

가

(The link between Australian patenting and basic science)

2

CSIRO

CSIRO, ,

CHI Reasearch
4가

가

가?

가

가?

CHI Research

(Lingkage)

가?

* (CHI Research)

가?

1999 ,
ARC(Australian Research Council)
CSIRO(Commonwealth Scientific and Industrial
Research Organisation;) CHI
Research Inc(USA) 가 ,

4가

가

4

4

가(patent citation analysis)

CHI Research 1999 , 9
2000 .

1. Patent Citation Analysis of Australian - Invented U.S.Patents, 1999.11.10
2. Statistical Comparison of International Science Citation by Patents, 1999.06.24
3. Patent Citation to Australian Papers, 1999.11.10
4. Science Base of Australian - Invented U.S.Paents, 1999.11.10

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가

가

가

1. (Patent Citation Analysis)

B.

A.

(front page) ()
 가 ,
 3가 ,
 1~2 , 1~2 , 7~8 ,
 5 , 4~5

Indicator

가 Indicator 'Current
 Impact Index(CII)' . CII 5 가
 가
 , CII=1.0 가

가 'Technology Cycle Time (TCT)' . TCT
 (median age)

. TCT
 4~5 ,
 10~15

SL

'Science Linkage'(SL)

. SL

SL 0 , 1~2 , 15 ,
 5~6 , Genentech 25

1979 - 1998

0.5%

가 . Fig.4

Fig. 4. Australian-invented percentage of U.S. patents granted 1979-1998

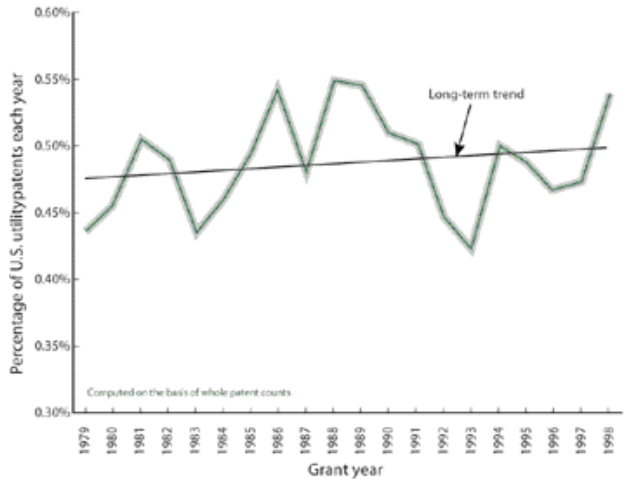
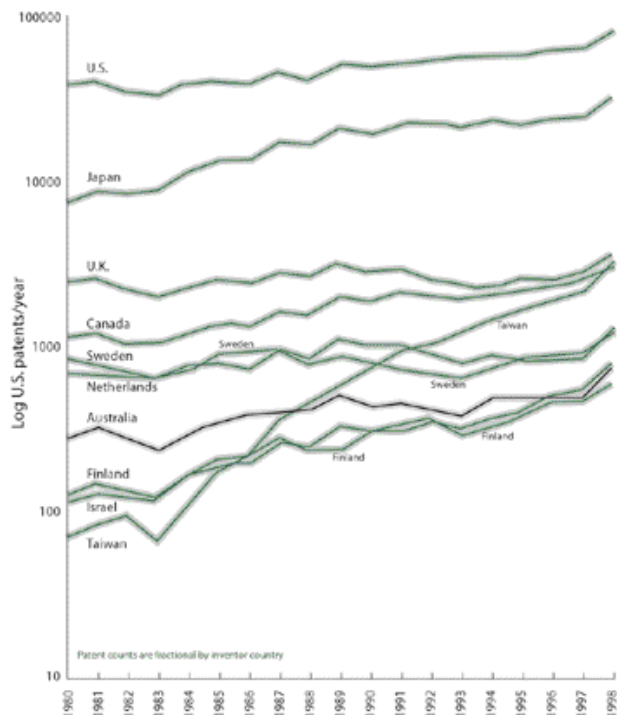


Fig.5

9

Fig. 5. Patenting trends in the U.S. patent system by inventor country 1980-1998



가 Fig.6 . GDP
 가 GDP
 가 GDP
 가

. TAs(Technology Area) SIC(
 SIC
 2~3
 CHI Research 가

Fig. 6. Patent count vs. GDP by inventor country



Fig 8

Fig. 8. Comparison of trends for U.S. and Australian patents granted to Australian-resident inventors 1987-1997



Fig. 9. Distribution of 1994-1998 patenting by technology area (%): Australian-Invented vs. all U.S. patents (technology areas ranked by Australian percentage)

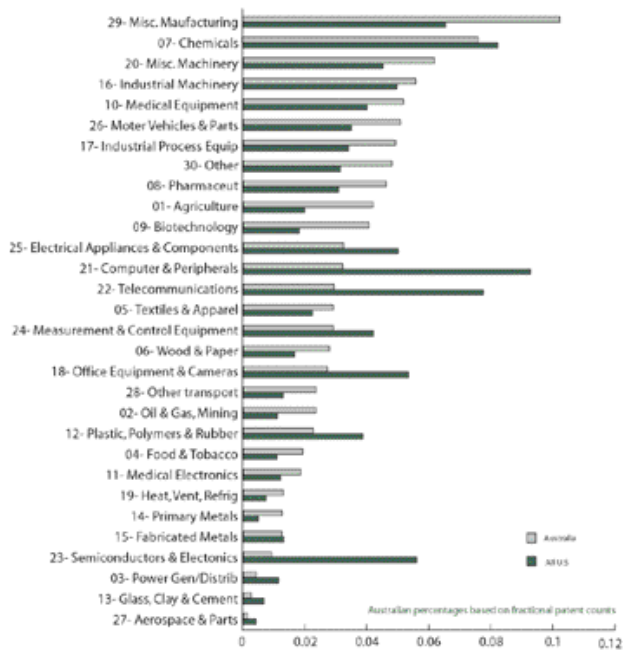
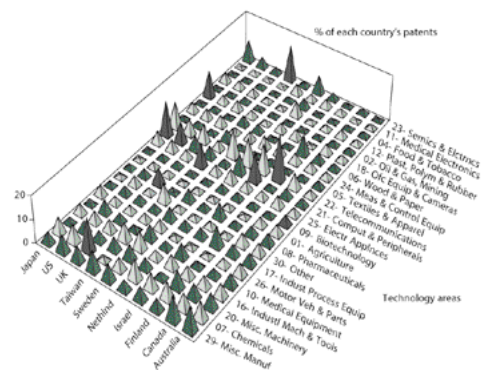


Fig.9

가

Fig. 10. 1994-1998 U.S. patent distribution by technology area for Australia and nine competitor countries



C.

30 Tech - Lire TAs() 5
 가

Tech - Lire 가 1200
 CHI Research

Fig.10 9
(TAs)
가

(Growth)

Fig.12 5 가 5
249%
174%
3% /

Fig.12. Technology area growth 1989-1993 to 1994-1998: Australian-invented vs. all U.S. patents (technology areas ranked by percentage change)

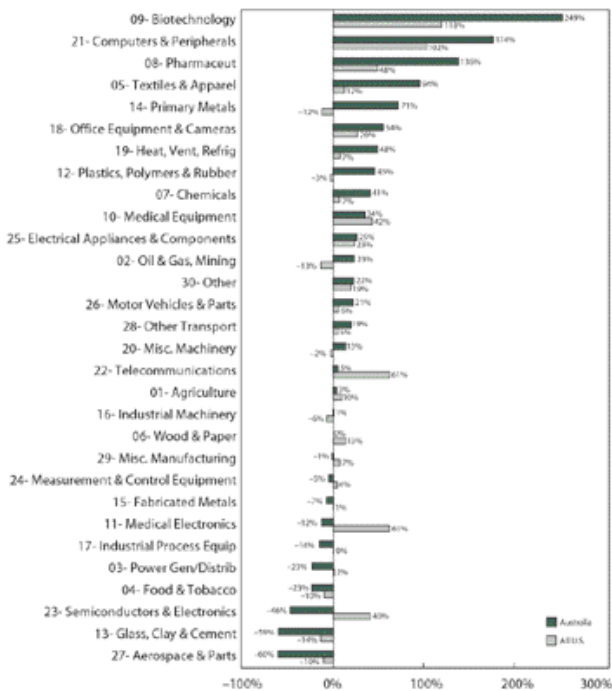
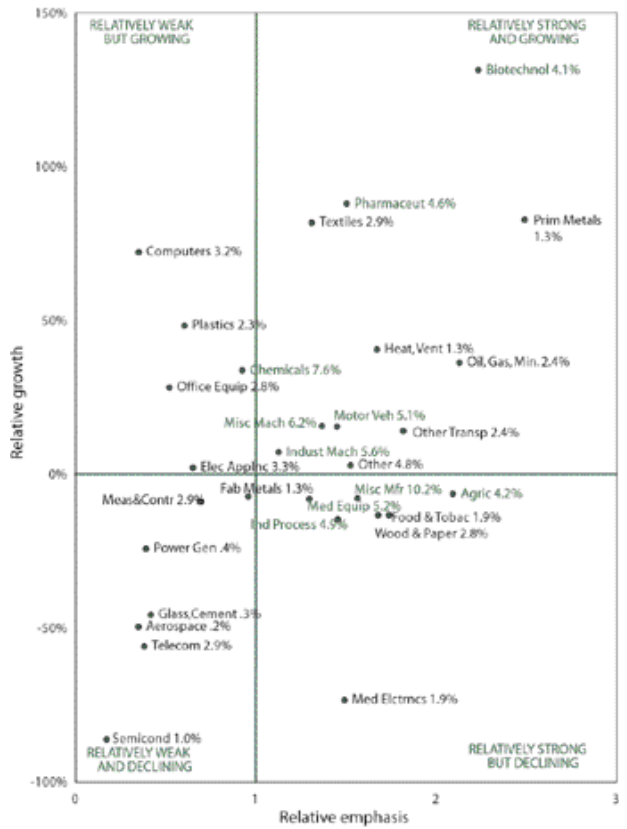


Fig.13

(relative emphasis)
(relative growth)

Fig.13. Australian emphasis vs. growth by technology area, relative to all U.S. patents in the same technology area



D. (enterprise; , ,)

Table 3. Counts* of Australian-invented† U.S. patents in four 5-year periods for enterprises with at least 10 patents 1979-1998. Fractional counts are rounded to whole numbers. Unified assignees are in bold.

20-Yr total rank	Company [§]	1979-1998 Total	1979-83	1984-89	1990-93	1994-98	% Growth b/w/ last 2 periods
1	CSIRO[†]	318	70	52	57	139	144
2	COMM. OF AUSTRALIA except CSIRO	232	37	83	49	64	30
3	ICI (now GRICA)	187	62	57	47	22	-53
4	ST. JUDE MEDICAL INC. (Pacesetter)	102	18	20	41	23	-43
5	UNISEARCH LIMITED	83	25	34	13	11	-15
6	ORBITAL ENGINE CO. PROPRIETARY LTD.	78	0	15	30	33	10
7	UNIV MELBOURNE	72	10	5	23	33	42
8	BROKEN HILL PTY. CO. LTD., THE	69	15	16	19	19	0
9	BTR PLC	43	12	13	8	10	25
10	CANON INC	40	0	0	0	40	#N/A

Table 3

20	5	CSIRO	144%
318	1	CSIRO	ICI (ORICA),
St Jude Medical	가	CSIRO	가

Table 5

.11	(TAs)	5
, CSIRO	8	1~2

Table 5. Enterprises with the largest number of 1994-1998 Australian-invented U.S. patents by technology area

01- Agriculture	17- Industrial Process Equip
COMMONWEALTH OF AUSTRALIA	12
INTL FLOWER DEVELOPMENTS PTY. LTD.	5
MINISTER FOR AGRICULTURE & FISHERIES	3
MALLINCKRODT GROUP, INC.	3
DARATECH PTY. LTD.	3
WESCOE CRUSHERS PTY LTD	2
STRATHAIR PTY LTD	2
SPEEDWIND INC.	2
REDOTT & COLEMAN PLC	2
MOUNT ISA MINES. LTD.	2
GOODMAN FIELDSER LIMITED	2
IFM HORMAZOZ NORMENIS PTY LTD	2
AUSTRALIAN NATL UNIV. THE	2

07- Chemicals	20- Misc. Machinery
COMMONWEALTH OF AUSTRALIA	30
UNIV MELBOURNE	11
LUDWIG INSTITUTE FOR CANCER RESEARCH	9
ICI AUSTRALIA OPERATIONS PTY. LTD.	8
UNIV SYDNEY	7
AMFAD CORP. LTD.	5
CHIRON CORP.	3
COMBLOD ALUMINUM LTD.	3
AUSTRALIAN NATL UNIV. THE	3
ROCHE HOLDING LTD.	3
UK DEPARTMENT OF DEFENSE	3
UNISSEARCH LIMITED	3
IRLANTAGENT HOLDINGS PTY LTD	3

E. 가(Measuring Patent Impact)

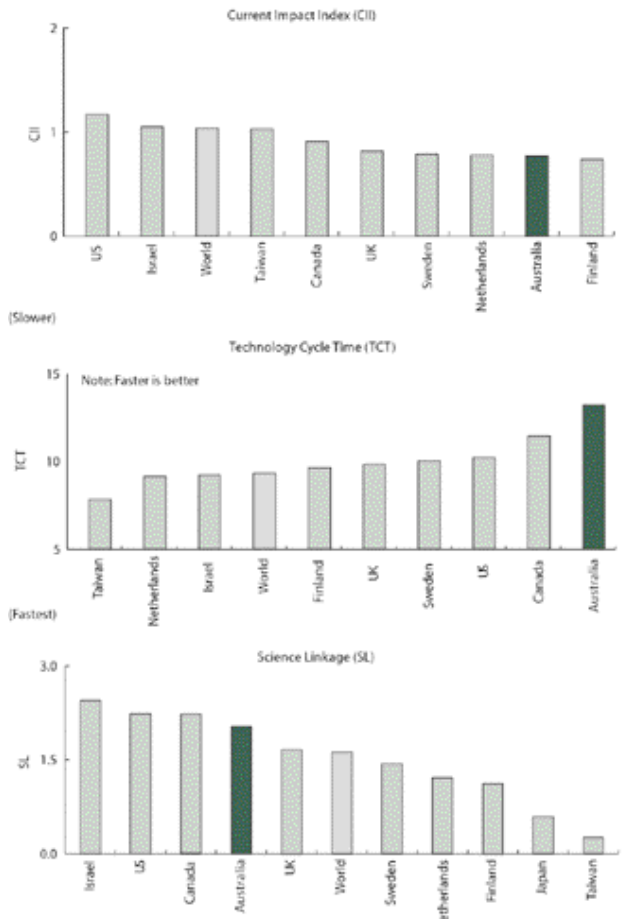
가
 :
 가 가
 가 가
 7~8 가
 가 가

Fig.A

CII(Current Impact Index), TCT(Tech-
 nology Cycle Time), SL(Science Linkage)

가 , Cycle Time
 가

Fig. A. Overall characteristics of Australian and competitor country patents, 1994-1998



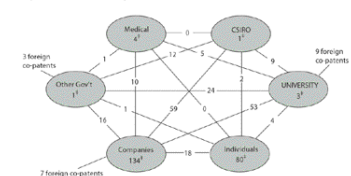
F. (Cross - Sector Citation Linkages)

CSIRO, , , 5

Fig.14A. Cross-sector citations among invented 1979-1998 U.S. patents



Fig.14B. Co-patents among Australian-invented 1979-1998 U.S.patents¹



¹Where organizations have more than one node on the network, the patent has been counted between each of the collaborating partners available in being publicly available. The network has been...
²Numbers within circles denote the number of co-patents with that sector. For example 11 patents for two or more companies in companies industry.

Fig.14A

. Fig.14B

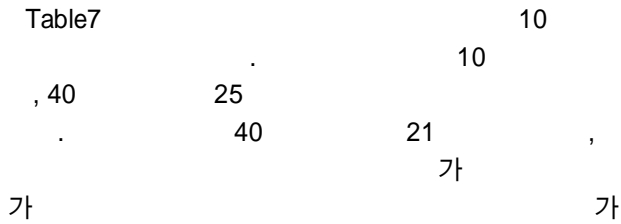
가

Table 7. Top-cited 1989-1998 Australian-invented U.S. patents (ranked by number of citations received, minimum of 25)

Pat. No.	Grant Date	Tech. Area	Parent Company	Cites Recd
5235595	9/10/93	22-Telecom	Tyco International LTD	65
5050166	9/17/91	22-Telecom	** UNASSIGNED **	63
4888832	9/19/89	21-Comput	NETWORK SECURITY SYSTEMS, INC.	61
4833992	5/23/89	07-Chem	COSELO IMMOTOPES PTY. LTD.	56
5314794	5/24/94	23-Med/Ph	GOODMAN FIELDER WATTE AUSTRALIA LTD.	48
5288187	12/1/93	04-Food/Ph	QUINJAN (M.J.) & ASSOCIATES PTY. LTD.	41
4930156	5/29/90	22-Telecom	** UNASSIGNED **	39
5421031	5/30/95	22-Telecom	DELTA BETA PTY. LTD.	39
5103367	4/7/92	25-Elec/Ph	Unisearch Limited	36
5164985	11/17/92	22-Telecom	** UNASSIGNED **	36
4893304	1/5/90	22-Telecom	Science Applications Int'l	35
5199434	4/6/93	10-Med/Ph	** UNASSIGNED **	35
4819395	3/7/89	17-Ind/Ph	AUSTRALIAN NAT'L UNIV., THE	34
4922244	5/1/90	22-Telecom	UNIV WESTERN AUSTRALIA, THE	34
5433700	7/18/95	10-Med/Ph	Heartport Inc.	34
4848181	7/11/89	10-Med/Ph	** UNASSIGNED **	31
5034004	7/23/91	10-Med/Ph	UNIV MELBOURNE	31
5272747	12/21/93	22-Telecom	AUSTRALIAN & OVERSEAS TELECOMM. CORP. LTD.	31
4972368	11/20/90	21-Comput	STALLION TECHNOLOGIES, PTY. LTD.	30

G.

Table 7



H. CSIRO

(Battelle), (NASA)

Fig. 15. Comparison of CSIRO, Battelle and NASA patent citation indicators in two five-year periods

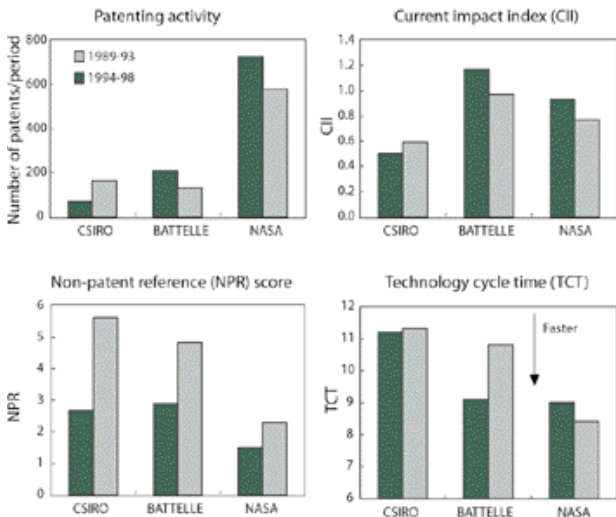


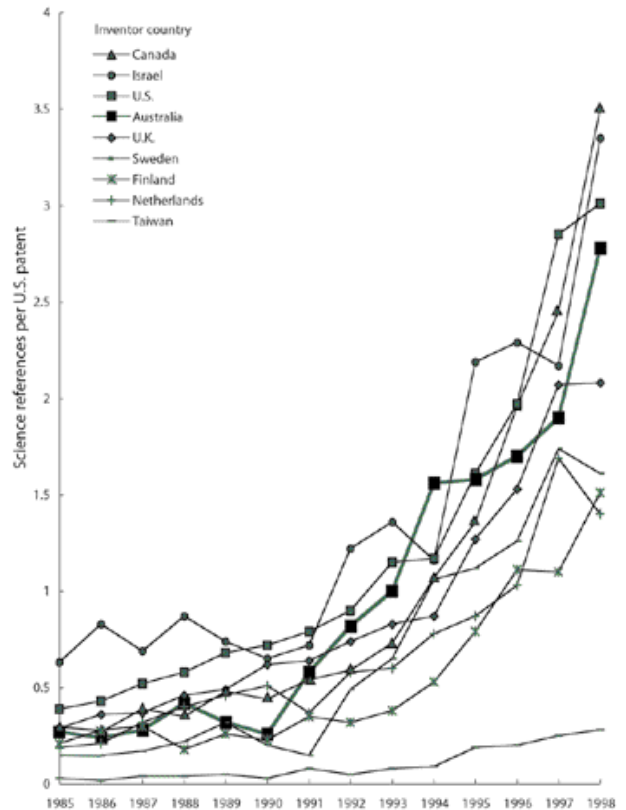
Fig.15 CSIRO (Battelle), (NASA), CII, NPR, TCT NPR(non - patent reference) SL

2.

A.

20 가

Fig.16. Science linkage (SL): citations from patents to papers are increasing, 1985-1998



B.

가

가

가 1/3 , 2/3

가

Fig.17. National citation ratios: the linkage between technology and science has a strong national component

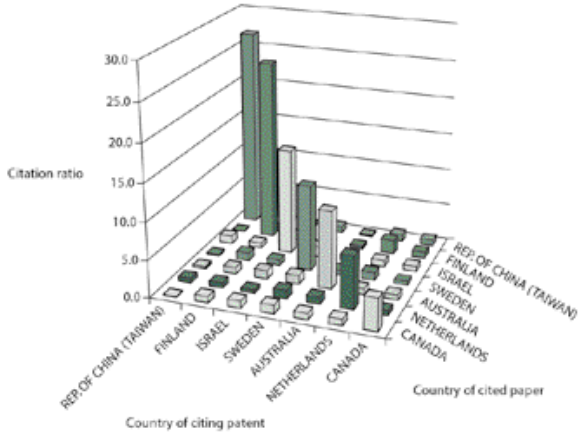


Fig.17 가

10

3.

A.

1981~1997 SCI(Science Citation Index)
 1988~1997 900,000 가
 3,200 7,800 , 0.9% 가 가

가

B. (Subfields),

Fig.18 Fig.19

Fig.18

Fig.19

가

Fig.18. Citations to Australian papers from 1988-97 U.S. patents, by field and subfield*

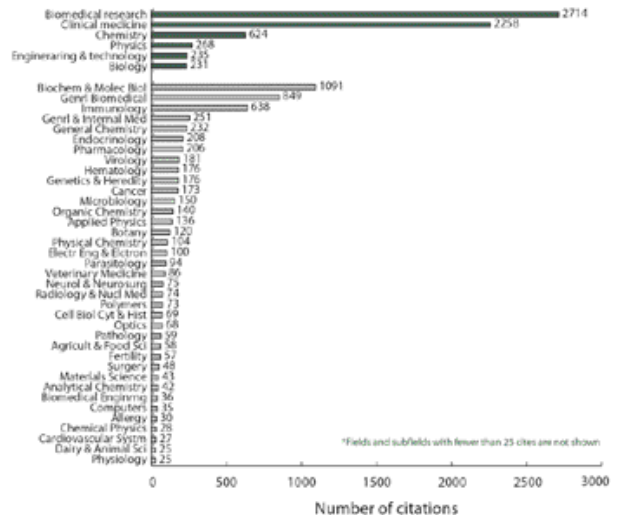


Fig.19. Australian papers cited by 1988-97 U.S. patents by field and subfield*

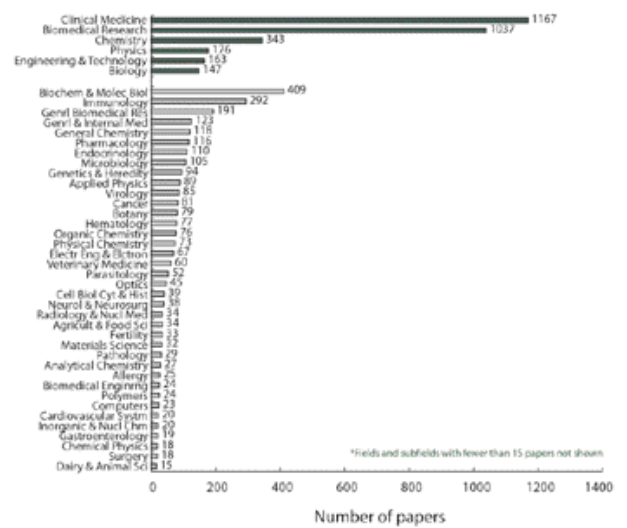


Fig.20

Fig.20. Relative citation ratio — patent citations to Australian papers, by cited paper field

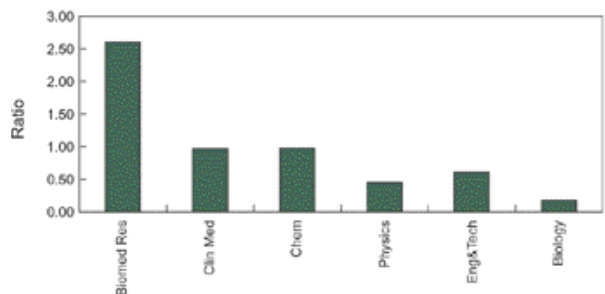


Table 15 1988~1997

가
10 'Australian Journal of Chemistry'가

Table 15. Top journals publishing Australian-authored papers cited in 1988—1997 U.S. patents (whole counts)

Journal	Cites	Cited papers
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	399	101
NATURE	332	52
NUCLEIC ACIDS RESEARCH	239	59
EMBO JOURNAL	138	32
AUSTRALIAN JOURNAL OF CHEMISTRY	134	74
SCIENCE	101	24
JOURNAL OF IMMUNOLOGICAL METHODS	100	39
JOURNAL OF BIOLOGICAL CHEMISTRY	96	41
CELL	91	22
JOURNAL OF IMMUNOLOGY	88	41
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	85	26

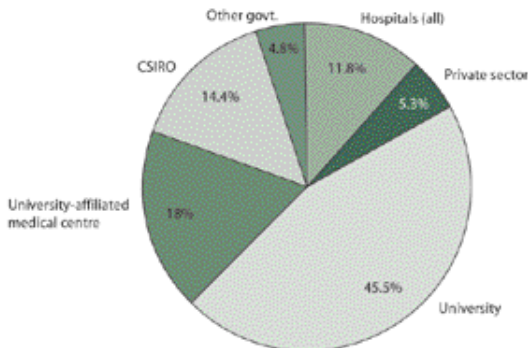
C.

Table 21 가
CSIRO가 가
, Walter and Eliza Hall Institute of Medical Research,

Table 21. Numbers of citations and cited papers in all fields for top Australian author institutions cited in 1988—1997 U.S. patents (whole counts)

To all papers	Citations	Cited papers
CSIRO	1069	465
WALTER & ELIZA HALL INST MED RES	775	292
UNIV MELBOURNE	627	308
AUSTRALIAN NATL UNIV	624	297
UNIV ADELAIDE	403	147
MONASH UNIV	372	217
UNIV SYDNEY	325	197
UNIV NEW S WALES	280	181
UNIV WESTERN AUSTRALIA	225	88
CSLLTD	220	48
LUDWIG INST CANC RES	215	89
UNIV QUEENSLAND	200	121
ROYAL PRINCE ALFRED HOSP	191	88
S AUSTRALIAN GOVERNMENT	153	60
ROYAL PERTH HOSP	134	28

Fig. 21. Sector of Australian papers cited in 1988—1997 U.S. patents



95%

63%

CSIRO 14%, 5%

Table 28. Top assignees of 1988—1997 U.S. patents citing Australian papers (whole counts)

Assignee	Number of citations	Number of patents	Number of papers
Roche Holding Ltd	351	129	188
American Home Products Corp	144	64	77
Chiron Corp	141	44	60
University of California	110	65	79
UNIV MELBOURNE	84	21	47
Commonwealth of Australia	83	28	74
University of Texas	82	66	47
US Dept Health & Human Services	72	55	67
General Hospital Corp, The	67	32	46
Glaxo Wellcome PLC	64	38	28

D.

Table 28 가
(parent company)
Genentech Roche Holdings
Table 28

Table 34. Top assignees of 1988—1997 Australian-invented U.S. patents citing Australian papers (whole counts)

Assignee	Number of citations	Number of patents	Number of papers
UNIV MELBOURNE	84	21	47
Commonwealth of Australia	83	28	74
GENE SHEARS PTY. LTD.	45	5	11
CENTRAL SYDNEY AREA HEALTH SERVICE	41	4	24
AMRAD CORP. LTD.	40	11	26
BIOTECHNOLOGY AUSTRALIA PTY. LTD.	40	7	26
Roche Holding Ltd	40	5	21
ST. VINCENTS INST. OF MEDICAL RESEARCH	37	4	23
MONASH MEDICAL CENTRE	37	4	23
MONASH UNIV.	37	4	23
Lubrizol Corp	36	11	30

E.

Table 34 가 가
(Link)

F. (funding organizations)

Table 37 1988~1997

Table 37. Top funding organisations acknowledged in Australian-authored papers cited in 1988—1997 U.S. patents (whole counts)

Funding source (General means Others not listed individually)	Cited papers
NHMRC (National Health Med. Res. Council)	841
Australian Government (all levels) (General)	394
ARC (Australian Research Council)	266
Foreign Govt and Non-Profit (non-AU, non-US)	174
Australian Universities (General)	153
Private for-profit institutions (all countries) (General)	148
Australian Foundations (General)	134
Victoria Anti-Cancer Council	116
National Cancer Institute (US)	101
All other U.S. private non-profit institutions	72

2,900

37%

1,100

NHMRC,

ARC

G. (多)

가

37 CSIRO

4.

A.

4

1988~1997

, SCI

(linkage)

B.

Table 45 1988~1997

가

. CSIRO가

Table 44

CSIRO

가

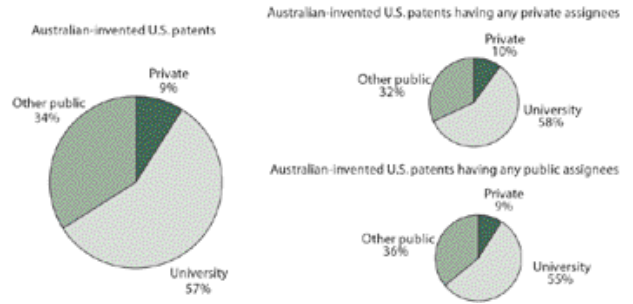
Table 44. Top cited paper details, by field

Biology					
3 cites by patents	Article: INHIBITION OF FUNGI FROM WHEAT ROOTS BY PSEUDOMONAS FLUORESCENS 2-79 AND FUNGICIDES Journal: SOIL BIOLOGY & BIOCHEMISTRY Vol: 0021 Pg: 1019 Year: 1989 Cites by papers: 845 loc: Z2DCY-				
Author(s) BRISLANE PG HARRIS JR MOEN R	Author institution(s) CSIRO	Dept. DIV SOILS	City GLEN OSMOND	Country AUSTRALIA	Funding Source(s) No funding information given
3 cites by patents	Article: STRUCTURE OF DESACYLSAPONINS OBTAINED FROM THE BARK OF QUILLAJA-SAPONARIA Journal: PHYTOCHEMISTRY Vol: 0026 Pg: 0029 Year: 1987 Cites by papers: 3735 loc: ZFHTTD				
Author(s) TOKIMITSU Y FUJIOKA T KIMMORI T KAWASAKI T DAKENFUDU DG HIGUCHI R	Author institution(s) CSIRO	Dept. FAC PHARMACEUT SCI DIV FOOD RES	City FURUOKA 812 N RYDE	Country JAPAN AUSTRALIA	Funding Source(s) Australian Govt (all levels) (General)
Biomedical					
53 cites by patents	Article: SIMPLE RNA ENZYMES WITH NEW AND HIGHLY SPECIFIC ENDO-RIBONUCLEASE ACTIVITIES Journal: NATURE Vol: 0334 Pg: 0585 Year: 1968 Cites by papers: 50730 loc: ZYBE-6				
Author(s) HASELOFF J GERLACH ME	Author institution(s) CSIRO	Dept. DIV PLANT IND	City CANBERRA	Country AUSTRALIA	Funding Source(s) Australian Government (all levels) (General)
57 cites by patents	Article: USE OF PEPTIDE SYNTHESIS TO PROBE VIRAL ANTIGENS FOR EPITOPES TO A RESOLUTION OF A SINGLE AMINO-ACID Journal: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA - BIOLOGICAL SCIENCES Vol: 0061 Pg: 3998 Year: 1964 Cites by papers: 76135 loc: UGLEKD				
Author(s) GEYSEN HM MELDEN M BARTELING SJ	Author institution(s) COMMONWEALTH SERUM LABS	Dept. 45 POPULAR RD	City PARKVILLE LELYSTAD	Country AUSTRALIA NETHERLANDS	Funding Source(s) No Funding Information Given

Table 45. Top assignees of 1988—1997 Australian-invented U.S. patents citing science papers

Assignee	Number of patents (fractional)	Number of cites (fractional)	Number of papers (whole)
Commonwealth of Australia	53.5	299.5	289
UNIV MELBOURNE	21.5	165.0	132
AMRAD CORP. LTD.	15.0	117.0	83
St. Jude Medical Inc.	14.5	26.5	25
BIOTECHNOLOGY AUSTRALIA PTY. LTD.	12.5	112.8	153
AUSTRALIAN NAT'L UNIV. THE	11.0	47.5	45
Lubrizol Corp	10.5	107.0	93
HOWARD FLOREY INST. OF EXPERIMENTAL PHYSIOLOGY	10.0	36.0	18
Ludwig Institute for Cancer Research	8.0	31.0	27
US Dept Health & Human Services	7.0	67.0	55

Fig. 22. Science citations by 1993—1994 patents with Australian inventors, disaggregated by sector



C. (Subfield)

E. (Sector; , ,)

Table 50

Fig. 22

91%

.가

가

,

가

,

73%

가

가

Table 50. Top fields and subfields of papers cited by 1988—1997 Australian-invented U.S. patents (whole counts)

Field/Subfield of Cited Paper	Number of cites	Number of papers
Field		
BIOMEDICAL RESEARCH	1728	1141
CLINICAL MEDICINE	958	751
CHEMISTRY	143	110
BIOLOGY	120	103
PHYSICS	68	61
ENGINEERING & TECHN	51	47
EARTH AND SPACE	10	8
PSYCHOLOGY	1	1
Subfield		
Biochem & Molec Biol	741	453
Genet/ Biomedical Res	510	327
Immunology	220	180
Endocrinology	130	75
Genet & Internal Med	126	91
Genetics & Heredity	120	90
Virology	90	59
Cancer	89	71
Microbiology	86	74
Botany	60	51
Hematology	57	47
Cardiovascular System	54	46

Table 55. Top author countries of papers cited by 1988—1997 Australian-invented U.S. patents (whole counts)

Country of Paper Author	Number of cites	Number of papers
US	1558	1138
AUSTRALIA	691	432
UNITED KINGDOM	274	206
JAPAN	168	121
CANADA	114	100
GERMANY	109	89
FRANCE	80	57
SWITZERLAND	75	61
SWEDEN	63	36
NETHERLANDS	58	46
ISRAEL	49	34
AUSTRIA	36	22
ITALY	36	31
BELGIUM	27	23
DENMARK	27	23

D. 가

F.

Fig. 23

가

CSIRO

가

97%가

Table 55

가

,

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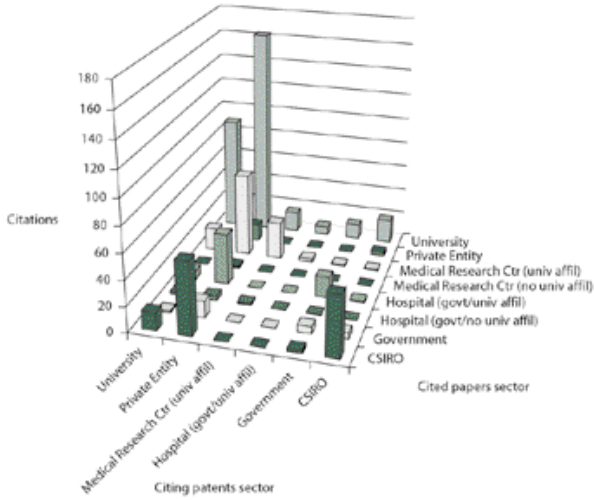
,

가

가

가

Fig.23. Australian cross-citation by sector (fractional counting; patents by private entity inventors include foreign assignees)



가

*

*

가

Cycle Time

*

97%

*

Fig.24

'Private Entities'

4

CSIRO

가

20 R&D

(

)가 가

Fig.24. Citation of papers by patents between Australian sectors



Notes: Counts are of references by patents to papers. Patents are counted fractionally; counts less than 0.5 have been omitted. Patents by private entity inventors include foreign assignees.

*

가

가

CSIRO

Walter and Eliza Hall Institute of Medical

Research

*

CSIRO

20

318

가
가

가

CHI Research

CHI

Research

CHI Research

700

CSIRO가