	n=3	n=113
Operational at year end	99	9	7 ^a	5	0	120
Non-operational at year end	3	2	3	0	0	8
2002	n=38	n=35		n=47	n=3	n=124
Operational at year end	111	13	3 ^a	8	1	136
Non-operational at year end	4	5	0	0	0	9

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

^a CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Table 28: Start-up companies – operational status for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Operational at year end	82	4	N/A	86
Non-operational at year end	1	0	0	1
2001				
Operational at year end	99	4	7 ^a	110
Non-operational at year end	3	2	2	7
2002				
Operational at year end	106	7	3 ^a	116
Non-operational at year end	4	2	0	6

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

^a CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Equity in start-up companies

For the purposes of this survey 'equity' is defined as acquisition of an ownership interest in a company by an institution or its commercialisation company – for example, stock and rights to receiving stock.

Institutions were asked to provide information on the number of start-up companies in which they held equity that were operational at year end.

Responses are summarised in Tables 29 and 30 and provided in full at Appendix 4.

Key Points – equity in start-up companies

Respondents to the 2001 survey held equity in 74 per cent of start-up companies formed as the result of licensing or assignment of their technologies and operational at year end. For 2002, the figure was 82 per cent.

The proportion of total start-up companies in which institutions held equity and were operational at year end remained fairly constant over 2000, 2001 and 2002 for those institutions which provided information in all three survey years.

The increase in value of equity holdings between 2000 and 2001 can be largely attributed to one dominant licensing agreement in the university sector.

Table 29: Equity held in start-up companies operational at year end 2001 and 2002

	Universities	MRIs	CSIRO	CRCs	Other PFRA ^s	Total
2001	n=35	n=33		n=41	n=3	n=113
Start-up companies operational at year end	99	9	7 ^a	5	0	120
Number with equity	70	8	6	5	n/a	89
% with equity	71%	89%	86%	100%	n/a	74%
2002	n=38	n=35		n=47	n=3	n=124
Start-up companies operational at year end	111	13	3 ^a	8	1	136
Number with equity	91	12	1	7	0	111
% with equity	82%	92%	33%	88%	0%	82%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency.

^a CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Table 30: Equity held in start-up companies operational at year end for institutions that responded for 2000, 2001 and 2002

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Start-up companies operational at year end	82	4 ^a	n/a	86
Number with equity	65	2	n/a	67
% with equity	79%	50%	n/a	78%
2001				
Start-up companies operational at year end	99	4 ^a	7	110
Number with equity	70	3	6	79
% with equity	71%	75%	86%	72%
2002				
Start-up companies operational at year end	106	7	3	116
Number with equity	86	6	1	93
% with equity	81%	86%	33%	80%

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation.

^a CSIRO data relate to start-up companies formed in the survey year and still operational at year end. CSIRO has spun-off more than 80 start-ups since the early 90s and a survey in 1996 indicated that survival rates for CSIRO start-ups is relatively high, at around 70 per cent.

Value of equity holdings

The survey sought information from institutions about the value of all equity holdings as at the end of the year.

Responses are summarised in Tables 31 and 32 and provided in full at Appendix 4.

Table 31: Value of all equity holdings at year end 2001 and 2002 (\$'000)

	Universities	MRIs	CSIRO	CRCs	Other PFRA's	Total
2001	n=35	n=33		n=41	n=3	n=113
Value of equity holdings	91,158	6,250	29,827	2,850	0	130,085
2002	n=38	n=35		n=47	n=3	n=124
Value of equity holdings	85,947	10,690	18,994	7,550	0	123,181

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation; CRC – Cooperative Research Centre; PFRA – Publicly Funded Research Agency

Table 32: Value of all equity holdings at year end for institutions that responded for 2000, 2001 and 2002 (\$'000)

	Universities	MRIs	CSIRO	Total
	n=32	n=12		n=45
2000				
Value of equity holdings	71,774	3,179	29,808	104,762
2001				
Value of equity holdings	91,158	3,250	29,827	124,235
2002				
Value of equity holdings	85,583	4,193	18,994	108,770

Key: MRI – Medical Research Institute; CSIRO – Commonwealth Scientific and Industrial Research Organisation

3. Country comparisons



An analysis was undertaken to compare the data in this survey with information about commercialisation activities occurring in institutions in the United States, Canada and the United Kingdom. Comparisons based on levels of research expenditure and gross domestic product are made in relation to universities only as the institution type surveyed was not uniform across the four countries.

The data presented in Section 2 of this report was collected using a questionnaire based on the Association of University Technology Managers (AUTM) Licensing Survey of technology licensing and related performance for United States and Canadian academic and non-profit institutions and patent management firms. This was to enable the Australian data to be compared directly with that for United States and Canadian institutions collected in the AUTM licensing surveys for 2001 and 2002.

The United Kingdom data was taken from the *Annual UNICO-NUBS Survey on University Commercialisation Activities for the United Kingdom* (Nottingham University Business School 2002).

Indicators used in the country comparisons were:

- United States patents issued
- licences executed
- adjusted gross income from licences
- start-up companies formed.

The comparisons express activity against each of these measures in relation to the overall research expenditure reported by responding universities and to each country's GDP. It should be noted that in relation to the United Kingdom data the 2002 research expenditure figures are unavailable and the United Kingdom data does not allow for differentiation in the patent count between United States and worldwide patents. Thus the United Kingdom is left out of the United States patent activity comparison.

The comparisons are subject to a number of qualifications (see Introduction).

Methodology

Comparisons based on levels of activity per US\$ billion research expenditure

For each country, research expenditure was the sum of the research expenditures of universities in that country that responded to the relevant survey.

Table 33: Total research expenditure for universities in Australia, United States, Canada and United Kingdom (\$/£ million) in 2000, 2001 and 2002

	Australia		United States	Canada ^a	United Kingdom	
	\$	US\$ equivalent	US\$	US\$	£	US\$ equivalent
2000	2,703	2,048	25,759	1,404	n/a	n/a
2001	2,812 ^b	2,099 ^b	27,568	1,639	1,635	2,579
2002	2,921	2,148	31,696	1,830	n/a	n/a

^a Canadian figures include some non-university respondents in year 2000.

^b This figure is interpolated – the average of the figures for 2000 and 2002.

For each country, research expenditure and adjusted licence income received expressed in local currency was converted to United States dollars by dividing that expenditure by the purchasing power parities developed by the OECD. The purchasing power parities used in this survey were:

Table 34: Purchasing power parities for Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada ^a	United Kingdom
2000	1.320	1.000	1.000	0.641
2001	1.340	1.000	1.000	0.634
2002	1.360	1.000	1.000	0.630

^a AUTM surveys report Canadian data in United States currency.

There are some variations in the scope of research expenditure reported by institutions in the four countries.⁴ The scope of the research expenditure data reported by institutions in Australia and Canada appears to be wider than that for data reported by institutions in the United States.

Comparisons based on levels of activity per US\$100 billion of gross domestic product

Country comparisons were made also on the basis of ratios of each of the four indicators to GDP as a way of adjusting absolute levels of commercialisation activity in the four areas in the four countries relative to overall economic output.

Figures for GDP in 2000, 2001 and 2002 for the four countries were sourced from *OECD's Main Science and Technology Indicators 2002/1* (Organisation for Economic Cooperation and Development 2002). For each country, the figure for GDP that was used for comparative purposes was that expressed in United States dollars on the basis of the purchasing power parities referred to above.

To account for the different response rates across the four countries, an adjustment factor was calculated to allow measures to be normalised to the United States response rate (Table 35).

⁴ For a summary of these variations, see OECD 2002.

Table 35: Adjustment factor used to compare Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada	United Kingdom
2000				
Respondents	34	142	22	n/a
Response rate	87% (A)	64% (B)	44% (C)	n/a (D)
Adjustment factor	0.74 (B/A)	1.00 (B/B)	1.46 (B/C)	n/a (B/D)
2001				
Respondents	35	142	27	98
Response rate	92%	64%	45%	80%
Adjustment factor	0.69	1.00	1.43	0.79
2002				
Respondents	38	156	33	125
Response rate	100%	69%	45%	100%
Adjustment factor	0.69	1.00	1.56	0.69

Key: B/A – ratio of United States response rate to Australian response rate; B/B – ratio of United States response rate to itself; B/C – ratio of United States response rate to Canadian response rate; B/D - ratio of United States response rate to United Kingdom response rate.

This adjustment was not necessary in the case of research expenditure, since the expenditures used in the calculation of ratios for the comparisons was only that of the respondent universities in each of the four countries.

The accuracy of the comparisons based on GDP is uncertain. In seeking to correct for variations in response rates to the surveys carried out in each country, the adjustment described above assumes that the samples of universities in the four countries are equally representative of the level of commercial activity of universities that were the subject of the surveys. There are no data available which can confirm that this is the case.

Findings from country comparisons

Commercial activity relative to research expenditure

Table 36: Commercialisation activity for universities per US\$ billion research expenditure for Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada ^a	United Kingdom
2000				
US patents issued	33	127	105	n/a
Licences executed	114	140	223	n/a
Adjusted gross income (US\$m) from licences	31	42	17	n/a
Start-up companies formed	16	14	46	n/a
2001				
US patents issued	10	115	93	n/a
Licences executed	85	120	188	332
Adjusted gross income (US\$m) from licences	16	30	25	10
Start-up companies formed	22	15	40	68
2002				
US patents issued	13	98	87	n/a
Licences executed	105	118	188	n/a
Adjusted gross income (US\$m) from licences	16	30	17	n/a
Start-up companies formed	21	11	25	n/a

^a Canadian figures include some non-university respondents in year 2000.

Figure 6: United States patents issued per US\$ billion research expenditure in 2000, 2001 and 2002

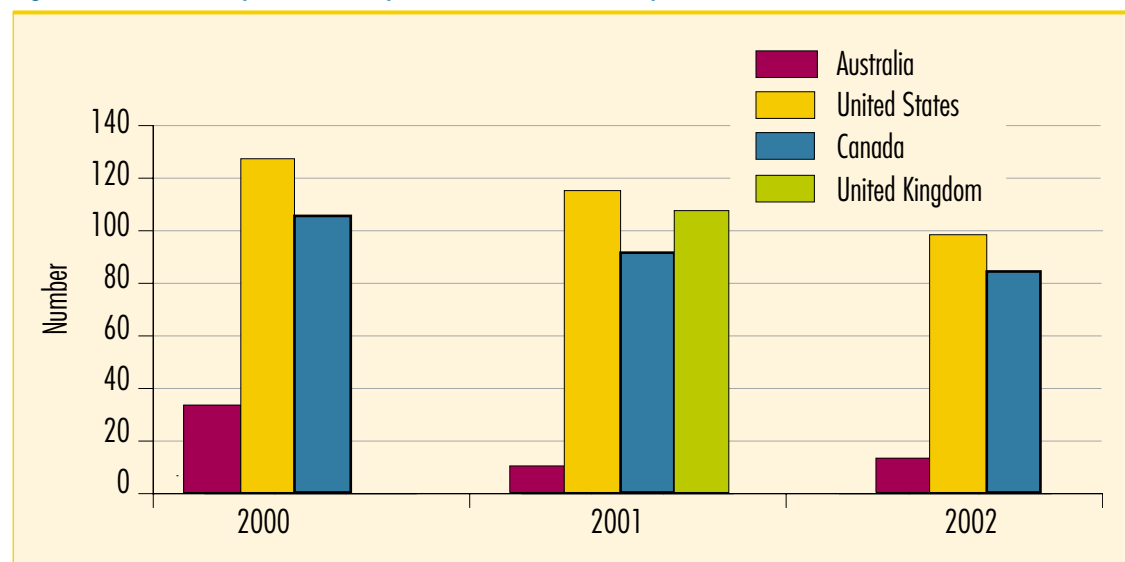


Figure 7: Licences executed per US\$ billion research expenditure in 2000, 2001 and 2002

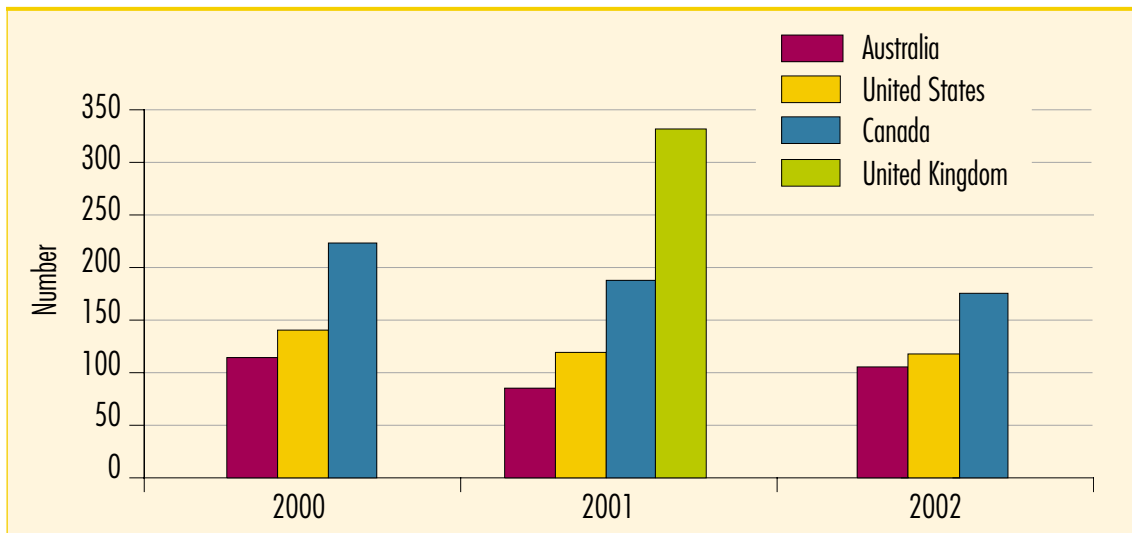


Figure 8: Adjusted gross income (\$/£ million) from licences per US\$ billion research expenditure in 2000, 2001 and 2002

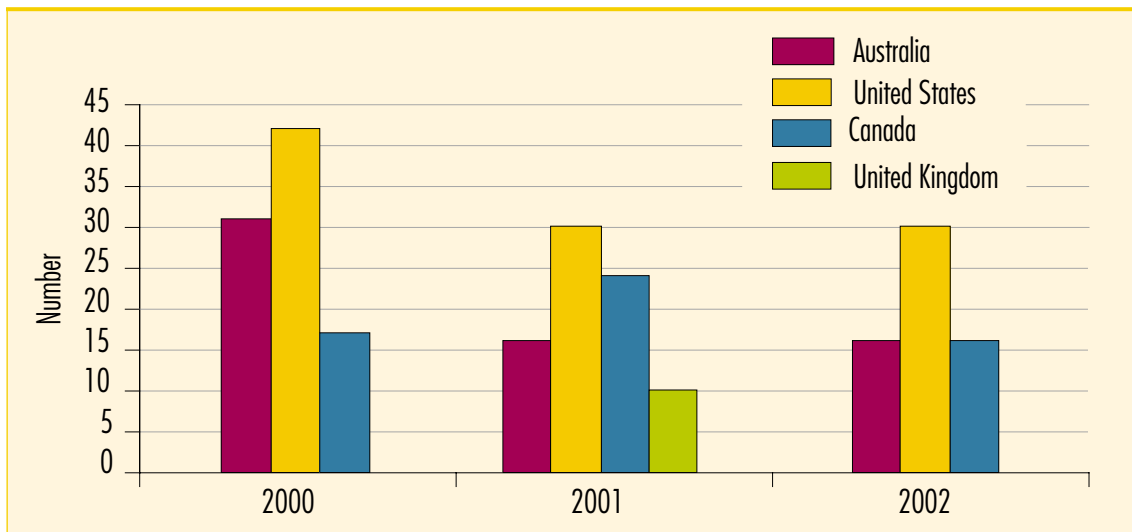
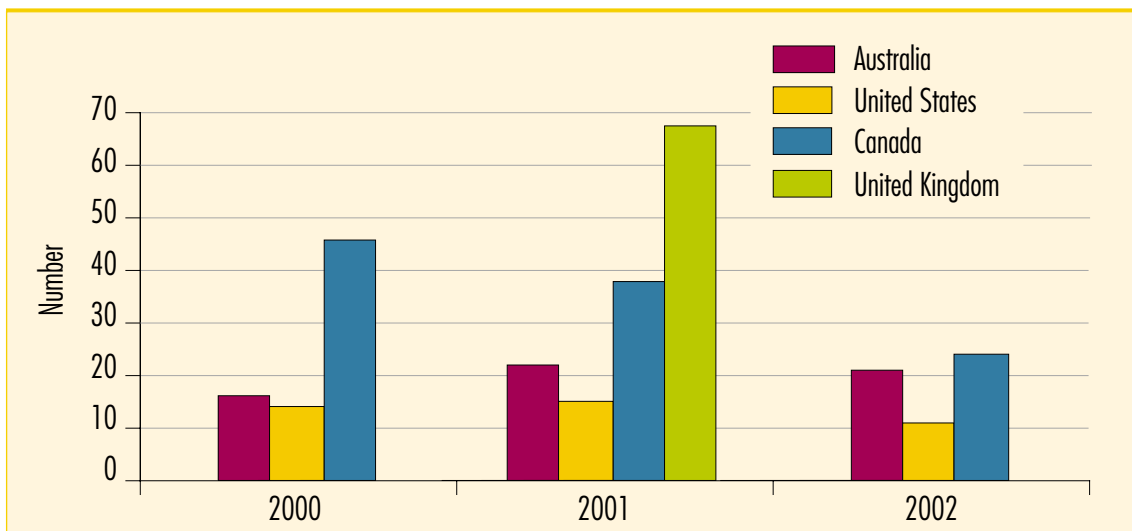


Figure 9: Start-up companies formed per US\$ billion research expenditure in 2000, 2001 and 2002



Commercial activity relative to gross domestic product

Table 37: Commercialisation activity for universities per US\$100 billion in gross domestic product for Australia, United States, Canada and United Kingdom in 2000, 2001 and 2002

	Australia	United States	Canada ^a	United Kingdom
(Figures in brackets are adjusted for response rate) ^b				
2000				
US patents issued	13 (10)	33	17 (25)	n/a
Licences executed	46 (34)	37	36 (53)	n/a
Adjusted gross income (US\$m) from licences	12 (9)	11	3 (4)	n/a
Start-up companies formed	6 (5)	4	7 (11)	n/a
2001				
US patents issued	4 (3)	31	17 (25)	n/a
Licences executed	34 (23)	33	34 (49)	56 (44)
Adjusted gross income (US\$m) from licences	6 (4)	8	5 (6)	2 (1)
Start-up companies formed	9 (6)	4	7 (10)	11 (9)
2002				
US patents issued	5 (3)	30	18 (27)	n/a
Licences executed	41 (28)	36	38 (59)	41 (29)
Adjusted gross income (US\$m) from licences	6 (4)	9	3 (5)	2 (2)
Start-up companies formed	8 (6)	4	5 (8)	10 (7)

^a Canadian figures include some non-university respondents in year 2000.

^b The figures in brackets seek to make an adjustment based on differences in response rates to the surveys undertaken in each country. The accuracy of comparisons based on GDP is uncertain, as the assumption that the samples of institutions in each survey are equally representative of the level of commercial activity cannot be confirmed. For discussion of the methodology, see the section in country comparisons on commercial activity relative to gross domestic product.

In summary the above tables provide comparisons of Australia's commercialisation performance based on research expenditure and per unit of GDP using raw figures and adjusted for response rate. While the different bases for comparison produce some differences in outcomes, overall the results suggest Australia's universities:

- have fewer United States patents issued to them than the United States or Canada
- execute fewer licences than the United States, Canada and the United Kingdom
- earn income from licences at a rate which is greater than the United Kingdom, roughly comparable to Canada but less than the United States
- form more start-up companies than the United States, but fewer than Canada or the United Kingdom.

Comparisons of licence income earned by individual respondents

An additional analysis for country comparisons was undertaken, ranking respondents in the Australian and AUTM surveys for the year 2002 according to their reported licence income in that year. Results are shown for the top 20 percent of licence income earners for Australia, United States and Canada in Table 38.

Table 38: Licence income received by the top 20 per cent of licence income earners in Australia, United States and Canada in 2002 (ranked by adjusted gross income from licences)

Australia (total Australian survey respondents = 124)				United States (total United States survey respondents = 180)				Canada (total Canadian survey respondents = 31)			
	2002 Adjusted Gross Income from Licences ¹ (US\$ equivalent) ²	2002 Research Expenditure (US\$ equivalent)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure
The University of Queensland	\$20,534,565	\$204,062,285	10.1%	Columbia University	\$155,653,442	\$407,405,270	38.2%	University de Sherbrooke	\$9,989,499	\$31,843,766	31.4%
CSIRO	\$7,502,348	\$593,747,059	1.3%	University of California System	\$82,048,000	\$2,417,638,000	3.4%	University of British Columbia	\$7,435,623	\$165,340,018	4.5%
The University of New England	\$4,279,190	\$32,901,679	13.0%	New York University	\$62,700,209	\$179,727,000	34.9%	UTI, Inc./University of Calgary	\$1,720,675	\$109,618,573	1.6%
Walter and Eliza Hall Institute of Medical Research	\$3,251,404	\$40,963,913	7.9%	Sloan Kettering Institute for Cancer Research	\$54,430,602	\$131,346,508	41.4%	University of Manitoba	\$1,565,004	\$43,127,859	3.6%
The University of Melbourne	\$2,742,029	\$266,984,921	1.0%	Florida State University	\$52,077,120	\$154,705,048	33.7%	University of Alberta	\$1,343,267	\$174,035,669	0.8%
Ludwig Institute for Cancer Research	\$2,601,577	\$12,401,425	21.0%	Stanford University	\$50,176,009	\$573,416,214	8.8%	University of Toronto	\$992,711	\$163,853,322	0.6%
Austin Research Institute	\$2,329,412	\$4,624,265	50.4%	University of Rochester	\$42,095,533	\$260,093,000	16.2%	Average for top 20%	\$3,841,130	\$114,636,534	3.4%
Eye Research and Technology (CRC)	\$1,628,676	\$17,987,500	9.1%	City of Hope National Medical Ctr. & Beckman Research Inst.	\$39,384,067	\$93,628,000	42.1%				
Garvan Institute of Medical Research	\$1,369,853	\$16,415,441	8.3%	W.A.R.F./University of Wisconsin Madison	\$32,060,854	\$662,100,000	4.8%				
Murdoch Childrens Research Institute	\$1,259,082	\$21,012,161	6.0%	University of Florida	\$31,597,753	\$369,246,830	8.6%				
University of Wollongong	\$1,213,015	\$40,044,658	3.0%	Michigan State University	\$29,758,071	\$289,787,000	10.3%				
The University of Sydney	\$1,113,206	\$191,271,162	0.6%	Emory University	\$29,557,917	\$250,719,041	11.8%				
Macquarie University	\$802,941	\$35,319,853	2.3%	Massachusetts General Hospital	\$28,579,181	\$357,222,000	8.0%				
Defence Science and Technology Organisation (DSTO)	\$730,882	\$170,766,912	0.4%	Massachusetts Institute of Technology (MIT)	\$26,346,992	\$898,989,000	2.9%				
The University of Adelaide	\$641,473	\$82,250,735	0.8%	University of Minnesota	\$25,870,843	\$494,265,000	5.2%				
The University of New South Wales	\$637,024	\$138,121,415	0.5%	University of Washington/ Washington Research Foundation	\$22,956,137	\$683,748,627	3.4%				
Telethon Institute for Child Health Research	\$594,118	\$7,611,029	7.8%	Research Corporation Technologies	\$22,570,384	n/a	n/a				
Discovery of Genes for Common Human Diseases (CRC)	\$463,235	\$4,641,963	10.0%	Wake Forest University	\$17,878,920	\$107,500,000	16.6%				

continued over

Table 38: continued

Australia (total Australian survey respondents = 124)				United States (total United States survey respondents = 180)				Canada (total Canadian survey respondents = 31)			
	2002 Adjusted Gross Income from Licences ¹ (US\$ equivalent) ²	2002 Research Expenditure (US\$ equivalent)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure		2002 Adjusted Gross Income from Licences ¹ (US\$)	2002 Research Expenditure (US\$)	2002 Adjusted Gross Licence Income as % of Research Expenditure
Distributed Systems Technology Centre Pty Ltd (CRC)	\$436,136	\$4,421,171	9.9%	SUNY Research Foundation	\$17,598,746	\$565,095,951	3.1%				
Howard Florey Institute	\$404,412	\$8,088,235	5.0%	Harvard University	\$15,488,149	\$522,104,100	3.0%				
The Australian National University	\$331,329	\$177,647,059	0.2%	University of Massachusetts	\$14,851,000	\$293,039,000	5.1%				
Royal Melbourne Institute of Technology	\$318,519	\$66,339,574	0.5%	Vanderbilt University	\$11,881,160	\$231,300,000	5.1%				
University of South Australia	\$263,303	\$25,014,795	1.1%	Tulane University	\$11,642,803	\$102,998,000	11.3%				
Queensland University of Technology	\$255,159	\$62,568,130	0.4%	California Institute of Technology	\$11,218,000	\$384,000,000	2.9%				
James Cook University	\$173,932	\$19,431,404	0.9%	Iowa State University	\$10,826,616	\$212,100,000	5.1%				
Average for top 20%	\$2,235,073	\$89,785,550	2.5%	University of Texas Southwestern Medical Centre	\$10,477,669	\$263,958,410	4.0%				
				Baylor College of Medicine	\$9,739,476	\$382,147,291	2.5%				
				Children's Hospital Boston	\$8,999,374	\$106,000,000	8.5%				
				Brigham & Women's Hospital, Inc.	\$8,719,112	\$287,842,000	3.0%				
				Johns Hopkins University	\$8,139,408	\$1,349,899,924	0.6%				
				University of Iowa Research Foundation	\$7,932,531	\$288,808,000	2.7%				
				Mayo Foundation for Medical Education and Research	\$7,308,129	\$323,600,000	2.3%				
				University of Illinois, Chicago, Urbana	\$6,646,908	\$687,026,000	1.0%				
				University of Cincinnati	\$6,527,700	\$115,945,506	5.6%				
				University of Pennsylvania	\$6,435,685	\$655,000,000	1.0%				
				Texas A&M University System	\$6,423,356	\$436,681,000	1.5%				
				Average for top 20%	\$27,405,496	\$431,641,159	6.3%				

Source: United States and Canadian data from AUTM Licensing Survey: FY 2002.

¹ Adjusted gross income from licences is gross income from licences minus licence income paid to other institutions. The subtraction of licence income paid to other institutions from gross income on licences removes a possible double count in licence income data that may occur from the reporting of the same income by more than one institution.

² Australian figures for adjusted gross income from licences have been converted to US\$ equivalents by dividing AS by the purchasing power parity used in the report (PPP = 1.36, see Table 34 in report).

4. Conclusions



This survey provides a picture of the commercialisation performance of our publicly funded research organisations as well as a basis for benchmarking our performance against that of our international peers.

The stock of income-yielding licences held by Australia's publicly funded research organisations has increased, as has the active stock of start-up companies formed by them and the overall value of their equity holdings. Their employment of commercialisation and commercialisation support staff is increasing. Their income from licences has remained reasonably steady, after taking account of a single, very large transaction reported in the 2000 survey which inflated the figure reported for that year. Their numbers of new inventions disclosures grew between 2000 and 2002, although they applied for and were issued fewer new patents.

The results suggest that, relative to their peers in the United States, Canada and the United Kingdom, and taking into account differences in levels of research expenditure and countries' GDP, Australia's universities:

- have fewer United States patents issued to them than the United States or Canada
- execute fewer licences than the United States, Canada and the United Kingdom
- earn income from licences at a rate which is greater than the United Kingdom, roughly comparable to Canada but less than the United States
- form more start-up companies than the United States, but fewer than Canada or the United Kingdom.

The growth in staffing numbers provides an encouraging sign that institutions are increasing their focus on commercialisation activity. By the same token, the results make it clear that there is significant room for improvement. A striking result, across all sectors and all measures used, is that a small number of our organisations account for the bulk of the commercialisation activity reported. On two of the international comparative measures listed above (licences executed and, especially, patents issued) we perform the least well of all the countries with which we are comparing ourselves, while we are 'middle-of-the-road' on the other two (licence income and numbers of start-up companies formed).

That said, it needs to be stressed that the measures used in the survey represent an early effort to measure the commercial benefits flowing from public investment in research. They are subject to a range of qualifications – especially, that they tend to focus on levels of commercialisation activity rather than on the ultimate outcomes of that activity on our economy and labour market. They do not capture the full range of commercial benefits flowing from publicly funded research – for example, they miss the benefits to the economy of: consultancy work carried out by researchers; theses on commercially relevant topics carried out by higher degree students; and the economic contributions made by people with research training who move into industry.

Further work on commercialisation metrics is currently underway under the aegis of the Government's Coordinating Committee on Science and Technology. This work will feed into the development of the Quality and Accessibility Frameworks for publicly funded research announced by the Government in the 2004–05 Budget as part of *Backing Australia's Ability – Building our Future through Science and Innovation*. The international commercialisation community shares the view that further work is needed to develop commercialisation metrics.

