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Health and Medical Research in Australia

Observatory on Health Research Systems

Amanda Scoggins

The research described in this report was prepared as part of RAND Europe’s Health Research System Observatory Documented Briefing series, funded by the English Department of Health.
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Preface

This documented briefing provides an overview of health and medical research in Australia. The report is part of a series of country-specific reports available from RAND Europe’s Observatory on Health Research Systems, funded by the English Department of Health.

The report is divided into three parts. In the first part, the *Structure of the Australian Health Research System*, including funding sources, sectors performing health and medical research, and health research priority setting, is presented. The second part, *Processes and Performance of the Australian Health Research System*, focuses on the types of funding available and how funding activities are conducted, and provides exemplars of the system’s performance. The third part presents an *Outlook* and considers current and emerging health research issues in Australia.

The report is based on desk-based document review and will be updated on a regular basis. It does not attempt to discuss current policy options, or make recommendations for future strategy. The report will be updated on a regular basis. The report will be of interest to government officials dealing with health and medical research policy, medical research councils, health and medical research charities, public and private institutions engaged in health research, and researchers.

The use of $ throughout this report stands for Australian dollars, unless stated otherwise.

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Summary

Summary: Key Points

- The Commonwealth Government, specifically the National Health and Medical Research Council, is the largest single funder of health and medical research; there has been continual growth in funding since 1995.
- The main sector performing R&D are higher education institutions, with a strong emphasis on encouraging links between government, researchers, and industry.
- The majority of funding falls within seven National Health Priority areas, which account for almost 80% of the total burden of disease and injury in Australia.
- Many types of funding support available, but most support is provided for research (e.g. project grants), people (e.g. fellowships), and infrastructure.
- Peer review of grant applications is a strong feature of the health research system.
- Australia has made an impressive impact in health and medical research, as measured by an established Performance Management Framework.
- Indigenous health research remains a national health issue, along with other current and emerging health issues.

Australia’s funding for health and medical research is sourced from a range of organisations across the public and private sector, including the Commonwealth Government, state and local governments, the not-for-profit sector, and industry. In total, health R&D expenditure in Australia was estimated at $1.7 billion (0.12% of GDP) in 2000–2001. Whereas nearly half was Commonwealth funded, about 70% of health R&D is performed by high education institutions and businesses.

The largest single funder of health R&D is the National Health and Medical Research Council (NHMRC; part of the Australian Government’s Department of Health and Ageing) which committed more than $484 million (0.05% of GDP) in 2005. The Commonwealth Government has steadily increased their investment in health R&D since 1995. This was encouraged by the Wills strategic review in 1999, which led to the historic doubling of funding by the Australian Government for five years since 2000. In the May 2006 Federal Budget, the Government allocated an additional $905 million for health and medical research which will run over the next nine years. Industry’s investment in health R&D, which was estimated at $420 million (0.03% of GDP) in 2000–2001, also continues to grow along with a increasing number of biotechnology companies and federal and state government–industry research support schemes. The Wills review and Grant’s

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progress review in 2003 recognised that a positive outlook for health R&D would not only require greater government investment in health R&D, but also in establishing links between the government, research community, and industry (known as the “virtuous cycle”).

The Australian Government has four National Research Priorities (NRPs). NRPs were developed in late 2002 and represent ‘whole-of-government; themes of long-term importance to Australia: An Environmentally Sustainable Australia; Promoting and Maintaining Good Health; Frontier Technologies for Building and Transforming Australian Industries; and Safeguarding Australia. The NHMRC has lead agency status for Promoting and Maintaining Health. Australia has also defined seven National Health Research Priority Areas (arthritis and musculoskeletal conditions, asthma, cancer control, cardiovascular health, diabetes mellitus, injury prevention and control, and mental health). The majority of funding goes into these areas, which account for 80% of the total burden of disease and injury in Australia.

Australia’s health research funding agencies, including the NHMRC, the Australian Research Council, and not-for-profit organisations (e.g. The Heart Foundation and Cancer Council Australia) provide similar types of funding support. The funding support can be categorised as research support (such as programme and projects grants), people support (such as scholarships, fellowships, career development awards), and infrastructure support (such as enabling grants and infrastructure support). Centres of Excellence and Research Networks also feature within the system, and may be jointly funded. These initiatives typically focus on highly innovative research at the forefront of development within areas of national importance. Funding support is typically awarded through a competitive grant applications system with assessment based on peer review following set criteria (such as significance and innovation, scientific quality, and track records of researchers).

The NHMRC Performance Measurement Framework, which was established in 2003, is the management tool which links the strategic plan and the NHMRC’s legislative objectives to an outcome-output framework. The framework emphasises what the NHMRC produces (outputs) and what impacts or consequences (outcomes) this has for the community. The Performance Measurement Report and other evaluations shows Australia has made an impressive impact in health and medical research across many performance aspects, such as dissemination of scientific results, national and international collaborations, research breakthroughs, commercialisation, and developing research capacity (NHMRC, 2003; NHMRC, 2006b).

Indigenous health is considered a national health issue by the Australian Government and research funding aims to tackle health inequalities in Aboriginal and Torres Strait Islander communities. There are also several other health issues that is likely to be the subject of ongoing consideration by Australian governments, non-government organisations, research organisations, and the community. These include obesity, complementary and alternative medicines, depression, dementia and addiction, and social and environmental effects on health. Several emerging health research issues are also likely to be considered over the next triennium, such as genetic testing, health disasters, water quality, regenerative medicine, public confidence in research, nanotechnology, new food technologies, and global health.
The author would like to give thanks for the valuable input of Observatory team members Edward Nason, Tom Ling, Sally Hargreaves, Miriam Shergold and Jan Tiessen, as well as careful editing by Lucy Bailey. Further constructive comments were provided by Quality Assurance reviewers Jonathan Grant and Charlene Rohr.
## Abbreviations and terms

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AAMRI</td>
<td>Association of Australian Medical Research Institutes</td>
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<td>AC</td>
<td>Companion of the Order of Australia</td>
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<td>ATSI</td>
<td>Aboriginal and Torres Strait Islander</td>
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<td>ARC</td>
<td>Australian Research Council</td>
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<td>CEO</td>
<td>Chief Executive Officer</td>
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<td>CRC</td>
<td>Cooperative Research Centres</td>
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<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
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<td>GDP</td>
<td>Gross domestic product</td>
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<td>GRP</td>
<td>Grant Review Panel</td>
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<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<td>NRP</td>
<td>National Research Priority</td>
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<td>NCGP</td>
<td>National Competitive Grants Program</td>
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<td>NHPA</td>
<td>National Health Priority Area</td>
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<td>PMF</td>
<td>Performance Measurement Framework</td>
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<td>WHO</td>
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This report provides an overview of Australia’s health R&D system. A health research system has been defined by the World Health Organization (WHO) as a system for planning, coordinating, monitoring, and managing health research resources and activities, and for promoting research for effective and equitable national development (WHO, 2002). Health research itself is multidimensional and can be categorised in many ways—in this report health and medical research encompasses biomedical research, clinical research, public health research, basic research, applied research, translational research, health services research, health system research, health policy, and health evaluation. Health research has been defined by the Global Forum for Health Research as “a process for obtaining systematic knowledge and technology that can be used to improve the health of individuals or groups to reduce inequalities in health” (Burke and de Francisco, 2004).

This report is split into three sections. The first section describes how the health R&D system in Australia is organised and coordinated, and specifies health research expenditures. In addition, a brief overview of the mission and governance arrangements of the key health R&D funding organisations is provided. The second section describes how the health R&D system carries out its activities and provides exemplars of how the system is performing. Finally, a brief account on Australia’s current and emerging health research issues is provided.
Australia’s funding for health and medical R&D funding is sourced from a range of organisations across the public and private sector, including the Commonwealth Government, state and local governments, the not-for-profit sector, and industry. In 2000–2001, health R&D expenditure in Australia was $1.7 billion (0.12% of GDP) and nearly half was Commonwealth funded (Access Economics, 2003). The largest single funder of health R&D is the National Health and Medical Research Council (NHMRC), which is part of the Australian Government’s Department of Health and Ageing. The NHMRC committed more than $484 million (0.05% of GDP) for new health and medical research awards in 2005 (NHMRC, 2006a). Many researchers are also funded by the Australian Research Council (ARC) and the Cooperative Research Centres (CRC) programme, both part of the Department of Education Science and Training, who invested approximately $77 million (0.02% of GDP) and $150 million (0.02% of GDP), respectively. In total, the commonwealth government invests approximately $800 million in health R&D (Access Economics, 2003). The state/territory and local government in 2000–2001 were estimated to fund $154 million of health R&D (Access Economics, 2003).

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3 This represents only the ARC funding approved in 2006 in the “Promoting and Maintaining Good Health” National Research Priority (ARC, 2006).

4 Data from CRC Web site: https://www.crc.gov.au (as of 14 April 2007).
Two examples of initiatives launched by state governments include the Victorian Science, Technology and Innovation Initiative and the Queensland Smart State Strategy. Another example is the New South Wales Office for Science and Medical Research, which is the lead New South Wales government agency responsible for policy and funding for medical research. In 2005–2006, the New South Wales Office provided over $30 million in direct funding for research programmes and capital grants, as well as business and operational assistance to universities, CRCs, and medical research institutes.

Australia also has several not-for-profit organisations investing in health R&D. These organisations typically focus on a single disease, such as Cancer Council Australia, which invested $36 million in 2007, and the Heart Foundation and Juvenile Diabetes Foundation, both investing about $9 million per annum in research. Other not-for-profit sector organisations include Diabetes Australia, which invested approximately $2.7 million in research in 2006 (Diabetes Australia, 2007), and the National Breast Cancer Foundation, which committed approximately $5.9 million in research in 2005.

Industry, especially pharmaceutical and biotechnology companies, contribute to health and medical research by funding their own R&D programmes or by sponsoring clinical trials. In 2000–2001, industry invested around $420 million (0.03% of GDP) in health and medical R&D Australia (Access Economics, 2003). A growing number of biotechnology companies, both publicly listed and private, are being established in Australia and expanding their R&D activities. Federal and state governments also provide a range of government–industry research support schemes to enable formation of research consortia. For example, state governments have established biotechnology hubs to develop policy and foster joint ventures. The not-for-profit sector may also source additional funding through industry partnerships. For example, the Heart Foundation has leveraged extra funding through the Heart Foundation Pharmaceutical Roundtable and partner organisations, particularly the NHMRC. The Pharmaceutical Roundtable is made up of nine pharmaceutical companies, which have contributed $2.2 million in research funding since 2003.

Australia’s researchers collaborate with colleagues overseas and may attract funding from international sources, such as the U.S. National Institutes of Health. Australia is also a member of the international Human Frontier Science Program, and has a specific program to support Australian researchers working with European colleagues under the European-Union Framework program. International companies invested around $120 million (0.01% of GDP) in health R&D in Australia in 2000–2001 (Access Economics, 2003). The NHMRC maintains close working relationships with similar agencies overseas. The NHMRC’s 2005–2006 Annual Report highlights 16 relationships or agreements involving Canada, New Zealand, Japan, the European Union, and also international organisations such as WHO and the Organisation for Economic Cooperation and Development (NHMRC, 2006a). Companies from outside the health and medical research sector, such as the Macquarie Bank Foundation (part of the Macquarie Group), also contribute through sponsorship or corporate philanthropy.

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Organisations that do health research in Australia also span the public and private sector: universities and businesses perform about 70 percent of health R&D (Access Economics, 2003). The majority of health R&D is done by the public sector, estimated to be around $1 billion (0.07% of GDP) in 2000–2001 (Access Economics, 2003). Within this sector in 2000–2001, higher education institutions (e.g., universities) performed around $771 million (0.05% of GDP), state governments $201 million, and commonwealth government around $53 million (Access Economics, 2003). Key government research agencies include research consortia (such as CRCs), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and other government-funded centres such as the ARC’s research centres.

By contrast, the health R&D done by the private sector was estimated in 2000–2001 at around $684 million (0.05% of GDP), of which $426 million (0.03%) was performed by industry and around $258 million (0.10% of GDP) by the not-for-profit sector (Access Economics, 2003). Agencies in the not-for-profit sector include disease-related charities and medical research institutes. The Association of Australian Medical Research Institutes (AAMRI) represents 36 independent medical research institutes across Australia. AAMRI institutes are independent, not-for-profit organisations, closely affiliated to hospitals and universities. They carry out much of the nation’s most distinguished health and medical research and are major partners in commercialisation of Australia’s biomedical discoveries. Currently, AAMRI institutes employ more than 4800 staff and train some 1200 graduate students in medical research. They have a total budget of over $250 million per annum.

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6 The Association of Australian Medical Research Institutes Web site has a complete list of all 36 member institutes at http://www.aamri.org/HTML/Members2.htm (as of April 17, 2007).
winning more than $220 million in competitive grant funding. Research institutes received 25 percent of NHMRC funding in 2005. The other recipients included universities (72 percent) and hospitals and non-government agencies (3 percent) (NHMRC, 2006a).

In the past few years, pharmaceutical or biotechnology companies will often enter joint ventures with research institutes, universities, hospitals, or government agencies such as CSIRO. In Australia, research is frequently a collaborative endeavour with national and international multisite networks working together or sharing infrastructure.
In late 2002, the Australian Government announced four National Research Priorities (NRPs) as an overarching guide for research agencies and funding bodies. These NRPs are presented in the slide above. The NRPs are broadly based, thematic, and multidisciplinary in nature. The NRPs were developed in three stages and will continue to evolve in future years to respond to changing circumstances.

The Priority Goals under Promoting and Maintaining Good Health (NRP 2) are as follows:

- **A healthy start to life**—counteracting the impact of genetic, social and environmental factors which predispose infants and children to ill health and reduce their well being and life potential.

- **Aging well, ageing productively**—developing better social, medical and population health strategies to improve the mental and physical capacities of ageing people.

- **Preventative healthcare**—new ethical, evidence-based strategies to promote health and prevent disease through the adoption of healthier lifestyles and diet, and the development of health-promoting products.

- **Strengthening Australia’s social and economic fabric**—understanding and strengthening key elements of Australia’s social and economic fabric to help families and individuals live healthy, productive, and fulfilling lives.

The NHMRC, as Australia’s lead body for supporting health and medical research, has lead agency status for NRP 2. In 2005, funding commitments by the NHMRC on the
four priority goals of Promoting and Maintaining Good Health accounted for more than 80 percent of total NHMRC research funding.

Although the NHMRC primarily directs its efforts in achieving goals under the Promoting and Maintaining Good Health NRP, they have also been active in areas of the other three NRPs that have the potential to influence health. For example, 15 grants were awarded in 2005, valued at $4.7 million, under An Environmentally Sustainable Australia, and 28 grants were awarded in 2005, valued at $35 million under the Safeguarding Australia NRP. Furthermore, 225 NHMRC grants were identified to address the goals covered by the NRP Frontier Technologies for Building and Transforming Australian Industries (109 of the 225 grants were identified as also having an impact on NRP 3; $51 million).

In performing its functions, the Australian Research Council (ARC) is also required to take into account the NRPs. The ARC implements the NRPs through all schemes of their National Competitive Grants Program. The ARC and NHMRC have agreed to jointly provide $30 million between 2005 and 2007 for research programmes addressing NRP 2.

Australia has also defined National Health Priority Areas (NHPAs). The NHPA initiative is Australia’s response to WHO’s global strategy *Health for All by the Year 2000* and its subsequent revision. The NHPA initiative, overseen by the National Health Priority Action Council, is a collaborative effort involving the commonwealth, state, and territory governments and is focused on those areas that contribute significantly to the burden of illness and injury, and that have the potential for health gains and reduction in the burden of disease. The NHPA initiative\(^7\) is designed to improve the management of chronic disease in Australia and identifies new priority areas on a regular basis. Currently, there are seven different health areas that have been identified for priority attention: (1) arthritis and musculoskeletal conditions, (2) asthma, (3) cancer control, (4) cardiovascular health, (5) diabetes mellitus, (6) injury prevention and control, and (7) mental health. It is estimated the seven NHPAs account for almost 80 percent of the total burden of disease and injury in Australia and impose high social and financial costs on the Australian society.\(^8\) The initiative also focuses on common health risk factors and health inequalities as reflected by NHPA diseases and conditions.

The majority of NHMRC health and medical research funding goes into the NHPAs. In 2005, 55 percent of the new funding awards were linked to one of the NHPAs. NHMRC expenditure against the NHPA in 2005 is presented above.


Reviews

- “The virtuous cycle, working together for health and medical research. Health and medical research strategic review.”

- “Exceptional returns: The value of investing in health R&D in Australia.”

Progress review: Grant report (2004)
- “Sustaining the Virtuous Cycle for a healthy, competitive Australia. Investment review of health and medical research.”

The Australian health R&D system has undergone a number of reviews. A Health and Medical Research Strategic review was commissioned in 1998 by the then Minister for Health, Dr Michael Woodridge, to focus on the future role of health and medical research up to the year 2010. The review in 1999 was led by Australian businessman Mr Peter J Wills AC. The report (Wills, 1998) provided some key findings and recommendations for policy action in Australia, including the following:

- Difficulty in maintaining a skilled and motivated workforce in the face of low salary levels, job insecurity, and uncertainty about the impact of research output;

- A greater need for research that contributes directly to the health of the population and a well-functioning evidence-based health system;

- Barriers to Australia’s ability to build an industry sector that mutually reinforces the contribution of research and government;

- A lack of understanding of the returns to the community through appropriate levels of government investment in health R&D; and that

- The outlook of health R&D lies not only in greater government investment, but also in establishing the links between public funding research and the commercialisation of findings through industry. A virtuous cycle must be nurtured by linking government, researchers, and industry.
The Wills review presented the concept of a ‘virtuous cycle’ between government, industry, and the research community, whereby increased investment in research and a range of enabling initiatives could advance research productivity and lead to increased health and economic benefit to Australia. The final report contained some 120 strategic recommendations for improving health R&D workforce. This led to a historic doubling of NHMRC funding by the Australian Government over the five years from 2000 to 2005. At the beginning of 2006, the annual NHMRC funding stood at $490 million, the highest in the world on a per capita basis, and it was increased further in the 2006–2007 budget (Mendis and McLean, 2006). Although NHMRC funding is only a proportion of total medical research funding, it is the major component.

The increased investment has enabled the NHMRC to substantially address many of the recommendations of the Wills review and has directly lead to the improved diversity and impact of the NHMRC’s reshaped health and medical grants programme. It has also enabled the NHMRC to participate in important and national collaborations and partnerships that will benefit the health of Australians. After the increase in funding, the NHMRC undertook a number of new activities (e.g. Public Health Capacity Building Grants, Centres of Clinical Research Excellence) and funded projects more fully. However, a major change was that the extra funds allowed the introduction of new, large, and flexible programme grants, which allow teams of researchers to be much more strategic in their research plans. The new funding also allowed the NHMRC to attend to things that were unpopular in some quarters: for example, the abolition of block funding of independent medical research institutes (Anderson, 2005a).

In 2003, the federal government commissioned a further review, to assess progress in the implementation of the Wills review. This review, chaired by Mr John Grant, identified
actions required to sustain the ‘virtuous cycle’ and deliver a healthy, competitive Australia (Grant, 2004). This review highlighted the important complementary role of private sector investment and concluded that some successes had been achieved and further long-term benefits were likely with the increased investments. The two key indicators of success were Australia’s high research productivity and the formation of new Australian biotechnology start-up companies. The number of biotechnology companies increased at a rate of 16 percent per annum from 68 in 1992 to 350 in 2003. The health and medical research investment has grown at around 10 percent per annum since 1993, and exceeded $2 billion in 2003. However, the report also cautioned that, “it might be too early to attribute any improvement in Australia’s health and medical research performance directly to investment increases” (Grant, 2004).

Research Australia is focusing on harnessing a fourth dimension in the ‘virtuous cycle’—philanthropy—to assist in building Australia’s health and medical research (Research Australia, 2006). Australian philanthropy contributed to over $216 million to health and medical research in 2001, which represented 12 percent of total health and medical research expenditure. The Giving Australia study identified that medical research received 10.2 percent of individual donations or $580 million (Prime Minister’s Community Business Partnership, 2005).

The Access Economics report commissioned by the Australia Society for Medical Research found that every dollar invested in health R&D yields an average annual return of $5 (Access Economics, 2003). The consumer benefits of the investment in health and medical research were estimated, by various techniques, to be in excess $5,000 billion since 1960 (gains in longevity of 8 years, worth over $2,900 billion; and gains in quality of life and avoided costs valued at $2,500 billion). Buxton et al (2004) pointed out several methodological difficulties with the Access Economics report.

The average overall rate of return was 240 percent, with returns over 750 percent for cardiovascular diseases. These estimates necessarily include a range of assumptions, but use a method that is generally supported by international healthcare economists (Access Economics, 2003; Grant, 2004). The report estimated the magnitude of health R&D in Australia, compared Australian health R&D activity with that of overseas R&D, and analysed the cost effectiveness of research.
The NHMRC is the key agency for managing the Australian Government’s investment in health and medical research, and is the sole contributor to the Department of Health and Ageing portfolio for health and medical research.

The NHMRC is Australia’s largest single provider of peer-reviewed health research funds for the public good. It provides research funds across the spectrum of health and medical science via a single Research Committee formed in 1997 by a merger of the Medical Research Committee and the Public Health Research and Development Committee.

The Federal Health Council (the precursor to the NHMRC) was established in 1926 following the Royal Commission’s recommendations. Membership of the council then consisted of the Commonwealth Director General of Health and the Chief Health Officer of each state. The NHMRC was established in September 1936 after the tragic influenza epidemic of 1918–1919. After the first meeting in February 1937, $30,000 was allocated to grants in the first year. Since then, the Council has consistently supported and stimulated health and medical research, keeping them closely linked to public-health issues and the community’s need for health advice. In 1996, total grants exceeded $1 million for the first time.

The functions of NHMRC come from the statutory obligations conferred by the National Health and Medical Research Council Act 1992.9

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The Act provides for the NHMRC to pursue activities designed to:

- Raise the standard of individual and public throughout Australia;
- Foster the development of consistent health standards between the various states and territories;
- Foster medical research and training and public health research and training throughout Australia; and
- Foster consideration of ethical issues relating to health.

In their 2007–2009 strategic plan, the NHMRC state (NHMRC, 2007) that to meet the health challenges facing Australia (Anderson, 2005b) they must:

- Fund the best and most relevant research to improve the health of all Australians and adopt the outcomes of health research conducted elsewhere around the world;
- Influence and support the infusion of evidence from research into improving the actions of health professional and health-care systems and into public health policies;
- Provide leadership in the ethical framework in which Australian health is delivered and research is conducted; and
- Work to ensure the discoveries of health and medical research contribute to growth of an innovative industry sector.
The NHMRC strategic plan covers the period January 1, 2007 to December 31, 2009 and has five strategic objectives (NHMRC, 2007). These objectives have been established to meet the challenges of the current and future health environment. Achievement of these objectives is the combined responsibility of the chief executive officer (CEO), the council, the committees, and the staff of the NHMRC.

To ensure the NHMRC achieves the targets established by the vision for the next decade, they will set, monitor, and report against quantifiable and achievable performance indicators that also stretch the organisation. In association with each objective, the NHMRC has identified key strategies mechanism and key performance indicators (NHMRC, 2007).

During 2003–2006, NHMRC developed a performance measurement framework (PMF), but this will be revised to align with the five objectives outlined in the new NHMRC strategic plan. To achieve all the objectives, the NHMRC will encourage and promote the involvement of Australians in getting skills, experiences, and careers in research, policy development, evidence-based health practice, and ethics.

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NHMRC became an independent statutory agency within the Health and Ageing portfolio on 1 July 2006. This change brought with it an amended National Health and Medical Research Act 1992, which defines the NHMRC as the CEO, the council and committees, and the staff of the NHMRC. This change also brought with it new members of the principal committee and council and a new CEO. The changes to governance of the NHMRC constitute the government’s response to the 2004 Australian National Office report into the governance of the NHMRC, and to the governance-related findings of the Grant review (Grant, 2004), and also in part due to the recommendations in the report of the Investment Review of Health and Medical Research.

This development has strengthened its independence and facilitates clear lines of responsibility for governance and financial accountability (Van Der Weyden, 2005). In this structure, the CEO reports directly to the minister and is directed by the minister. The minister directs the council through direct requests and the strategic plan. The principal committees report through the CEO on operational matters, and to the council on scientific or technical matters.

The NHMRC is responsible for the Department of Health and Ageing. Membership of the council of NHMRC and its principal committees is usually triennial. The NHMRC has five principal committees and a large number of subcommittees that oversee the NHMRC’s key areas of operation (NHMRC, 2006a). The five main committees are as follows:

- The Research Committee is the main funding arm of the NHMRC, and makes recommendations to the council on the application and monitoring of the reserve and advising the council on matters relating to medical and public health research,
including the quality and scope of such research in Australia. The committee also deals with urgent requests for research, monitors and reports outcomes and outputs of research funding, and oversees high quality grant assessment processes.

- The Embryo Research Licensing Committee oversees the national regulatory framework established by the Research Involving Human Embryos Act 2002\(^\text{11}\) and the Prohibition of Human Cloning Act 2002.\(^\text{12}\)

- The Australian Health Ethics Committee advises the council on ethical issues relating to health, for developing and giving council guidelines for the conduct of medical research involving humans, and other functions as the minister determines.

- The National Health Committee is the council’s overarching committee for its advisory programme. It manages and coordinates the development of advice and guidelines on all health issues.

- The Human Genetics Advisory Committee advises the government on high-level technical and strategic issues in human genetics, and on the social, ethical, and legal implications of human genetics and related technologies.

The NHMRC also provides the Australian Government with independent expert advice on important health issues, the allocation of government funding for health and medical research, and ethical issues in health and research involving humans. The agency also disseminates authoritative public advice, considers and promulgates advice on ethical standards in relation to complex health issues, research involving humans and animals, and regulated sensitive medical research activities.


Since 1995, there has been growth in NHMRC health and medical and research funding through the Medical Research Endowment Account (NHMRC, 2006a). There has been a continual push for a further increase in government funding for health and medical research in Australia since the Australian Government’s legislation for a six-year phased doubling of the NHMRC budget enacted in 1999 (Anderson, 2005a). The outcomes of a survey in 2002 of health and medical researchers revealed that about 90 percent of respondents believed that adequate funding was extremely important to their research role, but only 10 percent felt that the current level of research funding was adequate (Shewan et al., 2005). Many of Australia’s best and brightest health and medical researchers, judged by their peers to be in the top 10 percent internationally, have been missing out on NHMRC fellowship support. Almost 35 percent of applicants scoring in the ’excellent’ category were not funded in 2005 (Khachigian, 2006). Without a further increase in health and medical research spending, projections have indicated that the success rates will fall by a further 50 percent by 2011, with project grant successes rates dropping from 21 percent in 2006 to 8–9 percent in 2011. There is also concern that competition is increasing from countries that can either support Australia’s best researchers more lavishly (e.g. United States) or that are rapidly increasing their national funding (e.g. China, Singapore, and the European Union) (Anderson, 2005a).

In the May 2006 Federal Budget, the government allocated an additional $905 million for health and medical research. $670 million will be administered by the NHMRC, made up of $500 million over four years for research grants, and $170 million for Australian health and medical research fellows, which will run over the next nine years and support 50–65 outstanding researcher for five-year terms. The money for research grants will be incorporated into NHMRC’s base allocation for research, which will increase from $420...
million in 2006 to over $700 million by 2010. The remaining $235 million earmarked in the federal budget for health and medical research will support adult stem-cell research ($22 million) and an infrastructure and capital works programme shared among 17 research facilities nationally ($213 million).
The NHMRC grant support can be divided into research support, people support, and infrastructure support. A full list of NHMRC health and medical research grants within these categories can be found in the 2005 Annual Report (NHMRC, 2006a). In total, Research Support has 13 different types of grants, People Support has 26 different grants and Infrastructure Support has two different grants.

The majority of NHMRC’s funding in 2005 was provided as research support, totalling $321.2 million. The main types of research support are programme grants, project grants, and strategic awards. More than 45 percent of all NHMRC research funding committed to new grants in 2005 was directed to projects involving basic research and 30 percent of funding was committed to clinical research. In 2005, there were substantial changes in relative funding to health services and public health. Funding for health services research increased to about 4.2 percent in 2005 from about 2.7 percent in 2004 as a result of an $11 million health economics programme. Funding for public health research increased to 18 percent in 2005 from 12 percent in 2004 (NHMRC, 2006a).

Many of the projects funded by NHMRC under people support grants involved the training of postgraduate students. Whereas research grants account for almost half of total funding, career-related funding is also significant. In 2005, the NHMRC invested $118.1 million in people through Career Awards, Career Development Awards, Overseas and Australian Training (postdoctoral) fellowships, Postgraduate Scholarships, Scholarships and Research Scholarships (an increase of over 15 percent over that for 2004).

Infrastructure supports equated to $51.6 million in 2005 and is provided through Enabling Grants and Infrastructure Grants. The push has come from five Special Facilities Enabling Grants, worth more than $9 million over five years, and the first instalment of
the government’s $200 million funding over seven years for infrastructure for medical research institutes through the backing of Australia’s Ability Program.
The Australian Research Council (ARC) is a statutory authority within the Australian Government’s Education, Science and Training portfolio. Established as an independent body under the Australian Research Council Act 2001,13 the ARC reports to the Minister for Education, Science and Training.

The ARC advises the government on research matters and manages the National Competitive Grants Program (NCGP), a significant component of Australia’s investment in research and development. The ARC’s mission is to advance Australia’s research excellence to be globally competitive and deliver benefits to the community, and the ARC has seven key objectives.

The ARC supports the highest quality fundamental and applied research and research training through national competition in all fields of science, social sciences, and the humanities, with the exception of clinical medicine and dentistry. The ARC is one of the principal bodies for direct support of pure and strategic basic research in Australia’s universities, as well as fostering research collaboration between universities, and partner organisations in the community, government, and private sectors.

The outcomes of ARC-funded research deliver cultural, economic, social, and environmental benefits to all Australians.

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The ARC has a CEO and professor-level executive directors across the six inter-disciplinary groupings. These groupings align with the scheme-based administration of the NCGP. The ARC employs about 65 career public servants, including a deputy CEO and chief operating officer. Since June 2006, the board of the ARC was retired and most of its functions and responsibilities were transferred to the CEO, who receives input on research matters directly from an advisory committee. Funding recommendations are made to the Minister for Education, Science and Training by the CEO after independent and extensive competitive peer review by Australian and international experts.

The ARC’s academic executive directors are contracted, usually for between three and five years, to:

- Oversee the assessment of funding proposals through a peer review process;
- Integrate the views of external reviewers with the views of selection advisory or College of Experts committees;
- Liaise and communicate with the research community and users of research;
- Identify emerging disciplinary and cross-disciplinary developments and innovative approaches to research; and
- Conduct forums and reviews of the state of Australian research in an international context.

The executive directors are among the most respected in their fields and have extensive Australian and international research networks. They are able to provide high-quality
advice to government, through the ARC, to help ensure approached to research align with the realities of the research environment and can respond to changes in those conditions.
ARC funding programmes come under the umbrella of the NCGP. The NCGP was established in 2001, and accounts for approximately 9 percent of the Australian Government budget for science and innovation. The NCGP comprises a suite of research schemes through which funding is provided on a competitive basis to universities and other eligible organisations.

The ARC Discovery Program funds individual researchers and projects. Discovery projects build the scale and focus of research in the NRP areas and supports research training to enhance Australia’s knowledge base and research capability. Federation Fellowships help Australia retain and attract researchers, and Discovery Indigenous Research Development supports Indigenous Australian researchers to develop research experiences and expertise.

The ARC Linkage Programs funds collaborative projects to help broker partnerships between researchers and industry, government, and community organisations as well as the international community. Linkage Infrastructure, Equipment and Facilities helps access for Australian researchers to state-of-the-art facilities and equipment and provide incentives for the cooperative development of research infrastructure.

The ARC Centres Program builds research scale and focus and strengthens major research partnerships and networks. These centres undertake highly innovative research at the forefront of developments within areas of national importance, with a scale and a focus leading to international and national recognition. There are eight centres of excellence, some co-funded, with a five-year funding term, including an ARC Centre of Excellence in Biotechnology. There are nine special research centres with a nine-year funding term.

ARC also funds research networks, of which five are jointly funded with the NHMRC and will receive more than $9.2 million over five years. The programme facilitates the sharing

### ARC: Funding Allocations 2005–2006

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<thead>
<tr>
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</thead>
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<tr>
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</tr>
<tr>
<td>Linkage International</td>
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<tr>
<td>Linkage Learned Academics Special Projects</td>
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<td>ANZCCART</td>
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</table>

<table>
<thead>
<tr>
<th>Discovery</th>
<th>$ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery Indigenous Researchers Development</td>
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</tr>
<tr>
<td>Discovery Projects (including Fellowships)</td>
<td>255.1</td>
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<tr>
<td>Federation Fellowships</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>291.4</strong></td>
</tr>
</tbody>
</table>

Source: ARC (2006)
of information and resources among researchers working on related topics under the NRPs. These networks link researchers, research groups, and others involved in innovation nationally and internationally.

In 2005–2006, $556.6 million was invested through the NGCP (ARC, 2006). In performing its functions, the ARC is also required to take into account the NRPs. The ARC implements the NRPs through all schemes of their NCGP. Approximately 89 percent of new funding approved under these schemes in 2006 was allocated to research nominated by applicants as falling within the four NRP areas. The NRP on Promoting and Maintaining Good Health made up 16 percent or $77 million of NRP funding approved in 2006. The total NRP funding approved in 2006 was $467 million.\footnote{This reflects the researcher’s nomination of their research falling within national priority areas (the form only allows one NRP to be selected, whereas some projects address more than one NRP).}

ARC also collaborates with the NHMRC. Two recent funding initiatives are “Ageing Well, Ageing Productively” (administered by NHMRC) and “Thinking Systems” (administered by the ARC). The ARC and NHMRC contributed $5 million each to each initiative.
Australia has several not-for-profit organisations that invest in health R&D, and typically focus on a single disease. The scale of health research funding varies between these organisations. For brevity, this section focuses on one of Australia’s largest funders in the not-for-profit sector, Cancer Council Australia, who invests approximately $36 million in 2007 in cancer research, and on a medium-sized funder, the Heart Foundation, who invests approximately $9 million per annum in cardiovascular research. The Access Economics report estimated that private non profit sector funded approximately $128 million in 2000-01 (Access Economics, 2003).
Cancer Council Australia (formerly called the Australian Cancer Society) is the national non-governmental cancer control organisation. The Cancer Council’s members (the eight state and territory cancer organisations) are the leading providers of independent cancer research funding and related activities in Australia. The councils work together to undertake and fund cancer research, prevent and control cancer, and provide information and support for people affected by cancer.

Cancer Council Australia’s goal is to lead the development and promotion of national cancer control policy in Australia, to prevent cancer and reduce the illness, disability, and death caused by cancer. It acts nationally to advise the government and other bodies on appropriate practice and policies for the prevention, detection, and treatment of cancer, and is an advocate for the rights of cancer patients to access the best treatment and supportive care.

These councils are the leading funders of health research and related activities in Australia, granting more than $35 million to cancer research, research scholarships, and fellowships in 2007 (more than $26 million was funded in 2005) (Cancer Council Australia, 2007). Several state and territory cancer councils also fund their own epidemiological and behavioural research units that undertake important research to improve cancer prevention and detection.

The various state and territory Cancer Councils funded grants include student vacation research scholarships, research project grants, research program grants, professional chairs, Cancer Research Equipment Initiative, fellowships, strategic research partnership grants, career development research fellowships, postdoctoral research fellowships and scholarships. They also fund Cancer Control Research Institute programmes, Ph.D.
programmes, and hospital-based data managers. Research grants are made following a competitive peer-reviewed assessment from funds derived from fundraising, donations, bequests, and merchandise sales.
The Heart Foundation: Research Objectives

- Fund outstanding research across the areas of basic, clinical, and public health
- Support the training of outstanding young cardiovascular researchers across basic, clinical, and public health research
- Advocate increased funding for health research
- Establish and maintain partnerships and alliances to support the generation, dissemination, use, and funding support of cardiovascular research
- Market Heart Foundation-supported research outcomes and policy to external stakeholders
- Communicate research activities and outcomes within the Heart Foundation
- Support the translation and use of knowledge generated by cardiovascular research

The Heart Foundation is an independent Australia-wide, non-profit health organisation, funded almost entirely by donations. The Heart Foundation is now recognised as one of the largest organisations that funds cardiovascular research in Australia. The Heart Foundation has a divisional office in every state and territory and also regional areas of Queensland and New South Wales. The mission of the Heart Foundation is to reduce suffering and death from heart, stroke, and blood vessel disease in Australia, and their research mission is to be the leading Australian advocate, supporter, and champion of high quality cardiovascular research.

The Heart Foundation funds researchers to undertake projects relating to heart, stroke, and blood-vessel disease. In 2007, the Health Foundation will invest over $9 million in cardiovascular research throughout Australia. The funding will be made up of 50 grants-in-aid, 15 fellowships, 17 postgraduate scholarships, 23 vacation scholarships, and 60 travel grants. The Foundation has recently launched a Strategic Research Program, with funding commencing late 2007 or early 2008 for funding research in priority areas defined by the Heart Foundation’s work in the area of cardiovascular health. The Heart Foundation leverages extra funding through the Heart Foundation Pharmaceutical Roundtable and partner organisations, particularly NHMRC. External and leveraged research funding contribute to 27 percent of the growth in the research programme since 2001.

The Heart Foundation achieves a 20 percent success rate of applications in all of its award categories, and each year they fund over 60 percent new high quality research awards. The Foundation ensures a 50/50 balance between the funding of projects (in the form of grant-in aid) and people (in the form of scholarships and fellowships). This has been termed the “People/Projects” Policy. The Foundation also ensures a spread across the disciplines of basic, clinical, and public health research.
Cooperative Research Centres Programme

Objective
To enhance Australia’s industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation.

The CRC Model

Source: CRC Programme (2006a)

The CRC programme was established in 1990 to improve the effectiveness of Australia’s R&D effort. It links researchers within industry to focus R&D efforts on progress towards utilisation and commercialisation. The Minister of Education, Science and Training has overall responsibility for the CRC programme. The minister appoints an advisory committee, the CRC Committee. This committee consists of 13 members, who are appointed for a period of up to five years and advise on the selection, monitoring, and evaluation of centres and on the conditions to apply for the provision of funds under the programme. Committee members are drawn from industry, research providers, and Australian government agencies involved in research or research funding.

Two key outcome areas from the CRC programme are commercialisation performance (e.g. licensing executed, patents issued, inventions disclosed, patents applications filed) and student training. Industry contributes to CRC education programmes to produce industry-ready graduates.

The Australian Government awards between $20 million to $40 million in funding to CRCs over a seven year period. This funding must be maintained by cash or in-kind (e.g. expertise and research facilities) from CRC participants (including universities, industry, medical research institutes, CSIRO, and state governments). Since the commencement of the CRC programme, all participants have committed $11.1 billion (cash and in-kind) to CRCs. In terms of commonwealth government funding, cash support provided through CRC grants around $2.6 billion has been provided between 1990–1991 and 2005–2006. The combined cash and in-kind contributions from both Government and participants cover the operating costs and wages for all staff.

Since the Programme began, 158 CRCs have been funded. The CRC programme funding represents 3.5 percent of the Australian Government’s annual science and innovation
funding. There are 56 CRCs operating across six sectors. Nine CRCs currently operate in the medical science and technology sector, and deal with the following areas: Aboriginal health; asthma and airways; biomedical imaging development; cochlear implant and hearing aid innovation; vision; chronic inflammatory diseases; diagnostics; oral health science; and vaccine technology. The average funding per annum for medical science and technology CRC’s is $3 million (ranging from $1.9 million – $4.6 million). The total funding over the seven year grant period for these CRC’s is $189.3 million (CRC Programme, 2006b).

Across the nine funding rounds in the medical science and technology sector, the percentage of CRC funding as a proportion of the total was 21.1 percent (CRC funding $379.7 million; total funding $1,796.9 million).

The Australian Government awards between $20 million to $40 million in funding to CRCs over a seven year period.

The economic impact of the CRC programme was recently assessed (Insight Economics, 2006), and key findings from the study found that, for each dollar invested in the CRC Programme (rather than left with taxpayers), Australian gross domestic product is cumulatively $1.16 higher than it would otherwise have been, total Australian consumption is $1.24 higher than it would otherwise have been, and total investment is $0.19 higher than it would otherwise have been.
Peer review of grant applications is a strong feature in Australia’s health and medical research system. Health research funding agencies that use peer review include NHMRC, ARC, the Heart Foundation, and Cancer Council Australia.

Each year, the NHMRC establishes grant review panels (GRPs), which are panels of experts that are responsible for the review and ranking of NHMRC grant applications. Project grant applicants are reviewed by two GRP spokespersons and one external assessor for scientific content only.

Researchers who are currently receiving NHMRC funding are required to nominate GRP members. GRPs must take into account the following assessment criteria while reviewing project grant applications: significance and innovation; scientific quality; and track record in relation to opportunity. This is similar to criteria used in other funding agencies, such as the Heart Foundation. Other types of grants may have slightly different assessment criteria. For example, Program Grant applicants, which typically receive funding for five years, are

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16 The NHMRC does not require expression of interest or a notification of intent to apply. However, when it is not clear whether an application is more appropriately considered by the NHMRC or the ARC, applicants may submit a two-page summary outlining the proposal to the NHMRC, which is assessed with representatives from both organisations.
also assessed on the cohesiveness of the team and potential for collaborative gain, and may be interviewed by the GRP.

Recommendations from these panels are then considered and endorsed by a Projects Grant Working Group. The selected field of research is the primary source of information for the allocation of applications to a working group. The chairs and deputy chairs of the Project Grant Working Group meet to review the allocation of applications and ensure that the required expertise is present in each group to ensure all applications receive a fair and equitable review.

After the review of an application, the GRP nominates, by secret ballot, a category in which the application is to be placed. The Research Committee determines the applications that are to be funded using the categories provided by the GRP. GRP members also have the opportunity to provide advice on emerging research developments.

Applications relating to Aboriginal and Torres Strait Islander (ATSI) health or involving a clinical trial are subject to additional review by the Indigenous Health Panel and the Large Scale Clinical Trials Committee, respectively. Applicants are provided with the opportunity to respond to external assessment and GRP questions. GRPs and the Project Grant Working Group will determine budgets and make recommendations. In some cases if an application is recommended for funding, a GRP will determine the duration of the grant. The minister will determine the number of grants funded and the level of funding allocated to a grant.

The majority of funding under the NCGP, administered through the ARC, is allocated on the basis of peer review. Peer reviewers play complementary roles through membership of the ACR College of Experts, or as Australian-based readers assigned a batch of applications to rank (OZREADERS), or as expert assessors of international standing (INTREADERS).

The ARC College of Experts is a college of Australian and international experts that assess and rank proposals against selection criteria (significance and innovation, approach, national benefit, and researcher track record), and make funding recommendations and provide strategic advice to the ARC on emerging disciplines and cross-disciplinary developments. The ARC College of Experts currently comprises 77 members, and nominations are invited from universities and other institutions each year. Members are selected on the basis of attributes including excellence in research, broad disciplinary expertise, professional and academic standing, and relevant experience in industry or public-sector organisations.

OZREADERS read and rank up to 20 applications. OZREADERS databases are developed and revised for each of the six discipline clusters at the ARC. OZREADERS must demonstrate strong research performance, evidence of good assessor performance, relevant disciplinary expertise and standing, and evidence of ability to support the research of others.

INTREADERS are expert advisors who are invited to assess specific applications under Discovery Projects and Linkage Projects, on the basis of the match of their expertise to the research project or fellowship for which ARC funding is requested. Chosen for specialist knowledge and high research reputation, INTREADERS are asked to assess applications in the context of international research and benchmarks.
Numerous types of funding support are available to support Australian health and medical research. Typically, funding agencies publish funding policy documents associated with each grants scheme to outline the types of costs which are supported and grant administration requirements. An explanation on funding support is provided for the NHMRC Projects Grants Scheme, which is the NHMRC’s main avenue of support for individuals and teams of researchers undertaking biomedical, clinical, public health, or health services research in Australian universities, medical schools, hospitals, or other research institutes.

Although a project grant specifies financial support for individual researchers working on a specified topic, the institution is responsible for administration of the award and accepts financial responsibility for the grant. The institution is also responsible for providing basic infrastructure support to those involved in the research project. The NHMRC does not fully fund the total cost of research and pays only the marginal direct costs of research. Funds to support personnel are provided as personnel support packages that are designed to cover all salary and salary on-costs as well as some additional support for minor operational maintenance. The NHMRC also covers some equipment costs and direct research costs, but research infrastructure is not funded through its Projects Grants Scheme (or through the Australian Fellowship package).

The NHMRC provides funding annually for overhead infrastructure costs. No formal application is required for Infrastructure Grants but independent medical research institutes are only eligible if they are NHMRC accredited. Equipment Grants and Independent Medical Research Institute Grants are calculated by allocating funds pro rata to the NHMRC health and medical research grants held by a certain institution in a particular funding year. The Commonwealth Government provides Research
Infrastructure Block Grant to each university as a contribution towards infrastructure used by projects that are funded by Australian Competitive Grants (e.g. ARC and NHMRC). Each eligible high education organisation’s Research Infrastructure Block Grant amount is determined on the basis of its relative success in attracting research income from competitive funding schemes listed on the Australian Competitive Grants Register.17

Funding for a project grant will not commence until all relevant ethical and other approvals and licenses (such as a license for the use of excess embryos from assisted reproductive technology) have been received from the relevant bodies and lodged with the administrating institution’s research office. Provisional approvals are not acceptable. There are also areas for which special care, principles, or guidelines need to be considered, including use of personal information, administration of drugs to humans, ethical implications of human research, health research involving ATSI Australians, animal research, genetic manipulation, human embryo research, use of carcinogenic or highly toxic chemicals, and the use of datasets for research purpose.

Australia has made an impressive global impact in health and medical research. The NHMRC recently published a booklet that showcased some outstanding research achievements. Successes range from stem-cell transplants to cure leukaemia, targeting asthma and allergy, disease gene screening for haemochromatosis and prevention, diabetes self-management in Aboriginal communities, gene therapy to correct blindness, and imaging to improve diagnosis of brain infections. Khachigian identifies the following outstanding successes in Australian translational health and medical research: Frazer’s cervical cancer vaccine; Cade’s use of lithium for treating bipolar disorder; Clark’s bionic ear technology; and Marshall and Warren’s unravelling of the role of Helicobacter pylori in peptic ulcer (Khachigian, 2006). In addition, Australian researchers have been awarded six Nobel prizes in physiology or medicine.

The NHMRC has also published a Performance Measurement Report, which reports against their performance in 2000–2003 (NHMRC, 2003). The report demonstrated that “Australia’s quality researchers are achieving high-impact international standard research outcomes and that the NHMRC provides a vital and significant link to these achievements through the provision of relevant funding programs, effective advice and world-class ethical research standards” (NHMRC, 2003). The NHMRC also reports against indicators in their Performance Management Framework.
In September 2004, the NHMRC council approved the 2003–2006 Performance Management Framework (PMF) that aligns with the seven outcomes of the 2003–2006 strategic plan. The PMF is a management tool which links the strategic plan and the NHMRC’s legislative objectives to an outcome–output framework. The framework emphasises what the NHMRC produces (outputs) and what impacts or consequences (outcomes) this has for the community.

The NHMRC has recently published their new strategic plan for 2007–2009 (NHMRC, 2007), and although the PMF will be revised to align with the five objectives outlined in this new plan, this has not yet been published.

The PMF is an update of the original that was built on the conceptual research outcomes framework agreed to by the government after the 1999 Health and Medical Research Strategic Review. In 2002, the PMF was expanded by council to include indicators of performance in the health advisory and health ethics role.

The PMF is integral to the NHMRC’s planning and reporting processes and has three main purposes:

- To assist and inform the NHMRC internal business processes, including the development of business plans and the NHMRC’s strategic plan;
- To demonstrate a return on investment in health and medical research funding; and
- To utilise a range of reporting strategies informing both the Australian Government and the Australian community on NHMRC’s performance in meeting its strategic objectives and legislative requirements.
The indicators and measures have been chosen on the basis that they are appropriate, achievable, and proportionate to the scale of the activity, and have been developed to:

- Include a balance of inputs, processes, outputs and outcomes;
- Highlight the synergies between research, health advice, health ethics, and embryo research regulation;
- Provide a baseline comparing data overtime; and
- Address existing gaps that currently inhibit our ability to full demonstrate the impacts that NHMRC-funded activities provide.
To maximise the benefits from research, findings need to be disseminated as broadly as possible to allow access by other researchers and the wider community. The NHMRC encourages researchers to consider the benefits of depositing their data and any publications arising from a research project in an appropriate subject or institutional repository wherever such a repository is available. Published health research findings from NHMRC-sponsored researchers are cited in national and international journals at more than twice the national and world averages for all other health research publications (NHMRC, 2003).

A recent NHMRC analysis found that 73 percent of their funded award holders had undertaken activities to promote awareness of the scientific results arising from their research. Activities included presentations at conferences, speaker/addresses, poster displays, public presentations, key note addresses, and open days (NHMRC, 2006b). Furthermore, 27 percent of these researchers attracted media attention. For each grant that attracted media attention, there was an average of 8.6 media features either in newspapers, magazines, radio, television, or other media during 1999–2004. Four percent attracted international media attention. Publications arising from these funded awards included books, book chapters, and journal articles. A previous study concluded that two-thirds of journal publications resulting from a three-year NHMRC grant have been published or are in press by the end of the grant period (Butler and Biglia, 2001).

The effectiveness of research can also be measured by how well it is translated into health policy and clinical practice. The NHMRC provides a vital role in this process through its requirements to provide authoritative, timely, and effective advice that bridges the gap between research and policy and practice. The Performance Measurement Report 2000–2003 found that the NHMRC:

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**Dissemination of Scientific Results**

![Graph showing dissemination of scientific results](source: NHMRC [2003])

<table>
<thead>
<tr>
<th>Unit type</th>
<th>Number of awards</th>
<th>Total budget (M)</th>
<th>Number of publications</th>
<th>Output per grant</th>
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<tr>
<td>Strategic Awards</td>
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<td>$3.7</td>
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<td><strong>Grant Total</strong></td>
<td><strong>400</strong></td>
<td><strong>$168.3</strong></td>
<td><strong>4215</strong></td>
<td><strong>10.5</strong></td>
</tr>
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</table>

Source: NHMRC (2003)
- Produced or is developing 51 health advisory reports, many of them aimed at translating clinical research into practice.

- Collaborated with external guideline developers and agencies, including developing 14 health advisory reports and manuals that address vital health, social, and environmental matters.

- Consulted widely within the Australian community and with Australian state and territory government agencies. For example, the NHMRC received nearly 150 submissions on health advice and guidelines being developed by the NHMRC.

- Established two expert committees to produce timely advice for government and government agencies on matters of national importance: Special Expert Committee on Transmissible Spongiform Encephalopathies, and Expert Advisory Group on Antimicrobial Resistance.

Since 2003, the NHMRC has also set up another expert advisory committee, the Gene and Related Therapies Research Advisory Panel. This panel assists the Human Research Ethics Committees and researchers in the assessment of research proposals involving human somatic cell gene therapy and related issues, including stem-cell research and xenotransplantation.
A recent analysis of NHMRC-funded awards showed that 53 percent had involved national collaborations and 46 percent had involved international collaborations, which both exceed the PMF targets of 40 percent and 30 percent, respectively (NHMRC, 2006b).

The top three types of international collaborators include academic institutions (51 percent), medical research institutes (13 percent), and industry (13 percent). Other types of international collaborators include federal government policy makers, international bodies (WHO, etc.), government research funding, philanthropic funding organisations, consumer or patient groups, and non-governmental organisations.

The top three types of national collaborators include academic institutions (36 percent), medical research institutes (19 percent), and hospitals and health centres (8 percent). Other types of national collaborators include government research funding, federal government policy makers, philanthropic funding organisations, clinicians, CRCs, non-governmental organisations, state government policymakers, professional bodies, and consumer or patient support groups.
Commercialisation

Commercial actions arising from NHMRC-funded awards

- Patents assigned or licensed
- Interest from commercial party
- Development of therapeutic value
- Commercial potential still being tested or explored
- Joint ventured with commercial interests
- Start up company formed
- Interest from institutions commercial arm
- Development of scientific service(s)
- Successful clinical trials
- Knowledge gained use to support patent application
- Revenue generated from royalties
- Sales in products and therapies

28% (111/400) end of grant reports received for NHMRC funded awards that ended in 2004 had results with commercial potential

The NHMRC has no direct function in the commercialisation of discoveries and their policy is to leave the management of intellectual property to the research institution. Nonetheless, the NHMRC has increasingly supported research that demonstrates commercial potential. The 2000–2003 Performance Measurement Report examines the commercial performance of Australia’s health research (NHMRC, 2003), outlines the NHMRC’s contribution to it and presents several snapshots of commercial outcomes from NHMRC-sponsored research, including the following:

- The Industry Fellowship Scheme has allowed Australian researchers to work directly with industry in the commercial application of research findings. Commencing from 2002, $5 million has been invested in 15 four-year fellowships.

- The Development Grants Scheme provides funding for research commercialisation at the early proof-of-concept stage. $12 million has been invested in 37 awards in 2000–2003.

- The 2002 National Survey of Research Commercialisation demonstrated the potential economic benefits to Australia of the NHMRC funding programmes, such as generating start-up companies and achieving a return of over 30 percent on NHMRC research investment through income for medical research institutes from commercial license options and assignment activity.

A more recent analysis of NHMRC funded awards showed that 28 percent had results with commercial potential (18 out of 19 developmental grants answered ‘yes’ to...
commercial potential). There were a range of commercial actions arising from NHMRC-funded research, and the top three actions were patents assigned or licensed, interest from commercial party and development of therapeutic value. The analysis also found that 41 percent (total 400) agreed that their research is likely to lead to future commercial outcomes (NHMRC, 2006b). Twenty-three percent of chief investigators reported that their research award resulted in the development of intellectual property, such as patents, copyrights, and a trade mark (NHMRC, 2006b).

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18 Some respondents selected more than one option.
Developing Research Capacity and Resources within Australia

The NHMRC has reformed its funding schemes to attract and retain Australia’s researcher by providing:

- Research opportunities of greater scope, scale, and duration
- A wide range of research career development opportunities
- Opportunities for public health and clinician practitioners to develop a research career
- Increased and improved researcher support packages
- Enhanced researcher mobility

In Australia, opportunities are provided to graduates to consider health and medical research as a career and diverse training and career development opportunities are available for the current workforce. The NHMRC is taking a strategic approach to building capacity in areas that have historically been underdeveloped or where there are gaps in our research knowledge.

NHMRC awards support researchers at different career stages. The Performance Measurement Report 2000–2003 states there are 3700 full-time and 850 part-time researchers and research staff in Australia, including nearly 650 Ph.D. students (NHMRC, 2003). The Grant review estimated there were 15,000 highly trained health and medical researchers in Australia (Grant, 2004). The report also states that more than $55 million will be invested by the NHMRC in people over the triennium; over $100 million for the careers development of young and mid-career postdoctoral researchers.

The NHMRC has also successfully launched a number of initiatives to encourage the best and most productive researchers to remain in Australia. For example, re-shaping of the Research Fellowship Scheme resulted in the number of NHMRC fellows increasing from 150 to nearly 230. $8.5 million has been invested in funding schemes that have resulted in the return to Australia of at least 28 early career or eminent scientists.

Research training and workforce issues that arose in the analysis of 400 end-of-grant reports (NHMRC, 2006b) received for NHMRC-funded awards that ended in 2004 were as follows:

- 85 percent indicated that either postgraduate students or postdoctoral researchers contributed to their research. This equated to 737 postgraduate students and 562 postdoctoral researchers.
• 493 associated high degree completions were reported. 364 higher degree students with degree not yet awarded were also associated with these grants.

• 52 percent of reports indicated that postgraduate or postdoctoral researchers have been attracted to the institutions (total 333; 143 from within Australia, 121 from overseas, and 69 not specified).

• At least 27 Australian researchers who were working overseas have returned to Australia as a result of these 400 awards.

The NHMRC has built capacity in previously underdeveloped areas of health research including population health and clinical, primary, and community health. Targeted investment in clinical research is up from just $3.3 million in 2000 to nearly $30 million in 2003, whereas population health research in Australia has benefited from an $11 million dollar investment over five years.

The NHMRC has made a strategic investment in areas of Australian health that are underdeveloped and for which gaps in knowledge exist, such as Indigenous health, aging, palliative care, and oral health. More recently, the NHMRC has funded research involving stem cells. The total funding allocated for all stem-cell research in 2005 was more than $39 million.

Through its Enabling Grant Scheme, the NHMRC has provided vital support to facilities and services of national importance, such as the Clinical Trials Centre, Twins Register, Brains Banks, National Non-human Primate Facility, and the Australian Genome Research Facility.

More recently, the NHMRC committed $1.5 million to develop the Australian and New Zealand Clinical Trials Registry.¹⁹ This registry is a national online registry of all types of clinical trials being undertaken in Australia and New Zealand, and aims to increase the efficacy of the current clinical trial effort.

¹⁹ See Australian Clinical Trials Registry Web site: www.actr.org.au (as of May 3, 2007).
### Australia’s National Health Issues

- Arthritis and musculoskeletal conditions
- Asthma
- Cancer and cancer prevention
- Cardiovascular health
- Diabetes
- Health workforce
- Human influenza pandemic
- Indigenous health
- Injury prevention
- Mental illness
- Stem cell research
- Water quality

The Australian Government has identified the following as national health issues (NHMRC, 2007): arthritis and musculoskeletal conditions, asthma, cancer and cancer prevention, cardiovascular health, diabetes, health workforce, human influenza pandemic, Indigenous health, mental illness, stem-cell research, and water quality. As an exemplar, a brief description is provided for Indigenous health.

The health status of Indigenous Australians has been recognised as being among the poorest in the country. A recent report found that across virtually all the twelve headline indicators (e.g. life expectancy, disability and chronic disease), wide gaps remain in outcomes between Indigenous and non-Indigenous Australians. For example the life expectancy of Indigenous people is estimated to be around 17 years lower than that for the total Australian population (SCRGSP, 2007). Research funding aims to tackle health inequities in ATSI communities, with a focus on prevention, delivery of care, and governance, and considers social, cultural, and economic factors that contribute strongly to the health of individuals and communities. The NHMRC ensures it achieves five percent funding from the Medical Research Endowment Account for research relevant to Indigenous people (NHMRC, 2007). In 2005, the NHMRC committed a total of $48.3 million to 57 new research grants for up to five years that described projects of relevance to ATSI health (NHMRC, 2006a).

In addition to the national health issues, there are also current issues that have recently been identified by the NHMRC, and which are likely to be the subject of ongoing
consideration by governments, non-government organisations, research organisations, and the community in 2007–2009 (NHMRC, 2007). These include effective health care, obesity, complementary and alternative medicines, depression, dementia and addiction, and social and environmental effects on health. A brief discussion for three of these issues is provided below.

- **Obesity** is a serious and growing national health concern and an increasing burden on Australia’s health-care system (and worldwide). The most recent nationally representative estimate for the prevalence of overweight and obesity in Australia was 20 percent (Asia Pacific Cohort Studies Collaboration, 2007). The NHMRC have recognised there is a strong need to examine the key risk factors that lead to obesity (NHMRC, 2007), and actively pursue opportunities to provide the scientific support for holistic national strategies to reduce the individual and community health burdens. Obesity prevention and treatment will be a major focus for the NHMRC over the next triennium to support a comprehensive national strategy.

- **Complementary and alternative medicines**—One in two Australians regularly uses complementary or alternative medicines, with Australians spending more on these types of medicines than prescription drugs (NHMRC, 2007). During the triennium, the NHMRC will initiate new approaches to research and the provision of evidence-based advice in complementary therapies. A recent Australian study suggested there was a need to examine regulatory requirements concerning the provision of product information with complementary medicines in Australia and to implement mechanisms for increasing consumer awareness of regulatory procedures for these medicines (Semple et al., 2006).

- **Depression, dementia, and addiction**—These are major health issues that, over recent years, have reached increasing prominence. There is national interest in depression (e.g. the establishment of “Beyond Blue” and other initiatives), dementia (in an aging population), and addiction (including to newer recreational drugs) (NHMRC, 1997). During the triennium, the NHMRC will target research to develop the evidence base in this area.
In addition to the current issues, the NHMRC have also identified several emerging health research issues that will be considered over the current triennium. These include genetic testing, health disasters, water quality, regenerative medicine, public confidence in research, nanotechnology, new food technologies, and global health (NHMRC, 2007). The NHMRC will direct its research activities and advice to inform government and community consideration of these issues. An explanation of some of these emerging issues is provided:

- **Genetic testing**—The rapid growth in knowledge about human genetics has led to the possibility of widespread introduction of genetic testing in medicine and in everyday life. The NHMRC identified major issues that will be addressed during the triennium, including: (1) the need for new guidelines and standards (e.g. disclosure of genetic information, ethical aspects of genetic testing, and genetic registers); (2) ethical issues; (3) implications for business; and (4) the possibilities of individualised medicine (e.g. pharmacogenetics, nutrigenetics, etc.) (NHMRC, 2007).

- **Public confidence in research**—Recently, public confidence in research has been put at risk through events such as failures in clinical trials in the United Kingdom (e.g. the TGN1415/CD28-SuperMAB phase I trial), reports of ethical transgressions in Australia, and fraudulent stem-cell research in Korea. To distil public confidence, research must maintain the highest possible standards and transparency. The NHMRC stated they will continue to strengthen ethical oversight in Australian health and medical research and promote high standards by, for example, external, transparent review of all our processes and achievements; timely reviews in instances in which ethical guidelines have been breached in the
conducit of health and medical research in Australia; better coordination and surveillance of human experimentation; a strong code against research misconduct and fraud; a coordinated national approach to multicentre research; diligent and transparent regulation of stem-cell research; and educational initiatives (NHMRC, 1997).

- **Nanotechnology**—New nanotechnologies are ready to transform many aspects of manufacturing, and provide many advances in health diagnostics and treatments (NHMRC, 1997). Nanotechnology Australia is a virtual hub, which aims to bring together researchers and industry to foster, promote, and develop areas of nanotechnology and nanoscience. The hub also provides, for example, information on research, industry, and government activities and national and international project funding information and conference information.

Dealing with these issues successfully will involve cooperation and effort from all sectors of the Australian community, including governments, the private sector, research sector, non-governmental organisations including professional colleges, and the community. The NHMRC produces a newsletter to readers informed of current and emerging issues in the field in the field of health and research.\(^\text{20}\) The Royal Society of New Zealand also publishes a weekly science alert and daily science news.\(^\text{21}\)

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\(^\text{21}\) Royal Society of New Zealand: http://www.rsnz.org/events/ (as of May 3, 2007).


