Alliance Opportunities for Aus Biotech

Working Paper No. 23

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Pharmaceutical Industry Project
Working Paper Series

April 2004

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Introduction

Forming alliances between large pharmaceutical and biotechnology companies is an established mechanism to complete the process of development and marketing for a drug initially discovered by a biotechnology company. There is evidence that for most large pharmaceutical companies this process has taken on new urgency as the implications of product pipeline deficiencies are projected to reduce the previously high rates of growth in sales and corporate earnings. Over much of the last decade biotechnology derived medicines have been providing both an increasing number and share of total new medicines approved by the FDA. Therefore it would be surprising if large pharmaceutical companies were not turning increasingly to partnerships with biotechs to generate urgently needed new products.

If such a trend were to be confirmed, then it would appear to provide an opportunity for Australian biotechs to attract additional support from large pharmaceutical companies. This paper presents evidence of the nature and seriousness of the product pipeline problem for large pharmaceutical companies and how they have reacted by increasing their focus on later stage drug development alliances with biotechs. The paper demonstrates the very significant role of large pharmaceutical companies in funding drug development by biotechs through alliances.

However while Australian biotechs have been very active over the last several years in alliance formation, reaching a significant level in world terms, there is little evidence that there has been of much support to date from large pharmaceutical companies. The paper discusses possible reasons for this, and the need for increased focus from industry and government, to address this deficiency.

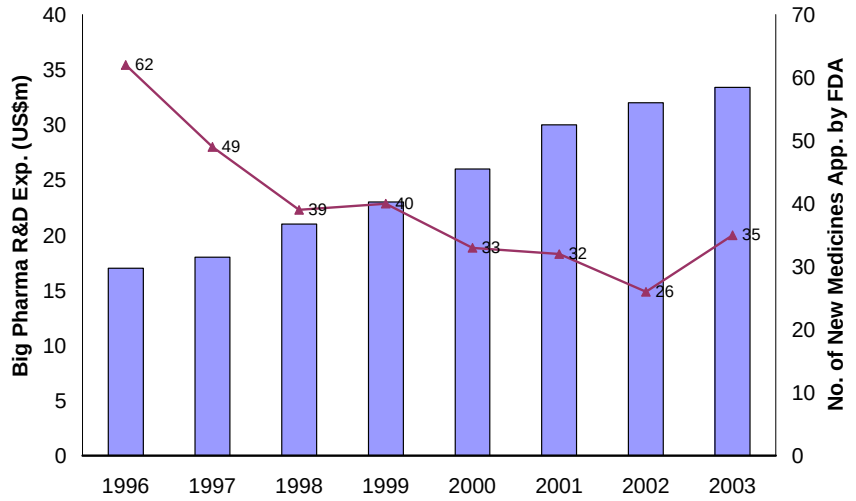
The next section discusses the causes of the product pipeline problems of large pharmaceutical companies.

Large pharmaceutical company product pipeline issues

The growth of the large pharmaceutical companies has been underwritten by the sales of so called blockbuster drugs. There has been concern in the pharmaceutical industry for a number of years about the decline in the number of drugs being approved by the FDA and the potential impact this would eventually have on new product sales (Drews and Ryser 1996). In the immediate future this problem is now likely to be exacerbated by the large number of patent expiries of blockbuster drugs in the period to 2008. Whereas in the past, replacement drugs would have been available, this prospect is diminished by the lower productivity of the new product pipeline.

Figure 1 shows the falling trend in new drugs approved by the FDA over the period since 1996 against the background of steadily rising R&D expenditure by the large pharmaceutical companies. While R&D expenditure over the period 1996 to 2003 has increased 94%, the number of new medicines approved has fallen steadily from 62 in 1996 to 35 per annum in 2003. There are of course complex leads and lags between R&D expenditure and new product output, but the fact remains that lower approvals means fewer drugs entering the market.

Figure 1. Declining R&D productivity in new medicines



A number of reasons have been offered to explain this declining productivity. One is that the estimated cost of discovering, developing and successfully getting a drug to market has been steadily rising from $318m in 1991 to $802m in 2000 (DiMasi, Hansen and Grabowski 2003). Another, and possibly associated reason, is that the relatively easy gains by way of new drug discoveries for large population diseases have been made and accordingly drugs for remaining diseases such as cancer, will be more difficult and costly (Schmid, James and Smith 2001). Moreover the recent major breakthroughs, in say genomics and proteomics, will take some time to impact on the near term product pipeline.

These productivity issues are being exacerbated by a bunching of patent expirations over the next few years of some of the largest blockbuster drugs on which a high proportion of the sales of large pharmaceutical companies depend. The patents for some 22 drugs out of 49 current blockbusters for the top 10 pharmaceutical companies are due to expire in the period to 2008 (see Table 1). Total sales for 2003 of blockbuster drugs for these companies, and sales for 2003 of those blockbusters under threat, are shown in the table below. Of total blockbuster sales of $110b, blockbuster sales of $54b, almost half are potentially under threat.

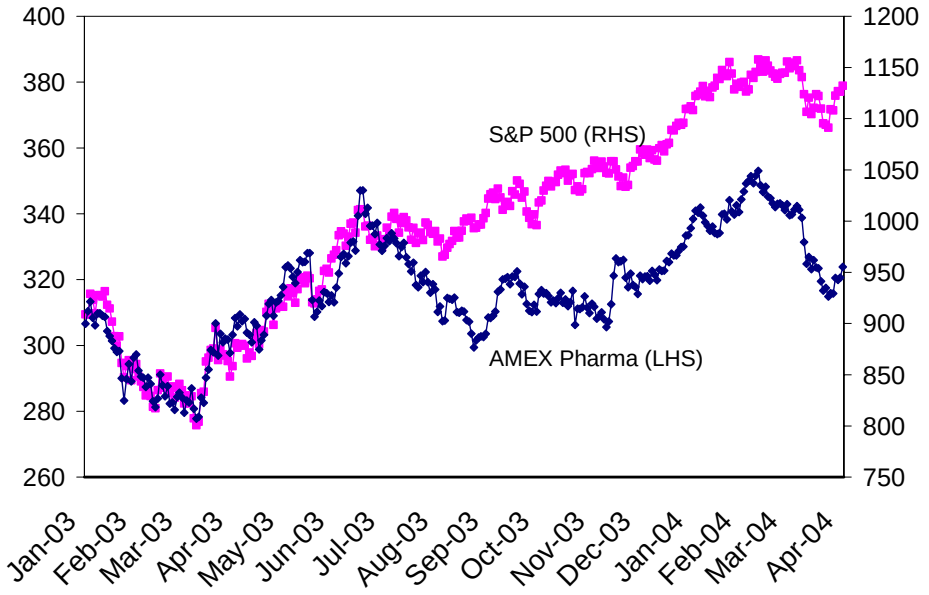
Table 1. Potential impact of patent expiries to 2008 on blockbuster sales of big pharma

Top 10 Companies#	*Blockbuster sales* 2003 US$b*	*Sales subject to patent expiries 2003 US$b*
AstraZeneca	8.6	5.9
Aventis	6.6	3.8
Bristol-Myers Squibb	7.5	5.3
Eli Lilly	7.4	0.0
GlaxoSK	14.8	8.4
Johnson & Johnson	12.0	8.1
Merck	14.9	7.8
Novartis	4.6	0.0
Pfizer	28.2	14.7
Wyeth	5.5	0.0
Grand Total	**110.1**	**54.0**

Top 10 pharmaceutical companies by global pharmaceutical sales.
* Drugs with global sales > US$1b.
Source: FDA, CSFB, Dresdner Kleinwort Wasserstein, company annual reports.

The ultimate impact on sales, is of course, more difficult to project. There are a range of strategies pursued by patent holders to extend the 'shelf life' of their branded products, such as reformulations and legal challenges. Nonetheless industry analysts have been expressing serious concern about the impact of patent expiries as part of a general reassessment of product pipeline prospects (CSFB 2003; Dresdner Kleinwort Wasserstein 2003). This has been affecting the stock price performance of the major pharmaceutical companies compared with the rest of the market over the past 12 months as shown in the Figure 2 below.

Figure 2. Large Pharma stock prices vs S&P 500, Jan 2003 to Apr 2004



Source: Standard & Poors, American Stock Exchange.

Figure 2 compares the AMEX Pharma Index, which primarily reflects changes in the stock prices of the top dozen pharmaceutical companies, with the broader market, as represented by the S&P 500. After closely tracking the S&P 500 for the first half of the year, a mid year reassessment of the growth prospects of large pharmaceutical companies led to a decline in their stock prices, opening up a 20% differential with the broader market, by the end of the March quarter 2004.

Also contributing to this relative decline, were concerns about emerging drug pricing issues and related political attitudes to the pharmaceutical companies, but the lack of new product weighed particularly heavily. With the growth prospects of large pharmaceutical companies being judged to be weakening to a significant degree, the question arises as to whether the drugs being developed by biotechs provide the solution to the new product deficiencies.

Examining the trends in biotechnology derived medicines approved by the FDA over the past decade, provides some encouragement to the view that investing more heavily in biotech drug development projects, may go some distance towards addressing the pipeline deficiencies.

An unpublished analysis by the Tufts Center for the Study of Drug Development of the type of drugs approved by the FDA, shows the much increased contribution from biotechnology-sourced medicines since the mid 1990s. In essence the analysis separately identifies, biotechnology sourced medicines, biologicals, recombinant proteins, monoclonal antibodies etc from the small molecule drugs. This analysis shows a significant lift in the number of biotechnology-sourced medicines, between the first half of the decade, 1990-95 and the remaining period to 2002. This shows that such medicines have increased from less than 5 approvals per annum in the earlier period to 10 in the latter period. Perhaps more significantly, the proportion of biotechnology-sourced medicines grew from an average of 16% to 25% of total medicines receiving FDA new 'first time' approval. This provides large pharmaceutical companies with good reason to more intensively seek alliances with biotechs to develop biotechnology-based medicines.

Alliances between biotechs and pharmaceutical companies

Total biomedical alliances

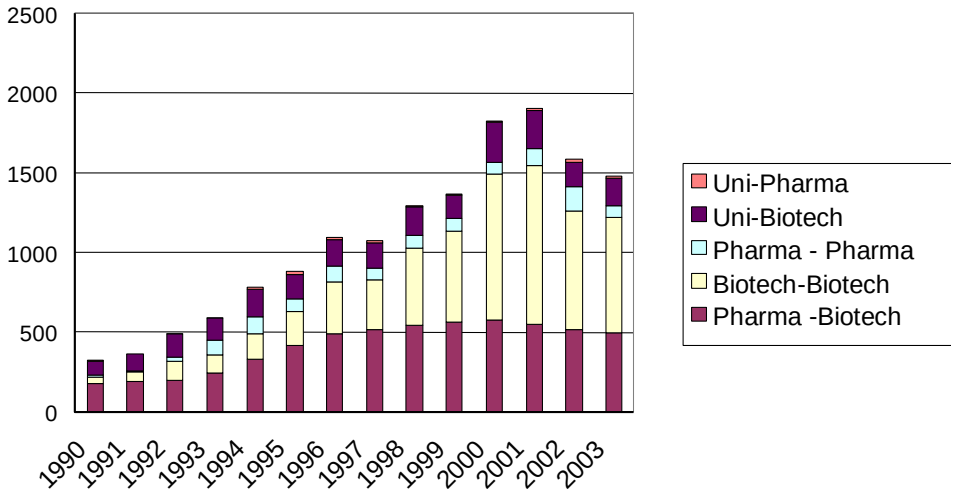
Alliances offer a mechanism by which large pharmaceutical companies can gain access to both new product and specialist technologies provided by biotechs. The focus of this paper is on drug development alliances, but the broader context in which these are formed, illustrates the significance of the more recent focus of large pharma on drug development alliances. The alliance generally involves a licensing arrangement in which, in return for upfront and milestone payments the biotech develops a drug, which is then trialed and marketed by the pharmaceutical company through its global distribution system. In addition, with a successful drug, the biotech will receive royalty payments.

The number of biomedical alliances recorded on the Recap database[1] by date of commencement is shown in Figure 3, classified by the parties involved. The Recap database classifies alliances by three parties – pharmaceutical companies (drug), biotechs and universities, including institutes, research departments and government.

Figure 3 shows the significant increase in the number of alliances formed in the period since 1990. As noted, the decline in 2002 and 2003 may be due to incomplete data for those years but may also reflect the influence of the industry cycle. The process of identifying and adding alliances to the database takes some time. This is illustrated by some 240 alliances for 2001 being added to the Recap database since May 2003.

[1] ReCap (Recombinant Capital) attempts to collect comprehensive, worldwide biomedical and related alliance information from press releases, United States Securities Exchange Commission filings and industry presentations. The information is limited to those alliances that are announced publicly. Sometimes this means that commercially sensitive information is withheld. On other occasions information is not reported until there are some positive results. For these reasons the information must be regarded as indicative and not necessarily a complete listing of all alliances. However, public disclosure rules generally require listed firms to announce information that is price sensitive. In other cases firms find it in their interests to release information about alliances as independent validation of their research or a sign of progress towards their strategic goals. For these reasons it can be expected that information about most significant alliances is released, and therefore available to ReCap. See www.recap.com.

Figure 3. Number of Biomedical Alliances 1990 to 2003



Source: Recap Apr 2004.
Note: Data for 2002 and 2003 may be incomplete.

There are a number of notable aspects to Figure 3. The first is the growth in the number of alliances, which totalled 321 in 1990 and reached 1905 by 2001. This growth has two aspects. The first is the rapid growth between 1990 and 1996 in alliances between pharmaceutical companies (drug) and biotech companies from 180 to 490, after which the number broadly stabilised. The second is the rapid growth in the number of alliances between biotechs throughout the period. This is shown in more detail in Table 2 below.

Table 2. Number and annual growth in biomedical alliances, 1990-2001

	Drug-Biotech		*Biotech-Biotech*		*Other*		*Total*	
1990	180		40		101		321	
1996	490	18.2%	322	41.6%	283	18.7%	1095	22.7%
2001	571	3.1%	1090	27.6%	358	4.8%	2019	13.0%

Source: Recap Feb 2004.

The growth in all alliances over the first half of the period from 1990 to 1996 was high (22.7% pa) from a relatively low base, especially for biotech biotech alliances. In the second period from 1996 to 2001, the number of new drug biotech alliances, grew only modestly from 490 to 571 (3.1% pa), while biotech biotech alliances continued to grow rapidly from 322 to 1090 (27.6% pa). Biotech biotech alliances have a focus on technology transfer whereas a greater proportion of those between pharmaceutical companies and biotechs are drug development alliances.

The issue raised by this data is why the growth in alliances between pharmaceutical companies and biotechs tapered off in the period since 1996. More detailed analysis of drug development alliances over the last few years illustrates the changing strategy

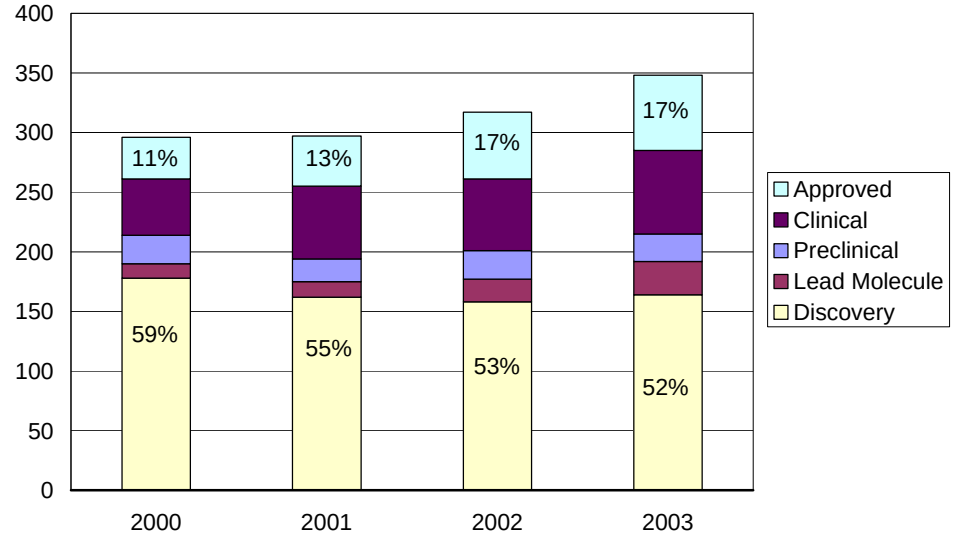
of the pharmaceutical companies as they seek more immediate new product through an increased focus on later stage alliances.

Drug development alliances

For drug development alliances, Recap classifies alliances according to the stage reached in the development pipeline at formation of the alliance. It provides details of alliance formation at each stage: discovery, lead molecule, preclinical, the three clinical phases and approval. It separately classifies alliances, concerned mainly with new dosages and delivery as 'formulations'. Because of the emphasis on new drugs in this paper, they have been excluded from this analysis.

From this alliance data it is possible to analyse shifts in focus by the parties from one stage to another. Figure 4 shows the number of drug development alliances between pharmaceutical companies and biotechs for the period 2000 to 2003.

Figure 4. Number of drug development alliances by development stage, pharma biotech



Source: Recap Mar 04, CSES.

It shows both an increase in the number of drug development alliances between pharmaceutical companies and biotechs and a shift in their focus towards later stage alliances. In the context of a slight decline in total alliances, recorded on Recap between pharma and biotech, over the period 2000 to 2003 from 577 to 495, the number classified as drug development alliances has increased from 322 to 367.

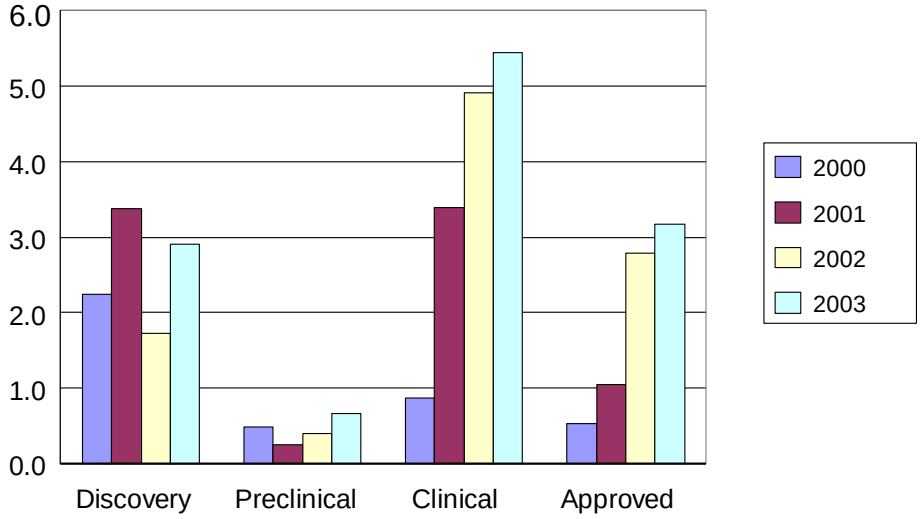
Of particular relevance to the product pipeline issues, the number of alliances formed at the approved stage, increased from 35 to 63 over the period, an average annual growth rate of 60%. The proportion of alliances formed at this stage, increased from 11% to 17%. The number of alliances at clinical trial stage also increased significantly, from 47 in 2000 to 70 in 2003. While the proportion of those formed at discovery stage declined from 59% to 52%, the number at lead molecule stage

increased significantly from 12 to 28, indicating that there was still support for early stage alliances where the lead molecule had been identified.

While the analysis of the number of alliances shows the shift to later stage partnering, the evidence provided by alliance payouts is particularly striking. There are qualifications about the nature and reliability of this data (see footnote[2]). In particular, payouts are the 'headline' amounts announced at the time of the alliance formation. The size of the alliance as reported, tends to be a total lump sum, incorporating actual upfront as well as contingent payments dependent on milestone achievements. So it is a measure of firm intention to pay rather than the actual amount paid. It should however, be a reasonably reliable measure of trends in the nature of alliances.

Figure 5 shows the total alliance payouts announced at alliance formation between pharmaceutical companies and biotechs recorded on the Recap database at each major stage in the product pipeline for the period 2000 to 2003. To simplify the presentation of the trends, the lead molecule stage has been included in the discovery stage.

Figure 5. Alliance Payouts by Development Stage, Pharma Biotech (US$b)



Source: Recap Mar 04, CSES.

Figure 5 shows the substantial increase over the period in alliance payouts at clinical and approved stage. At approved stage, payouts have increased from $552m in 2000 to $3.2b in 2003 and at clinical stage the increase over the same period is from $862m to $5.4b. This appears to reflect a major commitment from pharmaceutical companies to secure access to late stage new drug development projects, which will have a near term impact on their product pipelines. In contrast earlier stage payouts exhibit little overall trend.

[2] The Recap database also contains information about the financial size of alliances and related transactions, including mergers and acquisitions, where this information is publicly available. The financial terms of an alliance may remain confidential so in such cases the anticipated payouts would not be recorded in Recap. The financial structure of alliances can vary widely, and may incorporate equity investments and outright product purchases, as well as the more usual licensing arrangements. The dividing line between alliance and acquisition is not always clear. Nonetheless, we have filtered the database to remove mergers and acquisitions and similar transactions.

The pharmaceutical companies most heavily engaged in alliance formation over the past four years, are in general, the largest. Table 3 lists the top 10 pharmaceutical companies, ranked by number of drug development alliances, formed over the period 2000 to 2003. These companies dominate alliance formation, with 48% of alliances formed over the period. They also provide an overwhelming proportion of alliance payouts – 65% in the period 2000 to 2003. Most of the top 10 pharmaceutical companies by sales are in the list. The two not in the top 10 by alliances, Wyeth and Johnson & Johnson, would be well inside a list of the top 20.

Table 3. Top 10 Pharmaceutical Companies ranked by Number of Drug Development Alliances, Number by stage, 2000-03

	Discovery	*Preclinical*	*Clinical*	*Approved*	*Total*	*% later stage**
Pfizer	72	6	12	12	102	24%
GlaxoSmithKline	54	5	20	9	88	33%
Merck	52	6	1	4	63	8%
Novartis	27	7	12	11	57	40%
Roche	33	7	9	7	56	29%
Aventis	34	4	9	7	54	30%
Lilly	30	3	9	9	51	35%
Abbott	25	4	9	11	49	41%
Bristol-Myers Squibb	31	1	8	7	47	32%
AstraZeneca	34	1	5	4	44	21%
Total Top 10	392	44	94	81	611	29%

* Clinical and approved.

The table illustrates the different strategies followed by individual companies. A number such as Novartis and Abbott, each with over 40% of their alliances in later stage, compared with an average of 29%, appear to be focussed on near term product flow. In contrast, Merck, with only 8% of its alliances in this period in later stage alliances, remains concentrated on early stage alliances. Most companies however have adopted positions close to the average of about 30% later stage alliances.

The alliance payout data for the top 10 companies helps illustrate the ‘sea change’ generated by the large pharmaceutical companies in the last few years. Table 4 shows both the average annual payout by the top 10 pharmaceutical companies, and the proportion devoted to each development stage, for the two periods 1990-99 and 2000-03.

Table 4. Top 10 Pharma Co Drug Development Alliance Payouts by Development Stage,* 1990-99 and 2000-03

	1990-99		*2000-03*	
	Av. pa ($m)		Av. pa ($m)	
Discovery	872	43%	1724	29%
Pre clinical	233	12%	293	5%
Clinical	580	29%	2936	50%
Approved	328	16%	957	16%
Grand Total	2013	100%	5910	100%

* Ranked by no. of alliances.

This shows not only the substantial increase in annual payouts, partly as a result of the increase in the number of alliances, but also the significant increase in the proportion of alliance payouts committed to later stage (clinical phase) alliances. In the context of an increase in the average annual payout from $2.0b for the 1990s to $5.9b over the period 2000-03, the average annual payout for the clinical phase has increased from $580m to $2.9b, or from 29% to 50% of alliance payouts.

This section has attempted to illustrate the reaction of large pharma to an impending deficiency in their new product flow. It has shown that as a group, pharmaceutical companies have focused increasingly, over the last few years, on later stage alliances, both in terms of numbers formed and payouts committed. The top 10 pharmaceutical companies, which dominate alliance formation within this sector, have in general been particularly focussed on later stage alliances as evidenced by the payout data.

The next section turns to consider alliances involving Australian biotech companies, particularly in the global context, in which they compete for support from overseas pharmaceutical companies. As with the discussion of worldwide alliances, the section begins by presenting trends in total Australian biomedical alliances and their place in the global alliance network.

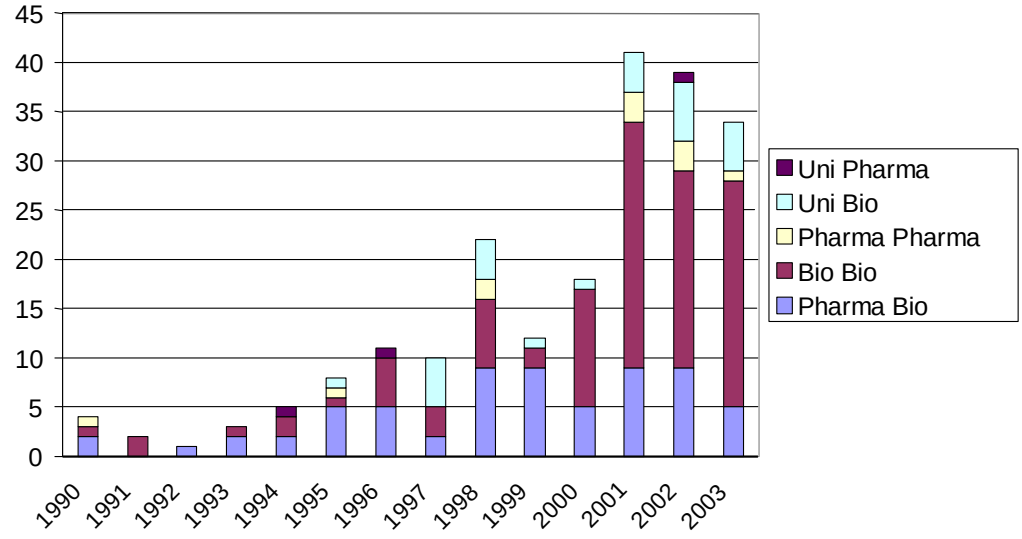
Australian biomedical alliances in the global context

Recent trends in Australian biomedical alliances

In the last few years, Australia companies have rather suddenly increased the scale of their participation in biomedical alliances as illustrated by Figure 6.

This shows the number of alliances formed by Australian biotechs, pharmaceutical companies and universities in the period 1990 to 2003 with both Australian and overseas counterparts. The Recap alliances are not classified by country. To obtain alliance data by country, including Australia, the Centre has cross-referenced company information on Recap with a global company database supplemented by company web searches. Each party to the alliance has been classified by country of domicile of the company corporate headquarters. This means that alliances formed by wholly owned subsidiaries would generally be classified by domicile of the parent company.

Figure 6. Australian Biomedical Alliances, 1990-2003



Note: Data for 2002 and 2003 may be incomplete.
Source: Recap Feb 2004, CSES.

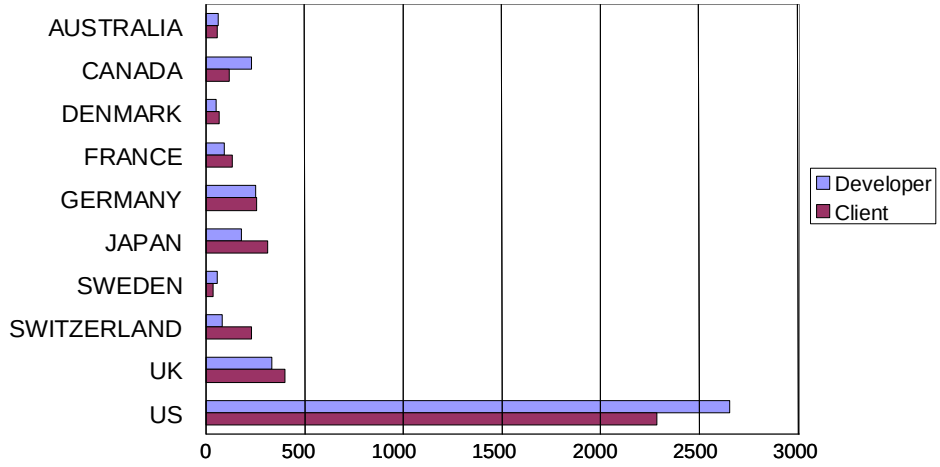
Australian biomedical alliances formed in the period 2001 to 2003 have averaged about 38 per annum, compared with about 8 per annum for the 1990s. The increase has been most marked in alliances formed between biotechs. This reflects mainly technology transfers between domestic and overseas biotechs, often related to development of devices and instrumentation. Proteome Systems, developers of proteomics instruments, for instance, has been particularly active. However the number of alliances with pharmaceutical companies has shown little associated growth. Since 1998, alliances formed with pharmaceutical companies have averaged about 8 per annum. A significant proportion of these have been formed by Faulding and associated companies with overseas biotechs so were not directed to supporting Australian drug or other developments.

The global context

Figure 7 lists the top 10 countries in the world by number of alliances recorded on Recap. Australia manages to be included in this list, with a comparable number of alliances to Denmark and Sweden, both countries with a longer history of mainstream pharmaceutical activity than Australia. Australia is ahead of such countries in its region as Singapore, India, China and Korea – each with a degree of focus on developing a pharmaceutical and/or biotech industry.

It is also clear from Figure 7 that in terms of number of alliances, the United States is a dominant player with total alliances equalling somewhat more than the rest of the world. A number of countries with longstanding pharmaceutical industries also have a prominent place – UK, Germany, Switzerland and France.

Figure 7. Biomedical Alliances by Top 10 Countries,* 2000-03



*Countries with more than 50 alliances.
Source: Recap Feb 2004, CSES.

The figure presents the number of alliances identified by 'developer' and 'client'. In most alliances there is a 'client', which directs and pays for the work done and another party, which we will call the 'developer' which undertakes the work and receives payment. Some alliances have high degrees of cooperation, where these distinctions are less clear or where payment is mostly in kind. In many alliances payment is contingent on success and made over an extended time. Some alliances bring together more than one company in the role of client or developer. Nonetheless for most alliances the distinction between the 'client' party and the 'developer' party is clear and Recap classifies the alliance parties based on this distinction

As a small player in the biotech industry, being involved in about 2% of global alliances, Australia represents an interesting case, in that the number of client and developer alliances is about equal. This reflects not only the role of Australian biotechs as a source of product with 48 alliances as developer, but also the requirements of Australian companies for complementary technologies as shown by the number of alliances in which they are the client (45). In such a small market with limited capabilities these technologies are acquired from overseas, most prominently from the US with 32 alliances. This compares with only 13 alliances formed internally over the same period.

A number of European countries Switzerland, UK and France have more alliances in which their companies act as client than as developer. This means that they support the development of drugs and other technologies by overseas companies. Many of these are in the US, which has more alliances in which it acts as developer than client.

Canada, has a relatively prominent role as a 'developer' on behalf of companies in the US, Europe, and UK. Compared with Australia, Canada has a favourable location vis a vis the US and appears to be undertaking an important role as a centre for biomedical research and development on behalf of US and other overseas client companies. This is also consistent with Canada's relatively favourable R&D cost structure, which makes it an important competitor for overseas support.

Alliance payouts

While Australia has a relatively prominent position, given the size of its economy, in the network of biomedical alliances as measured by number, its receipt of alliance payouts is much smaller. The data in Table 5, shows for each of the top 6 countries/regions, the total alliance payouts to and from each country, as developer and client respectively. To simplify the analysis, the payouts of the European countries (except UK) have been merged.

While the results should be regarded as indicative only, Table 5 provides confirmation of a number of the industry features evident from the analysis of the number of alliances. The first is the importance of the US both as a client (source of funds), 52% of the total, and as a receiver of funds to develop new product and technology, 69% of the total. The second is the role of Europe as a client, particularly for US technology and product. There is a very substantial imbalance between European 'purchases' ($11.7b) and supply ($5.6b). More detailed analysis of this data, indicates that European companies 'spent' about $7b over this period on US products and technology. Much of this comes from the major European pharmaceutical companies engaged in alliances with US biotechs.

Table 5. Alliance Payouts by Top 6 Countries, 2001 to 2003, US$m

Country	*Client*		*Developer*	
Australia	185	0.5%	284	0.8%
Canada	834	2.2%	2095	5.6%
Europe	11749	31.4%	5644	15.2%
Japan	703	1.9%	21	0.1%
UK	4321	11.6%	3329	8.9%
United States	19597	52.4%	25834	69.4%
Total	37389	100.0%	37206	100.0%

Source: Recap, CSES.

The role of Canada, and to a much lesser extent Australia, as a net recipient of alliance funding is also shown in the table. The data indicates that Canadian companies have entered into alliance commitments of over $2b, compared with under $300m for drug and technology development for Australia, over the period 2000 to 2003. The table would suggest that Japan is a small player in funding alliances, but it could also reflect the different disclosure policies of the Japanese companies involved.

An assessment of implications for Australia

This analysis of Australian alliances in the global context has revealed both some of Australia's strengths and its weaknesses. Australian companies, particularly biotechs have over the last few years significantly increased their involvement in the international biomedical alliance network to the extent that as measured by number of alliances that Australia has become a major world player, ahead of other countries in

its region and comparable to some European countries with a longer pharmaceutical history.

However most of this expansion in the number of alliances has been by biotechs seeking overseas technology partners to assist in the production of specialist products, devices and instruments, rather by biotechs than taking advantage of the opportunity afforded by the product pipeline deficiencies of large pharma, to attract sizeable drug development alliances. This is illustrated by the low 'developer' payout numbers for Australia. Because of their nature, alliances between biotechs tend to be relatively low value compared with those with pharmaceutical companies.

This becomes particularly apparent when an analysis is undertaken of Australian alliances with large pharma. Table 6 reproduces the list of top 10 pharmaceutical companies identified in Table 3, together with the payout and alliance data for each company listed on Recap. The table shows the size and significance of large pharmaceutical commitments to drug development alliances worldwide. The top 10 pharmaceutical companies listed, have payout commitments totalling $23b or 65% of the total. The number of worldwide drug development alliances listed by Recap for these companies total 609 or 48% of the total. The table also shows the number of drug development alliances these companies have with Australian companies, just 3.

Table 6. Top 10 Drug Development Alliance Co,* 2000-2003

Company	Payouts	No. of alliances	
	US$b	*Worldwide*	*No. in Aus*
Pfizer	2.7	103	
GlaxoSmithKline	3.8	88	1
Merck	1.4	62	2
Aventis	2.3	57	
Roche	2.6	56	
Novartis	3.5	56	
Lilly	1.7	51	
Bristol-Myers Squibb	3.6	47	
Abbott	0.9	45	
AstraZeneca	0.6	44	
Total top 10	**23.0**	**609**	**3**
Grand Total	**35.2**	**1258**	
Top 10 % total	**65%**	**48%**	

*Top 10 companies by no. of alliances.
Source: Recap March 2004.

This appears to indicate that to date Australian companies have not been able to take advantage of the significant opportunity afforded by the requirements of large pharma for new later stage drug development projects. The reasons for this may range from a failure to offer these companies drug development opportunities of interest, to difficulties associated with the 'tyranny of distance'. It also may arise from views of large pharma about the failure of PBS pricing to sufficiently reward innovation.

The Australian industry is small scale, compared with the US and Europe, and combined with the distance issues, it may be more difficult to attract the attention of decision makers in large pharmaceutical companies. Many of the advances in drug research and development are incremental and anecdotal evidence would suggest that the in-licensing decision makers prefer to support developments closer to home. The United States is an enormous market in itself. There were a total of almost 1700 biomedical alliances formed *between* US companies recorded on Recap over the period 2001 to 2003. Over the same period Australian companies were involved in the formation of about 100 alliances. The example of Canada with its proximity to the US is also instructive. While a somewhat larger economy than Australia, its biotechnology sector is significantly larger and it has enjoyed particularly good support from US companies, including large pharmaceutical companies.

The vexed issue of Australian drug prices under the PBS, may also be an issue for large pharma. Australian drug prices appear to be appreciably below many other countries, especially the US (Sweeny 2003). The pharmaceutical companies view this as discriminatory and a poor return on their investment in R&D. This may effect the decision to favour research and development in other countries, if the differences with Australia are not particularly material.

This lack of success in attracting large pharmaceutical company support needs to be addressed by industry and government. The evidence provided in this paper suggests that there is a 'window of opportunity' for Australian biotech to gain support for drug development. Large pharmaceutical companies provide the majority of that support and their increased involvement in the Australian industry would be a considerable boost. In competing for attention from such companies, highly focussed strategies need to be developed to overcome the disadvantages of distance and scale, faced by the Australian industry.

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