Research Australia
An alliance for discoveries in health

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Productivity Commission
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Dear Ms Bausch

Review of Public Support for Science and Innovation

Research Australia is pleased to have an opportunity to make a submission to this Review.

(1) The economic impact of science and innovation

Health and medical research (HMR) are major contributors to Australia's national economy. Funding for health and medical research through *Backing Australia's Ability: Building our Future through Science and Innovation (BAA),* has made a major contribution towards building research capacity and the potential to deliver significant social and economic returns to the Australian community.

Funding under BAA has provided considerable support for health and medical research. This includes $542 million available to universities under the National Collaborative Research Infrastructure Strategy, $57.9 m for the National Stem Cell Centre, and $20 million to assist biotechnology companies develop their research. Funding for Cooperative Research Centres, the CSIRO Flagship program, the Commercialising Emerging Technology Program and the Commercial Ready Program also contribute towards building health and medical research capacity.

When combined with funding for health and medical research through the National Health and Medical Research Council (NHMRC), this represents a significant Federal government investment. Innovation, building a viable health and medical research industry, commercialisation and capturing social and economic returns are major drivers of this investment. The government's 2006 Budget commitment for $500m of NHMRC funding and $170m for funding for Research Fellowships, provides major new investment in HMR and demonstrates the government's strong commitment to growth in this area.

The national policy context of Australia's health and medical research is provided by the Investment Review of Health and Medical Research (the Grant Review, 2004), which builds on the Wills Review of 1998. The Grant Review found that Australia has a strong and internationally competitive health and medical research sector. Investment in this area delivers excellent returns for the country both in social and economic terms. This return is better than for other areas of investment in research. Australia has a distinctive competence in health and medical research compared internationally, with a growing contribution to international research output.

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The Grant Review demonstrated that health biotech companies have been growing at 16% per annum and that 3,500 to 4,000 knowledge based jobs have been created. Over 450 companies are currently registered in Australia with more than 165 listed on the ASX attracting capital markets support. This represents one of Australia's fasting growing knowledge industries but continued discovery pipeline is imperative to support this young industry.

Measuring the economic impact of investment in health and medical research

The 2003 Access Economics report *Exceptional Returns The Value of Investing in Health R&D in Australia*, provided the basis of our current understanding of the economic impact of HMR. This report which has provided valuable benchmark data on health and research expenditure, the costs of disease and the value of health gains, notes the methodological difficulties in arriving at accurate assessments of economic and social impact. Nevertheless this report points out that investment in health research and development surpasses every other source of rising living standards. The 8 year gain in life expectancy as well as improved wellness over 1960-99 were worth $5.4 trillion to Australians. The gains associated with the prevention and treatment of cardiovascular disease alone totalled $1.7 trillion. Historically, annual rates of return to Australian R & D are up to $5 for every $1 spent on R&D.

Given the size of Federal government research investment it is important to ensure this funding continues to be invested in a way that will maximise social and economic returns.

Research Australia would support the development of a national system of benchmarking and measuring investment in HMR, and to enable a basis of comparison to the 2003 Access Economics report.

Research with commercial potential

Australian health and medical research has made a major contribution to the national economy through leaders such as Cochlear and Resmed. Smaller biotechs, including those examined in Research Australia's *Beyond Discovery* report (2004), also offer potential for significant investment returns.

Examples of research discoveries and inventions which have recently attracted significant private or capital market investment and are/or are poised to deliver significant export earnings for Australia include:

- Development of the papilloma virus vaccine to prevent cervical cancer – licensed to CSL and then by CSL to Merck in a deal expected to generate A$100-200m per annum in royalties to Australia.
- Work from the Walter and Eliza Hall Institute on antibodies to the IL-13 receptor for asthma under license through Zenyth to Merck will potentially deliver up to US$112m in license fees and royalties to Australia.
- Alchemia, has raised over $26m in venture capital for products developed from the synthesis of carbohydrate-based compounds.
- Biota Holdings has licensed a treatment for respiratory infection to a U.S. company in a deal worth up to US$112.5m.

- Cytopia Ltd has negotiated a A$274 m license with Novartis for collaborative R & D on Cytopia's JAK3 kinase inhibitor program for the prevention of transplant rejection.
- Ventracor, an Australian heart pump company, is completing clinical trials for a device with significant global market estimated to be around US $5 billion.

These recent examples underline Australia's research strengths particularly in immunology, cancer, vaccines, biologics and devices.

In a nation looking at 'working smarter' this is the area of innovation and research and development at which Australia unquestionably excels in productivity, excellence and commercial potential, notwithstanding the relatively small size of Australian biotechnology in the international context.

(2) Impediments to the effective functioning of Australia's innovation system

The Grant Review (2004) identified significant advances in health and medical research, including a better understanding of commercialisation, a growing research workforce, an increase in health and medical research output, and the higher return on Australian investment in HMR relative to investment in other areas. It also identified the need for continued growth, better alignment between policy and practice, support for industry development, and improvements in the structure and operation of the NHMRC.

Relationship between government funded and privately funded research and development

Research Australia's Beyond Discovery report examined the competitiveness of 100 Australian biotechnology companies and reveals important barriers to success. A key finding was a serious lack of funding for emerging biotechs. Research Australia believes that rather than crowding out or replacing private sector funding, public funding is not only a complement to private investment, but an essential building block to attract private funding and to support biotechnology start-ups in the early stages of their development.

Even when funding is adequate the industry is characterised by a significant time lag between discovery and product development. The average amongst the one hundred companies was 6.2 years with a range of 1 to 22 years. The majority of the businesses were formed before product development (72%), while a smaller number of companies (26%) were formed after product development. Importantly, 62% of companies considered the original research funding inadequate affecting the efficiency of the research process ultimately leading to delayed time to discovery by underpaid research staff.

Initial funding was most commonly provided by venture capital sources (61%) during the commercialisation period, while 35 of the 100 companies raised early stage funding via initial public offerings. Support for establishing biotech businesses was received from a large number of sources which included private entrepreneurs (33%), professional services groups (29%), university based business development offices (26%). Commonly, early stage business indicated a strong reliance on informal private and professional networks for commercialisation support. Funding sources included state government and START grants. Most of the surveyed companies have multiple products and services (66%) or developing platform technologies (31%), albeit at an early stage with 61 out of the 100 companies indicating revenues of less than $2. Businesses most commonly derive revenue from selling their products or services (44%) although licensing their intellectual property comes as a

close second at 43%.Recruitment of qualified management staff has been one of the key concerns of the industry.

Unfortunately in this survey only 13% were generating an income, a factor which seriously hampers future business prospects.

In the early stages of the discovery and development phases the return on risk is high, and therefore unattractive to shareholders. Hence the private sector almost exclusively funds late stage product development where there is a lower risk and higher return on shareholder investment. This opens up the need for public funding to provide basic research infrastructure and to support a strong research foundation particularly for basic science at the discovery and early stage development phases.

Innovation funding for early stage development is essential to building a strong biotech industry

Government funding is required to:

- Further develop leading edge basic science;
- Support critical areas such as public health, "orphan or small market" products, biosecurity and diagnostics;
- Develop opportunities to a stage which is attractive to private sector investment;
- Facilitate the translation of basic research into commercial or public good outcomes, including venture capital and commercialization support;
- Provide core capabilities, such as animal facilities, informatics, and systems biology.

Access Economics found that 87% of research and development in the public sector is financed publicly and 74% of private research and development is financed privately. The balance is funded through other sources such as philanthropy. Australian business investment in health and medical research is generated primarily from the pharmaceutical industry, which targets later stage clinical development and trials. Similarly, venture capital flows primarily towards product development rather than early stage discovery.

Melbourne University's 2005 R&D and Intellectual Property Scoreboard, prepared by the Intellectual Property Research Institute of Australia provides an important overview of the contribution made by Australian based health research. Health and medical research companies comprise four of the top ten biggest spenders on R&D, with CSL ($101.2m), Cochlear ($44.5m), Mayne Group ($44.0m) and GlaxoSmithKline ($38.6) contributing $228.3m collectively. Shareholder returns for the top ten spenders averaged 17.1% against 7.7% for the top 1000 companies. Rather than crowding out spending on research, these investments have been made at a time of rising government expenditure on research and development.

In addition to issues regarding financing, there are significant barriers in relation to Australia's ability to capture additional HMR investment, including:

- Difficulty in retaining senior researchers in Australia to build and sustain research teams
- Small size of the pharmaceutical industry and distance from corporate R&D laboratories of the world's leading innovative pharmaceutical companies.
- Fragmentation of research base across a large geographic area that limits cooperative networking across groups of Australian scientists
- An 'innovation gap' in infrastructure, funding and skills, in medicinal chemistry and biopharmaceutical R&D. These gaps arise due to the perceived high risk associated with early stage development, or the intellectual property being purchased and commercialised overseas rather than through Australian interests.
- Complex ethical approvals processes hampering clinical trials
- Taxation and other incentives may be outpaced by incentives offered by competitors overseas i.e. Ireland and Singapore
- Limited supportive infrastructure to attract philanthropic funding for HMR
- Fragmentation between research, policy and health service delivery agencies which inhibit the capacity to link research, policy and practice.
- Limitations associated with data linkage and I.T. capacity.
- Infrastructure gaps i.e. in bio-manufacturing and medicinal chemistry
- Limited private venture capital involvement

These issues are further explored in a report to be released in September by Medicines Australia and Research Australia. This report identifies strategies to strengthen pharmaceutical industry investment in Australia. The report will identify how transformation from a 'second-tier' to a 'first-tier' innovator will require further investment to strengthen technology-based business, the generation of ideas, the creation of value, an expert workforce and the generation of available investment capital. The report identifies a range of potential R&D strategies based on tax concessions and exemptions to fund local researchers to develop their innovations to a stage of development (i.e. compounds) which generates commercialisable intellectual property. It notes that these should be viewed as an investment rather than as a cost to government, given the economic returns generated.

Approvals Processes

Approvals processes impact on the extent to which new products enter the Australian market. This applies to medical devices as well as new treatments and pharmaceuticals.

Effective commercialization of innovations in medical technology in Australia will depend heavily on entry points to supply. For example, in the case of new medical devices,entry points are controlled by the Therapeutic Goods Administration (TGA), the Medical Services Advisory Committee (MSAC), the Prostheses and Devices Committee (PDC) and local public sector health technology assessment processes. The relentless application of full cost recovery at the federal level, except with MSAC, and the lengthy overall approval times adds cost and delay to the uptake of new technology increasing risk for innovators.

It is recommended that the Productivity Commission look closely at this final stage of the realization of the results of HMR.

(3) Different components of Australia's innovation system

Ensuring the community benefits from research

The Grant Review in 2004, building on earlier recommendations of the Wills Review in 1999, emphasised the importance of public policy and population health research along with clinician driven clinical trials and health service evaluations.

Innovation through effective health services research carries the potential to deliver considerable economic and social benefits to the community.

Improvements in health outcomes, health service cost savings and health economic benefits can be achieved through undertaking and implementing the findings of policy and practice research at four broad levels:

- Clinical practice -evidence based clinical best practice based e.g. use of new technologies or multidisciplinary care protocols;
- Health services - turning evidence into action in our health system e.g. policies which improve access to care, early detection and intervention such as flexible and innovative workforce arrangements;
- Public health interventions at a population level and programs e.g. immunisation programs, dietary folate to prevent spina bifida, obesity prevention
- System improvements through analytical tools and information management

The following Australian examples demonstrate this potential:

- Studies in advanced breast cancer found that high-dose chemotherapy with bone marrow transplantation was no better than standard dose chemotherapy, despite initial enthusiasm for the high-dose treatment. – In Australia up to 1,000 women per year have avoided this toxic procedure (estimated cost saving $50,000 per patient: total savings approximately $50 million per annum).
- Studies in malignant melanoma have progressively shown that less extensive surgery is effective saving patients many days in hospital and about $5,000 per patient. Total savings approximately $10 million per annum.
- An Australian trial in testicular cancer (the most common cancer in young men) found that one type of chemotherapy cured more patients and saved more lives than another. Before the trial, the two treatments were considered equally effective.
- NSW State Trauma Plan – local hospital ambulance bypass implemented for patients with major trauma to one of 7 designated trauma centres. This was based on overseas research that demonstrated higher survival and better outcomes if patients were in the care of an expert trauma team within the first hour after trauma occurred - the ‘golden hour’. The implementation and following epidemiological study in NSW demonstrated thousands of lives saved and improved trauma outcomes in line with those predicted from the original research.
- SIDS prevention – based on Australian public health research, a major public health education campaign has reduced the incidence of sudden infant death syndrome in Australia by 80% or 400 deaths per annum (from 500 to 100 babies dying form SIDS) by sleeping babies on their backs.
- General Practice Collaborative Study is providing useful data to enable doctors to measure their performance against best practice, so improving quality of service delivery.

(4) Social and environmental impacts of public support for science and innovation in Australia

Reports of Research Australia Public Opinion Polls 2002 – 2005 may assist the Commission to identify community attitudes towards research and development. These reports (enclosed with this submission) identify an exceptionally high level of public support for health and medical research.

Public opinion polls

In 2002 Research Australia's inaugural public opinion poll, conducted by AC Nielsen, showed that the public has a high level of interest in health and medical research but limited understanding and awareness of the organisations that conduct and fund health and medical research in Australia. In particular, the public does not understand the key role of the Federal government in funding and encouraging medical research.

Subsequent polls conducted by Research Australia have consistently found strong public backing for government policy supporting health and medical research. The 2004 and 2005 polls both revealed strong voter intentions based on a commitment to increase funding for medical research, and through taxation incentives for companies investing in research and development.

The 2005 public opinion poll found that Australians are looking to the future. Investing in health and medical research is considered to be critically important as it is the best way of investing in Australia's future and health. While extraordinarily strong support is expressed for health and medical research overall, it is highest in women and older Australians. Younger Australians are both aspirational and practical in relation to health and medical research, and want to see Australia well positioned globally. Younger people more readily identified wider economic benefits such as job creation, exports, and savings on the cost of buying knowledge into the country.

Australians are looking for greater life expectancy, illness prevention, cures, and to improve life enjoyment and productivity through health and medical research. Cancer is a top of mind issue in our community, while significant "lifestyle" conditions such as heart disease, mental illness and addiction, diabetes and obesity are also emerging as key issues.

Researcher opinion poll

An expert scientific workforce will be essential to underpin successful innovation and R&D industry.

In 2003 Research Australia undertook a researcher poll to be used to inform government, the private sector, philanthropy and the community and provide valuable feedback about changes following the Wills Review recommendations and the increase in funding for NHMRC post 1999.

This Poll explored researcher attitudes towards the environment in which they work, success factors in determining research outcomes and motivations towards commercialisation.

Findings include:

- Concern about the adequacy of funding for their research.
- The key motivator of health and medical researchers is the excitement of discovery.
- A high level of support for increased investment for Australia to be internationally competitive.
- The majority of researchers believe their research makes an important international contribution.

- The most important outcome for researchers is to improve health. Success is measured by generating publications. Outcomes of relatively less importance are patenting research findings and creating new businesses.
- An overwhelming view that the Australian health and medical research environment does not provide a secure and long-term career path.
- Criticism of the level of infrastructure support.

Conclusion

Australian health and medical research is essential in the context of innovation and Australia's social and economic advancement. Future challenges, through population ageing, threats to national security through bioterrorism, and the development of new competitors in China and Asia, will continue to exert pressure on Australia's R&D capacity.

Australia will need to develop a strong education and training base, along with an expert scientific workforce if it is to meet growing competition and avoid an erosion of living standards as the population ages. The Productivity Commission has identified the importance of a nationally co-ordinated approach towards the development of a professional workforce to meet future health system requirements, and similar approaches need to be developed to ensure an expert scientific and research base to underpin developments in health and medical research.

Linkages between physical and biological sciences and between research, industry and academia will be important in determining our ability to innovate, develop new products and services, and build bridges between discovery and application. A shorter pathway between discovery and community access would deliver strong social and economic returns to the community.

The approvals processes for new medical devices, technologies and treatments should support timely and effective assessment of new and innovative products. This may be an area for further consideration.

It will be important to promote supportive public opinion and strong leadership to support growth in innovation to meet future challenges. Research Australia has the capacity to contribute to raising community understanding of research and potential community benefits.

Thank you again for the opportunity to provide comments to the Review.

Yours sincerely

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