

**STRATEGIES FOR MEDICAL RESEARCH  
INSTITUTES**

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**ABSTRACT**

This paper considers the strategies used by a group of 17 medical research institutes to ensure continued funding. The study was based on two financial years, 1989/90 and 1990/94.

No correlations have been found between the income of the institutes and output as assessed by publications. Whilst such a link may exist for individuals and competitive grants, it is not seen at the organisational level. A positive correlation does exist between the size of the research team and output.

The analysis of the 1989/90 financial year identified four distinct strategies by mapping the institutes in two dimensions: government sourced funding and private sourced funding. For government sourced funding the variable was the ratio of competitive grant funding to direct government funding. For private sourced funding the variable was the ratio of corporate sourced funds to public appeal funding. This analysis has been repeated for the 1993/94 financial year. In the four year intervening period, all of the institutes have adopted, or moved towards adopting, similar strategies. This may be explained by mimetic organisation theory. During this time all institutes increased their dependence on income from government sources, particularly competitive grants. Similarly there was a move by all institutes to increase the proportion of funding from corporate sources as opposed to public donations.

# STRATEGIES FOR MEDICAL RESEARCH INSTITUTES

## INTRODUCTION

As part of a broader study of the management of science, we are interested in looking at the corporate strategies pursued by Australian medical-scientific research institutes.<sup>1</sup> The research conducted by such institutes is highly focussed and tends to be close to the "pure" end of the continuum between pure and applied research. They are of interest from the organisation research view point as they are characterised by: diffuse goals; long term commitment; work conducted in teams that have a long life time; and strongly focussed basic research. As such they do not fit many of the standard models for the management of research and development. (Payne 1990, Katz & Allen 1982, Tushman 1979, Twiss 1992)

Within Australia there is a high geographical concentration of these institutions within one state, Victoria. There are also large differences in public perception of the institutes, in the level of government support, in public and corporate support, and in their output as determined by publications. The human resources of all of the institutions are similar, with senior staff highly qualified and with international reputations. Most of the research is supervised by staff with PhD or equivalent qualifications, with considerable post-doctoral experience overseas, and impressive publications records.

In this paper we explore the "market orientation" of the research institutes as well as the ways in which they seek to influence the environment within which they operate. Whilst our institutes have higher level objectives, expressed in their research programmes, they must ensure not only survival but where possible growth. We are interested in examining the variety of strategies adopted to achieve this end.

We have adopted a survey approach. Initially, twenty medical research institutes were identified from government reports, abstracts of conferences and information supplied by professional societies. Of these, one was based in Queensland, five in New South Wales, and the remainder in Victoria. Subsequent investigations revealed that one institute had ceased to exist, one was excluded as it was judged to be a government agency rather than a true research institute, and two organisations failed to reply to our initial request for information. Information regarding one of these was obtained from published sources and personal contacts within the institute. Our final sample consisted of three institutes in NSW, one in Queensland and thirteen in Victoria. All institutes are involved with medical research, and all major areas of medical research are represented, including mental health. In the 1989/90 fiscal year the total income of these institutes was \$70 million and by 1993/94 total income had increased to \$100 million.

## METHODOLOGY

Using the data contained in annual reports we have identified income received, staff employed, and publications: the inputs and outputs of our institutes.

### Staff

Our primary classification of staff, into research, technical support, and administrative, is based on information provided by the individual institutes. Where such information is lacking, we have classified staff according to their qualifications. For most institutions, it was possible to

unambiguously assign staff to the administrative category. Here we note that several institutions designate their director, usually an eminent scientist, as an administrator rather than researcher. Unless we had clear evidence to the contrary, graduates were assumed to be researchers and non-graduates technical support staff. Staff attached to computing units were classified as technical support staff. Cleaning and catering staff were not included, on the grounds that most of our institutes are attached to larger institutions, such as a hospital or university, which were assumed to provide such services.

Research staff have been further classified on the basis of academic qualifications. Those with higher degrees, PhD, MD, or equivalent, comprise the first group. We assume that these senior scientists head up research teams, initiate research projects and are the primary generators of new research thinking. Those with first degrees, such as BSc or MBBS, are assigned to a second group, under the assumption that such staff contribute significantly to team research, they require supervision and are not the primary ideas generators. The ratio of the numbers in each group gives us an indication of the size of research teams within a given institute, reflecting the 'group' orientation of the organisation.

Visitors, such as academics on sabbatical leave, are included in the research staff category. We assume that during their stay in an institute not only do they consume resources but they also generate output attributed to the institute.

### **Publications**

These are classified into books, chapters or reviews, journal articles, conference abstracts, and invited lectures. The emphasis given to publications in annual reports varies widely across institutes, as does the extent to which publication types are differentiated. Whereas in some annual reports publications of different types are clearly distinguished, in others there is a 'half-hearted' attempt at classification, while a minority make no attempt to separate the various publication types. For most institutes it was necessary to reclassify some journal articles, either as book chapters or conference abstracts. Some judgement and knowledge of the literature was required to distinguish reviews from journal articles. "In press" articles were included as publications, double counting being avoided by excluding articles published in the year of interest that had been included as "in press" in the previous year.

To derive a measure of total research output, weightings were assigned to each type of publication. A book was given a weighting of 10, a book chapter or review 6, and a journal article 3. Because of wide variations in the reporting of conference abstracts and invited lectures, these were assigned a zero weighting. While we recognise that the weightings adopted are arbitrary, we note that the effect should be neutral across institutes. Sensitivity tests involving doubling the weighting of each publication type in turn did not produce any significant changes in the ranking of institutes. Journal articles are the major choice of output for all institutes.

Whilst we recognise that alternative measures of output, such as citation analysis, might be used we have not pursued them in this paper. We note that a number of authors have drawn attention to the problems posed by citation analysis (New Scientist, 1991; Gibbons, 1991; Irvine, 1987).

### **Income**

The income received by our institutes comes from three major sources: government, the private sector (either corporate or private sponsorship), and from the proceeds of past investment.

Income from government has been divided into two categories: first, funds obtained from competitive grants, administered by agencies such as the National Health and Medical Research Council (NH&MRC) and the Australian Research Council (ARC) or the Victorian Medical Health Foundation<sup>2</sup>; second, funding directly allocation by federal or state governments, whether or not administered through a 'parent' agency such as a hospital or university.

Money from private sources also has been subdivided into two categories: first, funds obtained from private agencies such as the Anti Cancer Council of Victoria, which operate a competitive grant system similar to that operated by the NH&MRC; second, funds obtained from public donations, philanthropic trusts, and corporate philanthropy.

Most institutes have sizeable investment portfolios. The interest from such portfolios and together with income derived from other sources is included as other income.

In looking at the strategies pursued by research institutes, two aspects of funding assume special importance. The first is the amount obtained through competitive grants, awarded either to the individual scientist or the institution, as against that obtained by direct government funding. The second is the degree to which an institute seeks corporate support as against direct private donation or public appeal.

### **Derived Parameters**

Information contained in the annual reports of the institutes has been used to derive a number of parameters that can be used as indicators of performance, management style etc ( See Table 1 Derived Data for Research Institutes)

#### ***Output/Staff***

Two measures have been developed: output per PhD; and output per research staff member. Output per PhD reflects the view that senior scientists constitute the core of any institute and that such research leaders are the primary generators of ideas, whereas output per staff member carries the more egalitarian connotation that research is dependent on all staff members of the institute (Roberts, 1988; Baker, 1980). Output per staff member suffers from the drawback that it may be biased against those institutes whose research fields require a large technical staff; for example, those that operate labour intensive facilities such as animal houses. Similarly, those institutes whose technical staff are provided by the parent institution would be advantaged in any comparison.

#### ***Income/Output***

The ratio of total income received to output (Tot\$/Output) is a raw measure of productivity. The ratios of government income to output (Gov\$/Output) and private income to output reflect strategic choices by management, which are in turn influenced by the requirements of the income source. For example, reliance on competitive grants from government sources would tend to encourage a publications of refereed papers in order to maximise the chance of renewing grants. In contrast, private income sources may be less concerned with publication *per se* than with the perceived 'significance' of the output or even its emotional appeal.

#### ***Income/Staff***

While the number of competitive grants obtained per PhD employed (Comp Grant/PhD) may be viewed as a measure of the quality of an institute's senior staff, it reflects also an institute's ability to 'manage' the external environment and measures the degree to which the institute is able to enhance

it's researcher's ability to obtain competitive funding. Our alternative measure, competitive grants per research worker (Comp Grant/Res Staff), reflects the quality of the research staff as a whole as well as the effectiveness of an institute's research teams. We would expect to find a close correlation between competitive grants per research worker and the institute's output.

The ratio of total income to research staff employed (Tot\$/Res Staff) not only reflects the ability of an institute to attract funds, but also reveals the close links between some of our institutes and their parent organisations. Some of the institutes included in our sample cannot be considered fully independent organisations: they are more realistically considered as a department of the parent institution. The strategy of these institutes must necessarily align closely with that of the parent organisation, effectively constraining strategic choice.

## **DISCUSSION**

Since they reflect the view that each organisation wishes to convey to the outside world, the research reports produced by the institutes form a convenient starting point for our investigation of strategy. The reports are of a high standard: all institutes take this form of reporting seriously. However, and in our view significantly, institutes choose to project their activities in very different ways. Some emphasise the quality of the science undertaken in their laboratories, providing detailed abstracts of research projects and comprehensive lists of publications. Others do not list publications, choosing instead to emphasise the prestige of their senior staff, including detailed reports of overseas visits, invited lectures and conference presentations. Yet others have a human interest emphasis, focussing on the personal characteristics of staff. Most of the institutes have adopted a corporate structure, including a board of directors, and some choose to emphasise the prestige of board members, listing the companies and organisations with which board members are associated.

The financial reporting in all cases conforms to statutory requirements, but in many cases exceeds these, providing much higher quality and timely information than required by law. Five year comparisons, charts, details of grants obtained, and listings of individual and corporate donors being common. Those institutes which are not incorporated tend to have their finances integrated with those of the parent organisation. In such cases the data reported is that for the parent organisation and unambiguous financial information was not always available for the research institute.

Data derived from annual reports is shown in Table 1.

### **Output**

Research output, in the form of new scientific ideas and discoveries is disseminated primarily by means of publication. We have chosen to use publications per staff member as a measure of output, thus factoring out the effect of size. Subjective assessment of the quality of publications has not been attempted. It is clear that there is a wide variation in the number of publications per staff member employed across our institutes. Whilst the average output per PhD, per Research Staff, or Total Staff, appears to have decreased slightly from 1989/90 to 1993/94, this is not significant. From this we conclude, that whilst there have been local variations in publication rates, these reflect local issues rather than any trend across all institutes.

**Table 1: Derived Data for Research Institutes**

Institute	Team Size		Output/PhD		Output/Res Staff		Output/Tot Staff		Gov\$/Output		Tot\$/Output		Comp Grant/PhD		Comp Grant/Res Staff		Tot\$/PhD		Tot\$/Res Staff	
	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94	1989/90	1993/94
A	1.55	0.95	n/a	8.95	n/a	4.59	n/a	3.49	n/a	\$8,162	n/a	\$15,507	\$81,156	\$90,799	\$31,846	\$46,626	\$175,674	\$138,747	\$68,935	\$71,248
B	1.64	2.85	15.27	15.77	5.79	4.10	4.94	3.18	n/a	\$11,830	\$20,164	\$16,558	\$8,808	\$222,102	\$3,341	\$57,746	\$307,953	\$261,099	\$116,810	\$67,886
C	0.52	n/a	9.12	n/a	6.00	0.00	5.07	0.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D	1.00	1.46	12.30	5.08	6.15	2.06	4.10	1.55	n/a	n/a	\$11,891	\$40,223	n/a	n/a	n/a	n/a	\$146,260	\$204,210	\$73,130	\$82,960
E	2.92	2.17	24.75	16.75	6.32	5.29	5.21	4.52	\$2,635	\$3,818	\$6,192	\$6,420	\$65,214	\$64,485	\$16,650	\$20,364	\$153,253	\$107,529	\$39,129	\$33,956
F	2.14	2.26	7.50	5.21	2.39	1.60	1.62	1.21	\$2,657	\$6,717	\$38,457	\$65,154	\$39,071	\$73,583	\$12,432	\$22,550	\$288,429	\$339,488	\$91,773	\$104,03
G	0.80	3.29	5.40	12.00	3.00	2.80	2.25	2.33	\$11,522	\$7,249	\$29,882	\$11,373	\$62,221	\$111,962	\$34,567	\$26,125	\$161,365	\$136,473	\$89,647	\$31,844
H	0.91	3.26	4.04	9.00	2.11	2.11	1.55	1.75	\$3,125	n/a	\$16,325	n/a	\$18,459	n/a	\$9,649	n/a	\$66,011	n/a	\$34,506	n/a
I	1.29	1.62	17.71	18.66	7.73	7.12	5.33	5.01	\$3,217	\$4,507	\$6,166	\$7,810	\$63,305	\$94,356	\$27,640	\$36,004	\$109,201	\$145,701	\$47,679	\$55,596
J	2.56	2.34	17.88	7.05	5.02	2.11	3.17	1.48	\$3,254	\$4,830	\$11,191	\$18,783	\$68,991	\$90,615	\$19,374	\$27,113	\$200,067	\$132,470	\$56,183	\$39,637
K	0.40	0.65	9.00	2.85	6.43	1.73	5.00	1.58	\$3,811	\$4,992	\$6,109	\$11,278	\$24,099	\$16,673	\$17,214	\$10,105	\$54,982	\$32,142	\$39,273	\$19,480
L	1.27	1.52	6.27	7.92	2.76	3.14	2.03	2.44	\$4,190	\$5,391	\$11,196	\$14,997	\$32,356	\$93,314	\$14,237	\$37,029	\$70,230	\$118,774	\$30,901	\$47,133
M	1.30	1.10	11.46	11.74	4.99	5.60	2.61	3.44	\$6,836	\$11,977	\$16,941	\$21,486	\$117,550	\$200,731	\$51,161	\$95,773	\$194,219	\$252,236	\$84,530	\$120,34
N	1.59	1.97	8.03	9.94	3.10	3.35	2.12	2.38	\$8,285	\$9,925	\$19,325	\$20,440	\$49,842	\$135,256	\$19,257	\$45,519	\$155,171	\$203,231	\$59,953	\$68,395
O	1.09	1.53	13.17	15.16	6.31	6.00	4.04	4.17	\$2,773	\$11,036	\$9,805	\$20,610	\$41,122	\$174,682	\$19,704	\$69,145	\$129,176	\$312,410	\$61,897	\$123,66
P	2.00	2.53	7.80	15.00	n/a	4.25	1.66	3.31	\$14,560	\$6,632	\$17,499	\$12,259	\$113,570	\$102,647	\$37,857	\$29,051	\$136,490	\$183,881	\$45,497	\$52,042
Q	1.96	1.29	9.56	n/a	3.23	0.00	1.77	0.00	\$16,929	n/a	\$23,977	n/a	\$165,863	\$129,412	\$55,979	\$56,539	\$229,109	\$182,623	\$77,324	\$79,787
Mean	1.47	1.92	11.20	10.74	4.62	3.29	3.28	2.46	\$6,446	\$14,633	\$16,341	\$28,512	\$63,442	\$114,330	\$24,727	\$41,406	\$161,099	\$183,401	\$63,573	\$66,534
Std Dev	0.69	0.80	5.47	4.76	1.83	2.03	1.49	1.45	\$4,925	\$35,529	\$9,191	\$47,219	\$42,325	\$54,890	\$15,012	\$22,672	\$72,308	\$81,780	\$24,232	\$31,563

We hypothesise that the pressures for a research scientist to publish stem from: the scientist's own need for recognition and career development; management of the research institute, which may encourage publication explicitly by means of its reward system or implicitly through the creation of an environment that places a high value on publications; as well as external agencies which take publications into account when assessing grants.

An institute that encourages its scientists by creating a culture favourable to publication, may expect to receive competitive grants, both as grants to the institute and individual grants to its scientists. We note especially that an institute that relies for its survival on competitive grant funding, including institutional block grants, must necessarily maintain a high output of publications.

Figures 1 and 2 test these hypotheses. In Figure 1 we compare output per senior scientist with competitive grants received per senior scientist for both 1989/90 and 1993/94. The figure for any given institute is of course an average value, obtained by dividing the total of competitive grant funding by the number of senior scientists employed. Here we come up against a dual problem of direction of causation and delayed effect. We might hypothesise that grants obtained reflect past publications. Alternatively, we might expect a lag between the level of grants received and the output of these grants. Whilst the data appears to indicate a trend, neither assertion is supported with no correlation in either direction being observed between the publication rate and ability to obtain financial support, in the same year, or following a four year lag. Two explanations are consistent with this. The first is that competitive grants, the major source of funding, increased from 30% to 60% on average from 1989/90 to 1993/94. Since these are obtained by individual researchers they reflect individual rather than institutional excellence. The second is that the ability of institutions to attract funds is dependent on factors other than publications.

**Figure 1: Relationship between Competitive Grants Obtained and Output per Senior Research Scientist**

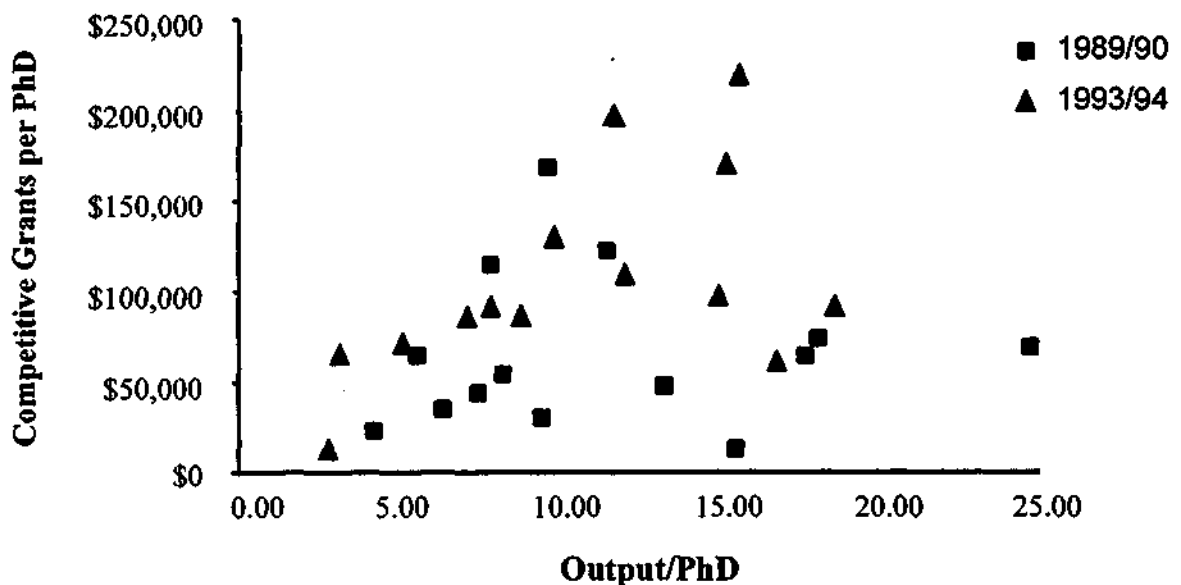
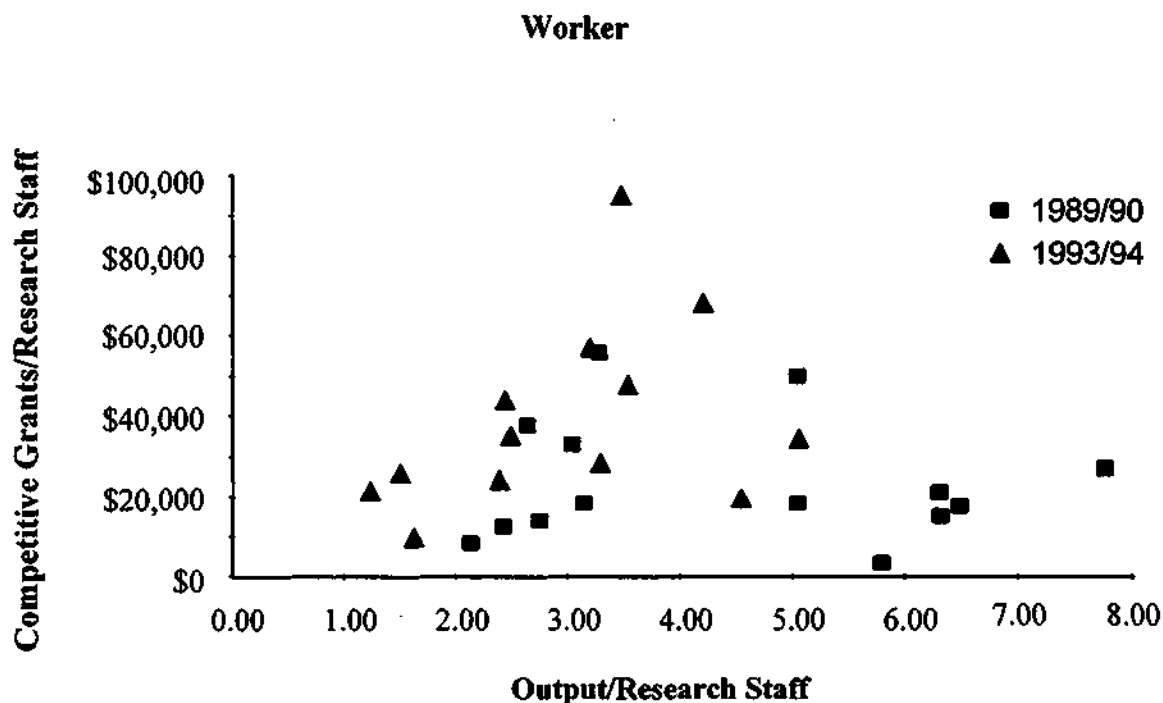


Figure 2 compares output per research worker with competitive grants received. Since many institutes receive block grants, included under the heading competitive grants in our analysis of income, we would expect to observe some correlation between these parameters. However, whilst

the trend is similar to that of Figure 1 again there is little or no correlation between the data , with or without a time lag.

**Figure 2: Relationship between Competitive Grants Obtained and Output Per Research**



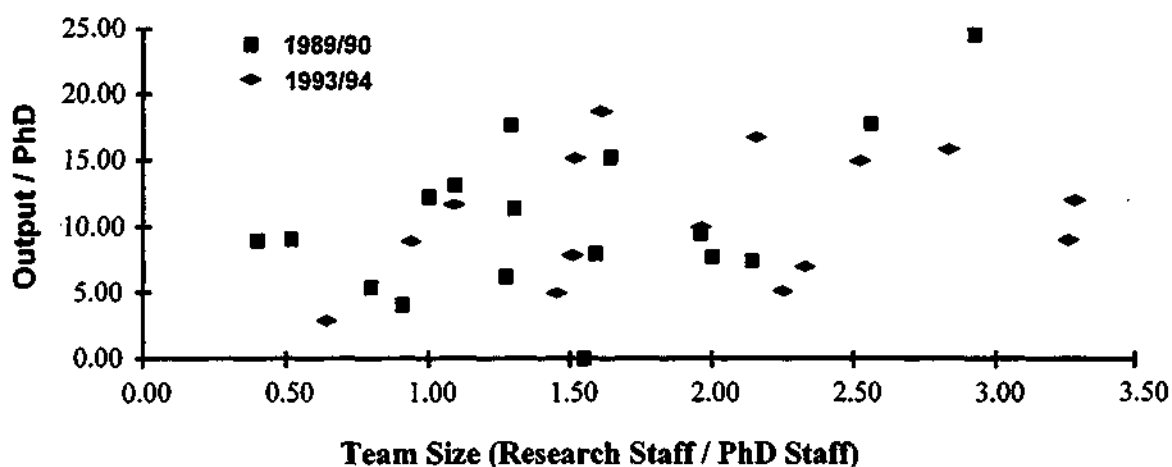
We have not looked in detail at the issue of research collaboration and its effect on publication rates. Nor have we looked at the variation in the average number of authors per publication across institutes. So far as the individual scientist is concerned, collaboration will increase the number of publications. So far as an institute is concerned, collaboration between its scientists and scientists from other institutes will increase the number of publications, since each institute will include joint papers in its publication list. However, if collaboration occurs within an institute one possible outcome is that the number of names on papers rises while the number of papers published is static. Obviously these are matters requiring further investigation.

**Team Size**

The ratio of the number of staff with higher degrees (PhD, MD) to the number with first degrees (BSc, MBBS or equivalent) has been taken as a proxy for team size. This ratio is then compared to the observed output per senior scientist. The correlation between output per senior scientist and team size is shown in Figure 3:



Figure 3: Relationship Between Team Size and Output per PhD Scientist



The correlation is positive suggesting that team work in medical research pays off, at least in terms of publications. If publications are important in ensuring continued financial support, there are clear strategic/managerial implications in this finding.

### Income

While a range of potential funding sources are available to the institutes, each imposes (explicitly or implicitly) its own requirements in terms of: the types of research it is willing to fund; expectations regarding research outputs and the way they are reported; and the emphasis given to 'practical' outcomes as distinct from advances in scientific knowledge. An institute must necessarily take a strategic position *vis-a-vis* these requirements.

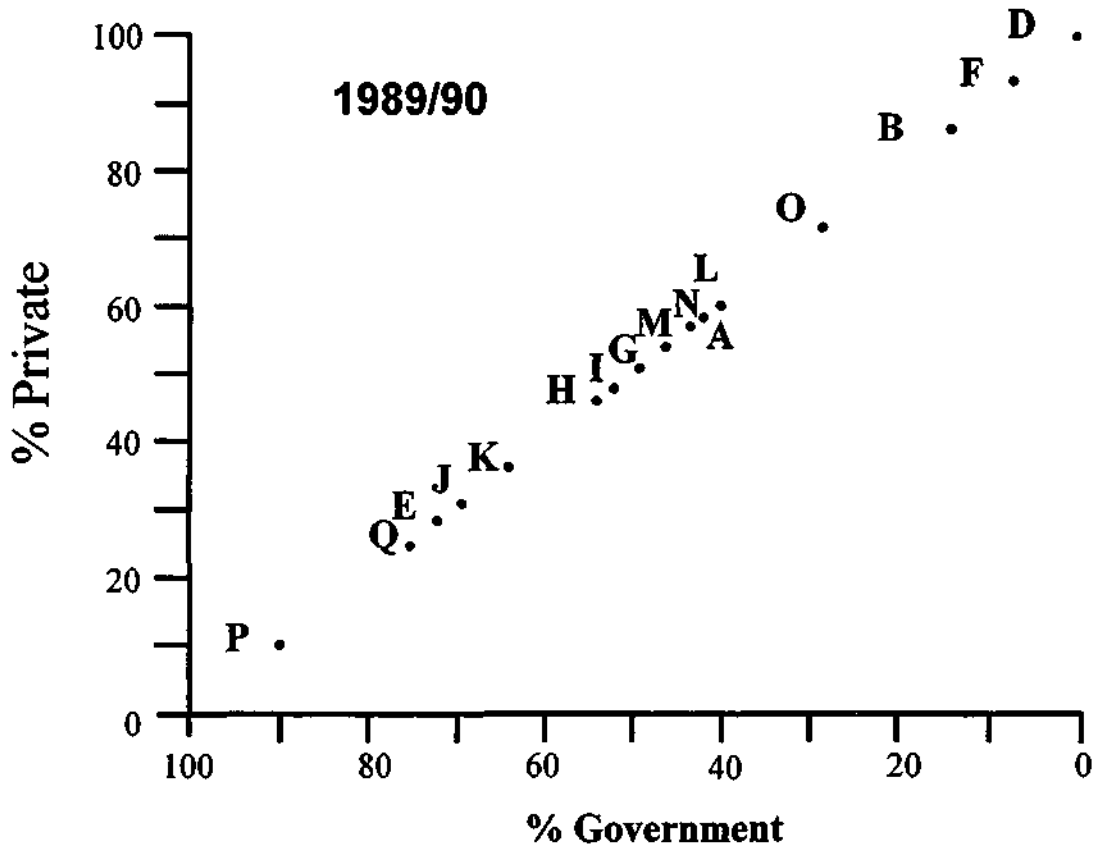
Institutes have adopted quite different attitudes to donations and endowments. Some choose to use donations to fund current research. Others invest donations and endowments, choosing to use the interest accruing to fund their research. Institutes relying on investment portfolios for a significant fraction of their income appear to have greater freedom to pursue their own strategies, at least in the short term. This is not to deny that they have a responsibility to their donors. We note that such institutes often work in areas, such as children's diseases, that have a high emotional appeal to the public. If we accept the hypothesis that the public like to make a donation to a cause rather than an investment portfolio, such institutes face the very real difficulty of maintaining the emotional commitment of their supporters. They must necessarily maintain a relatively large public relations unit.

The balance between government and private funding reflects the different ways in which the institutes seek to influence their external environment. An institute relying on government to provide a high proportion of its income must seek to influence decision making either by direct lobbying on its own behalf or by attempting to create a favourable attitude to the branch(es) of science in which it specialises. It must also ensure that its individual scientists are engaged on projects that meet the requirements of government granting agencies. Institutions dependent on private income, notably from corporate sources or philanthropic trusts, must also strive for excellence but must be aware of sponsor preferences regarding type of research and research reporting. In seeking to ensure a constant flow of funds institutes have to learn to manipulate their

environment, creating sufficient space for their scientists to engage in research they deem worthwhile.

Figure 4 compares the proportion of government and private funding for each institute in our sample for 1989/90. While the relationship is necessarily linear, since we are interested only in the trade-off between government and private funding. Figure 4 reveals two distinct clusterings of institutes.

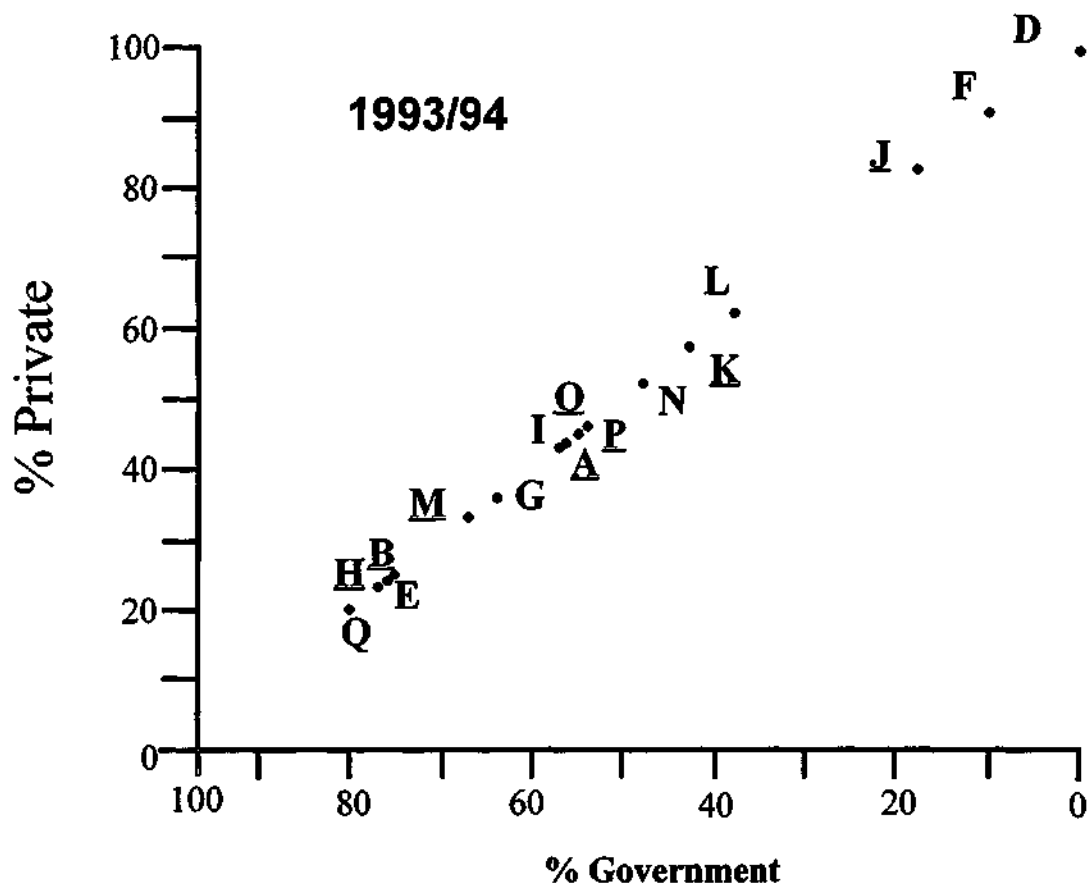
**Figure 4: Government vs Private Funding 1989/90**



The major group of seven institutes is characterised by a 50:50 split between government and private funding, whilst the smaller group has a 70:30 split between government and private funding. Four institutes clearly prefer a high level of private funding, although they do not form a well defined cluster. In contrast, one research institute relies on government for 90% of its funding.

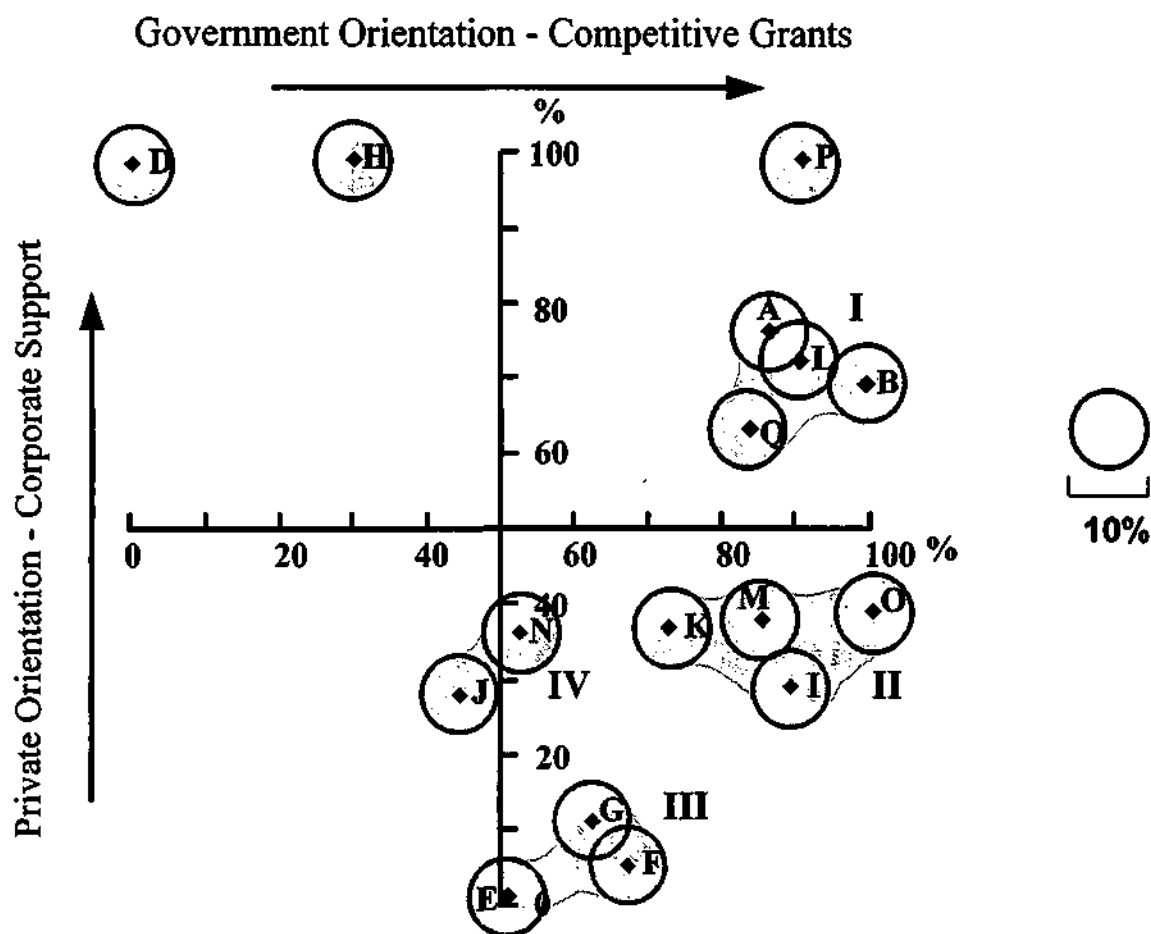
Comparison with the same data for 1993/94, Figure 5, reveals that whilst there is still some clustering it is less distinct, and there have been significant movements. Where there have been such movements, the letter identifying the institute has been underlined. Consistent with the increase in competitive grants as a source of funding, there has been a general move towards government sourced funds.

Figure 4: Government vs Private Funding 1993/94



Variations in fund raising strategies employed by the institutes are illustrated in Figure 6. On the horizontal axis we measure government funding: an institute obtaining its government funding exclusively from direct grants would be placed on the extreme left hand side of the graph, whilst an institute obtaining all its government support via competitive funding would be placed on the extreme right. Private sector funding is measured on the vertical axis. An institute relying exclusively on private donations would be positioned at the bottom of the graph, contrariwise an institute relying on corporate funding would be positioned towards the top of the graph. Our calculations assume that investment assets have been consolidated from direct private funding, i.e. they are the result of past public appeal or individual private donation

Figure 6: Strategies with respect to Sources of Funding, 1989/90



The mapping suggests that the majority of institutes tend to follow one of a limited number of clearly defined strategies, giving rise to several 'clusters' or 'strategic groups' on our map. However, we note that a minority of institutes follow highly individual strategies. Whilst some of the institutes occupying individualistic strategic niches do so because their funding policy is truly unique, others may have been incorrectly classified as a result of uncertainty regarding the true source of their funds.

Group I consists of four institutes each characterised by high levels of corporate funding and substantial reliance on competitive grants. Some, but not all, of these institutes obtain a block grant from NH&MRC. They span the spectrum from the largest institutes considered to some of the smallest. Clearly, their business strategy is to attract both corporate and government support, the latter primarily through granting agencies. This strategy is reflected in the style of their annual reports, which emphasise their corporate connections but give less detailed coverage of scientific work. We would expect institutes in this group to have somewhat lower pressure to publish than institutes in other strategic groups, an interpretation that is borne out by a weighted average of 8.32 publication units per senior scientist<sup>3</sup>.

The four institutes in Group II rely much more heavily on past investments than their rivals in Group I. As with Group I, competitive grants (including block grants) are the major source of government funding. All institutes in this group have investment portfolios or foundations that provide significant income. It would appear that a high proportion of these investments have been

built up from private donations or bequests. Whilst they receive some corporate support, this is more than matched by investment income. Their annual reports emphasise the quality of the science undertaken, and as a group these institutions tend to emphasise publication rates, with a weighted average of 10.82 publication units per senior scientist.

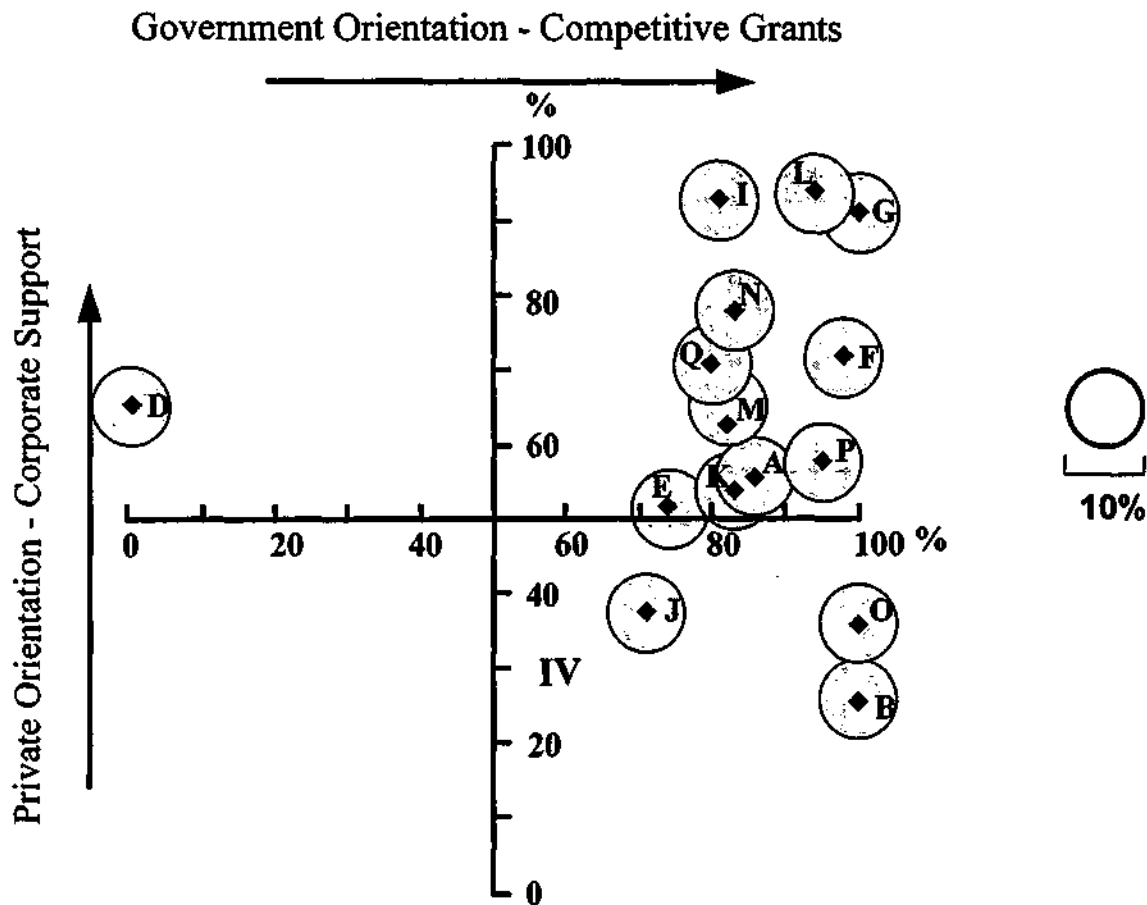
The three Group III institutes rely on a mix of government funding and public donations. Whilst they receive competitive grant funding, and in one instance a block grant, they obtain a much higher proportion of their government funding than Group I and Group II institutes from direct government support, both Federal and State. In addition they obtain very significant support from the public, either through direct fund raising, service clubs, or other community organisations. Only a small proportion of funding is obtained from the corporate sector. The annual reports of Group III institutes emphasise the human relations aspects of their science and feature their staff achievements. These institutes are characterised by extremely disparate publication rates, ranging from 7.5 to 24.8 publication units per senior scientist, with a mean of 15 publication units.

Group IV, with one exception, appear to have confused strategies. The exception is a large research institute that is able to follow a mixed income support strategy, being successful in obtaining corporate and direct public support from the private sector, as well as competitive grants and direct support from the government sector. Other Group IV institutes are small and do not appear to have developed coherent strategies for income support. There is a very wide range of publication rates in this group, from 8.0 to 17.9 publication units per senior scientist.

Two of the three 'outlying' institutes owe their position to variations in the manner in which they report financial data: we cannot dismiss the possibility that they belong to one of the clusters. The third is unique.

In contrast the 1993/94 mapping, Figure 7. reveals that most organisations are shifting towards a common strategic position where the majority of government source money is coming from competitive grants and corporate support is the major source of private funding. Institute "D" still retains a unique position, which is due to the unique nature of this institute.

Figure 7: Strategies with respect to Sources of Funding, 1993/94



For some institutions this has involved major changes in strategy and the forces for this isomorphism would appear to be essentially coercive and mimetic (DiMaggio and Powell, 1983). Coercive forces arise from government policy that funding for research should be on a more competitive basis (Industries Commission, 1995, p 22) and the expectations within society for more competition. Mimetic forces arise from uncertainty within the environment, partially due to government funding policies (Industries Commission, 1995, p 10), and as a response to this the more successful organisations become models for other organisations operating within the same environment (DiMaggio and Powell, 1983, Galaskiewicz and Wasserman, 1989).

### Income/Staff

Income per research staff member is both a reflection of the ability of the institute to raise income, and an indicator of its effectiveness in managing its external environment. How much this reflects research excellence as against managed perception is difficult to ascertain. An institute that relies on public support must necessarily create the perception that its research is of high quality but must address those problems that are of concern to the public. Research papers *per se* are unlikely to achieve this end. However, we note the possibility of 'halo' effects in the awarding of grants to individual scientists.

Several important questions remain to be addressed in the future. Does the prestige of the institute affect the awarding of grants to its scientists? How important is government liaison for managements of institutes that rely heavily on government grants? The question of peer review is

also relevant (Gibbons, 1987). Does Australia have a large enough group of scientists (a critical mass) for adequate peer review?

## CONCLUSION

Whilst we have examined the current 'market orientation' of our medical research institutes, as yet we have not explored the ways in which such strategies developed. Traditionally, strategy has been seen as an analytic process concerned with the future development of an organisation. However, the strategic behaviour we observe appears consistent with Mintzberg's concept of emergent strategy: strategy as pattern in a stream of action (Mintzberg and Waters, 1985; Mintzberg, 1987). According to Mintzberg "strategies can form as well as be formulated" and an important part of the management of strategy lies in "the ability to detect emerging patterns and help them take shape". (Mintzberg, 1990, p.41)

This is not to deny that intent lies behind the patterns we observe, but to stress that these strategies have developed or are evolving over time. Consistent with this is the observation that there are a limited number of successful strategies for research institutes to ensure financial viability by seeking funds from both government and private sources. Whilst at some stages there may appear to be a number of distinct strategies, the forces acting on institutions that initially cause a cluster of strategies, may over time continue to act to produce a commonality of strategy, as has been observed. This is best explained using the concept of organisational isomorphism, or mimetic organisations, developed by DiMaggio and Powell (1983). This concept, has been in analysing strategies of 'not-for-profit' organisations (DiMaggio and Powell, 1983; Galaskiewicz and Wasserman, 1989; Burn and Wholey, 1993), such as hospitals and other medical institutions. The forces that act to produce isomorphism are essentially coercive, mimetic and normative. Coercive forces arise from the external environment, largely from government action and societal pressure, and we have identified government policy of greater competition for research funds as one such pressure. Mimetic forces arise from successful institutions acting as models for newer and less successful organisations, particularly in periods of high uncertainty, such as has been the situation in the period under investigation. Normative pressure arise from the professional networks of scientists and their desire for comparability and interchangeability between institutions, and processes such as peer review. These normative forces would be expected to be constant over time as scientist have always relied on professional networks for the maintenance of an occupational subculture.

Our sample of institutes includes a number that are well established as well as some of recent origin, each of the strategic groups observed in 1989/90 contained at least one well established institute. Such institutes are usually associated with a powerful charismatic leader, the role of the director in providing strong leadership over many years in a well established institute having recently been discussed by Charlesworth (Charlesworth et al, 1989, pp 72 - 76). Whilst such leaders may not conform in every respect to the image of the charismatic founder, the culture of the institutes usually reflects their beliefs (Farris, 1988; Root-Berstein, 1989). Not unexpectedly we associate strong research leaders with certain preferred strategic options. We would also expect well established institutes and their directors to provide models for newer institutes, so that the strategies for some of the newer organisations are essentially mimetic. However, as uncertainty increases the coercive and mimetic forces combine so that the strategies of these established institutions also evolve towards commonality, which is what we observe in 1993/94. We would postulate that this would continue until one or a small number of institutions find an advantage in changing their strategy. At this stage the forces acting towards isomorphism no longer apply, as observed in Burns

and Wholey's (1993) study of the adoption and abandonment of matrix organisation by hospitals, and clusters of strategies will again develop.

How difficult is it for an institute to change its business strategy? Our contention is that, since such a strategy embodies the culture of an institute, which in turn depends on leadership style and beliefs, it would be difficult for an institute to switch from one group to another in the short term. The competing strategies call for a different balance between research that will produce results in the short term, necessary to ensure competitive grant funding, and longer term - perhaps more esoteric, or higher risk - research that can be funded from investment income. Attitudes towards these tend to be entrenched and difficult to change. Opposing this are the coercive and mimetic processes that encourage isomorphism and these are more gradual and overtime will produce evolutionary change.

Our research raises many questions and further work is required. In particular, we see a need to explore the question of the critical mass of scientists needed for adequate peer review. The relationship between the management of research institutes and government bodies, particularly granting agencies, must also be explored. The environmental model of organisations suggests that any responsible research institute should seek to ensure that its scientists and the organisation are viewed favourably by government and granting agencies. So that it would be expected that institutes would seek to influence government policy towards research and in particular certain types of research. The nature of links between government and management of research institutes needs to be examined.

Turning to the internal management of the institutes, we are interested in exploring the relationship between the varying strategies and the motivation of research staff. Also how the various pressures to publish are reflected not only in management styles but in the broader culture of the institutes. Similarly, we are interested in the perceptions of individual research scientists regarding the strategies of their institutes, particularly those that rely substantially on public funding. We hope in the future to be able to investigate some of these issues.

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## NOTES

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- <sup>1</sup> To focus on the generic strategies employed, rather than characteristics of individual institutes, we have identified the institutes only by letter.
  - <sup>2</sup> The National Health and Medical Research Council and the Australian Research Council are the major mechanisms by which the Australian Government funds research. There are other government agencies which also fund research through competitive grants (e.g. National Occupational Health and Safety Commission). The Victorian Medical Health Foundation is an initiative of the Government of the State of Victoria, which distributes funds obtained through a tax on tobacco products to medical research through competitive grants.
  - <sup>3</sup> The weighting of publications is 3 per journal article, 6 per review or book chapter and 10 per book.