House of Representatives Standing Committee on Science and Innovation

INQUIRY: Pathways to technological innovation

The House of Representatives Standing Committee on Science and Innovation (the Committee) is conducting an inquiry into pathways to technological innovation. The inquiry has been referred by the Australian Government Minister for Education, Science and Training, the Hon Brendan Nelson, MP.

By letter dated 23 March 2005, the Committee invited the National Health and Medical Research Council (NHMRC) to provide its views on matters relating to the above topic. The NHMRC forwards the following submission in response to that invitation.

Background

The NHMRC, established in 1936 and operating under its own *National Health and Medical Research Council Act 1992,* is Australia's principal health and medical research funding body with responsibility for fostering scientific excellence and knowledge creation in disciplines relevant to human health in order to contribute to improved individual and public health outcomes.

In responding to this inquiry, the NHMRC has focused on technological innovation and commercialisation in the sphere of health and medical research, including the issue of translational research. While commercialisation is an important mechanism for research outcomes, particularly in the pharmaceutical and devices sectors, NHMRC also has a key responsibility to facilitate better health, by encouraging translation of outcomes generated by health policy and practice focused research into health benefits.

Arguably, all NHMRC funded research is required to be innovative, with applications displaying such characteristics being scored more favourably by grants review panels. Additionally when considering applications for funding, the NHMRC's major schemes, the Project Grants Scheme and the Program Grants scheme, allocate scores for intellectual property developments under the scoring category of an applicant's record of research achievement, and in the case of Program Grants, scores for commercialisation activities as well. However, there are other NHMRC programs that specifically target innovative research with a focus on commercialisation potential, or have a weighting in their selection criteria that significantly advantages applications that target innovation and commercialisation.

The NHMRC has long-established links with scientific experts in the health and medical research field, and in compiling this submission, sought the views of leading researchers appointed to Council or NHMRC's Research Committee, with a background in technological innovation and commercialisation.

Innovation, Commercialisation and the NHMRC

A range of complex, multi-faceted issues are associated with innovation and the commercialisation of research. Further, these issues continually evolve, requiring re-evaluation on a regular basis.

Technological advantage is clearly a threshold issue that enhances the likelihood of success. According to the *Investment Review of Health and Medical Research 2004*[1] (the Grant Review), Australia has three identified areas of technological advantage, agriculture, mining and health and medical research. Over the last forty years, health and medical research within Australia is estimated to have created benefits in longevity and quality of life of over $5000 billion[2]. Additionally, this is an area of growing demand and rapid innovation that is attracting investment by governments, industry and financial investors around the world. For these reasons, commercialisation of health and medical research has been identified by a number of reviews[3, 1] as at least important a reason for Government to invest in health and health and medical research. State and Territory Governments, especially Queensland, New South Wales and Victoria, have also recognised the benefits of investing in such research.

A key function of Australia's peak health and medical research body is to ensure that the best possible outcomes are realised from the Australian Government's investment in health and medical research. This includes the establishment of an environment in which research can be commercialised, with the returns accruing to the Australian economy as appropriate.

1998 Investment Review of Health and Medical Research

In 1998, the Government commissioned the *Investment Review of Health and Medical Research* (the Wills Review)[3], which articulated a vision for the health and medical research sector and an implementation plan by which it was to be achieved. This vision comprised four distinct elements, one of which related directly to innovation and commercialisation. The Wills Review provided advice and direction to the NHMRC in relation to the maximisation of opportunities relating to innovation and commercialisation[4].

Following the NHMRC's separation from the Department of Health and Ageing and the appointment of a CEO, the NHMRC responded to the Wills Review by developing new programs and re-shaping existing programs to address the issues it raised. In 2004, the *Investment Review of Health and Medical Research* (the Grant Review)[1] examined how well the NHMRC had performed in implementing the recommendations of the Wills Review.

In a comment concerning the NHMRC's performance, the report states "....many of the specific recommendations from the Wills Review have been implemented, and overall there has been a significant improvement in NHMRC performance from the perspective of the research community".

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[1] *Sustaining The Virtuous Cycle For a Healthy, Competitive Australia Final Report*
Investment Review of Health and Medical Research December 2004

[2] Both as a direct result of new therapies, as well as technologies leading to shorter bed days and decreasing morbidity as a result of population health initiatives.

[3] *The Virtuous Cycle Working together for health and medical research*
Health and Medical Research Strategic Review 1999

[4] It is important to recognise that a proportion of the research funding by the NHMRC, while contributing to the economy through improved health outcomes and/or reduced health care costs, has no immediate commercial outcome. This is, for example, the case with much of the population health research funded by the NHMRC.

Below is a brief summary of each of the NHMRC programs that have fostered examples of outstandingly successful grants / awards that demonstrate innovation and commercialisation potential:

PART 1 - NHMRC SCHEMES

1. The NHMRC Development Grants scheme

Established in response to the Wills Review, Development Grants provide funding for research commercialisation at the early proof-of-concept stage. While it is not a requirement that applicants have a commercial partner in place at the time of application, this is strongly encouraged.

The scheme is not intended to be an alternative to the NHMRC Project Grants scheme (see below), nor is it meant to be an alternative to industry development schemes. Rather the scheme is pitched at the perceived funding gap between the end of a high quality basic research program and the developments required to make the project commercially attractive to potential investors.

Applications must demonstrate a basic understanding of the process and steps to move from research to outcomes with commercialisation potential, including;

- the process and steps to a market, the nature of the market;
- the milestones and risks of the venture; and
- an understanding of possible means of handling intellectual property connected with the project.

Development Grants are normally awarded for a period of one year, but are extendable, subject to existing milestones being met. The grant request will usually not exceed $200,000 per annum, unless there are exceptional circumstances. Peer review is conducted by the Development Grants Assessment Panel.

Applications for Development Grants are currently called twice a year.

The Development Grants Scheme is currently being evaluated, following the final report of *the Investment Review of Health and Medical Research 2004*[1].

Examples of some outstanding Development Grants are provided at Attachment A.

2. The NHMRC Industry Fellowships scheme

Industry Fellowships were established to develop the commercialisation skills available to researchers. The objectives of the scheme are to:

- Provide a vehicle for Australian researchers to gain experience in industrial research including project planning, business planning, and knowledge of business and industry dynamics, and
- Increase knowledge of the commercial aspects of R&D within research institutions.

Industry Fellowships target researchers with a track record of research excellence and commercial interest to spend up to two years in industry (in Australia or overseas), followed by 2 years at a research institution in Australia. Up to ten of these four year fellowships may

be awarded annually, determined by the scientific and commercial merits of the applications. The amount offered in support of the Fellowships is $88,750 per annum. The industry partner is not required to contribute salary but to provide support for research activity during the placement.

The scheme could be usefully extended to support fellows gaining direct clinical trial research experience, experience in clinical biostatistics and drug safety evaluation, toxicological pharmacology, pharmacogenomics research and assay or enabling technology development research.

There have been widely fluctuating application numbers and success rates eg. in 2002 there were 11 applications, with 5 successful. In 2003 it was 23 applications and 8 successful, and in 2004 there were 10 applications and 4 were successful. There is a perception by potential applicants and industry that the scheme is not achieving its objectives, is not widely-known in the research community and that researchers do not understand the function of the scheme.

In particular, the scheme is perceived to be inflexible in the "two years in Industry, two years at the academic research institution" requirement. This proves unattractive for both applicants and industry partners. The current scheme also appears to provide a narrow focus in regard to industry partners, so that there are only a limited range of industries represented in the applications for these Fellowships.

The NHMRC is currently considering a range of recommendations to revise the scheme, and enhance its scope to make the Fellowships more flexible, thereby attracting more applicants and a wider range of industry partners.

Examples of some outstanding recipients of Industry Fellowships are provided at Attachment B.

The NHMRC Project Grants scheme

The NHMRC Project Grant scheme is the NHMRC's main avenue of support for individuals and small teams of researchers undertaking biomedical, clinical, public health or health services research in Australian universities, medical schools, hospitals or other research institutions.

Despite not specifically targeting commercialisation, NHMRC's Project Grants Scheme has also generated some significant research with commercial application. The fact that patent information relating to applicants is considered as part of their track record may have some influence in funding of Project Grants that realise good commercial outcomes.

Project Grants specifically target innovation, one criterion[5] used for the assessment of Project Grants applications being the significance of the proposed research and whether it is innovative.

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[5] *"The potential to increase knowledge about human health or improve human health by application of new ideas and procedures to important topics".*

For Project Grants commencing in 2005, a total of $185 million was awarded to 416 new research grants.

Examples of completed Project Grants with outstanding innovation and commercialisation features are listed at Attachment C.

Other NHMRC schemes that encourage innovation and commercialisation include:

The NHMRC Program Grants Scheme

The NHMRC Program Funding Scheme aims to provide support for high achieving teams of researchers to pursue broadly based collaborative research activity that contributes new knowledge at a leading international level in important areas of health and medical research. An additional aim of the scheme is to develop novel ideas and approaches. Innovation is therefore a cornerstone of the scheme.

The assessment of Program Grants applications is weighted toward the record of achievement of the nominated Chief Investigators (CIs), with sixty percent of the score being for the Record of Research Achievement (RORA) of the CIs and the remaining forty percent being for the team's Proposed Research, Collaborative Gain, Critical Mass and Cohesiveness. Factors considered and scored by assessment panels under RORA include intellectual property developments and commercialisation activities. Again, through this scheme, the NHMRC encourages researchers with track records in innovation and proven commercial outcomes.

Program Grant funding is typically for five years.

Examples of some outstanding Program Grants are listed at Attachment D.

The Diabetes Vaccine Development Centre

The Diabetes Vaccine Development Centre (the Centre) is a joint initiative of the Juvenile Diabetes Research Foundation International (JDRF) and the Australian Government through the National Health and Medical Research Council (NHMRC).

The Centre is a commercially focused entity that bridges the gap between research and commercial product development. Its mission is to accelerate the development of one or more vaccines that would prevent or delay the progress of early onset diabetes, aiming to have clinical proof of concept in 3-5 years, with the studies conducted to a standard acceptable to regulatory agencies and an eventual industrial partner.

The DVDC is currently close to finalising two contracts towards the development of a diabetes vaccine for juvenile diabetes, and a further contract is in an earlier development stage. The DVDC also called for Expressions of Interest in August 2004, but at this stage has no plans to make further calls.

PART II - Comments concerning the specific issues nominated by the Committee:

In its call for submissions, the Committee listed a number of specific issues to be addressed. The NHMRC's response, compiled from input provided by current and former members of Council and Research Committee, is as follows:

- **pathways to commercialisation;**

  These are many and varied in the health and medical research sector. Strategies involving licensing agreements with Australian and multi-national biotech companies and the formation of spin off companies are popular and numerous.

  A range of factors is associated with the commercialisation process, including a potentially long time period from the initial research discovery to the current commercial results, the need for many different types of collaborations, not simply one industrial partner, the need for considerable financial resources and strong industry support and expertise.

  Attachment E contains examples of successful commercialisations based on research that has been wholly or partially funded by the NHMRC.

  Two national surveys[6] of research commercialisation provide more detail concerning patenting and licensing of intellectual property arising from research being conducted within Australian universities, publicly funded MRIs and CSIRO. The surveys included information about the formation of start up companies on the basis of that intellectual property.

- **intellectual property (IP) and patents;**

  The above examples are each underpinned by IP and patents. The NHMRC, together with other key stakeholders, participated in developing the *National Principles of Intellectual Property Management for Publicly Funded Research*[7]. The main focus of the National Principles is to assist researchers, research managers and their research institutions, in ensuring that they have access to best practices for the identification, protection and management of IP, and therefore, to maximise the national benefits and returns from public investment in research.

  When providing funding for research, the NHMRC, through its Deeds of Agreement with Administering Institutions, ensures that all such research is conducted in keeping with the *National Principles*. The NHMRC does not seek vesting of intellectual property generated as a result of its funding, in the NHMRC. Instead the NHMRC cedes those rights to those Administering Institutions that receive NHMRC research funding.

  The NHMRC's view is that Administering Institutions, in which intellectual property generated by NHMRC research funding is vested, are best placed to exploit such intellectual property. This is not an entirely altruistic position. Rather, the NHMRC, as a publicly funded institution is best at identifying and supporting research which is

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[6] *National Survey of Research Commercialisation Years 2001 and 2002*
National Survey of Research Commercialisation Years 2000

[7] Can be located on the NHMRC web-site at http://www.nhmrc.gov.au/research/general/ipman.htm

likely to have the most significant impact, whether it is through improved public health outcomes or relevant to the Australian economy

The NHMRC recognises that larger institutions have greater expertise and resources (for example business development offices within universities that are established for the purpose of research commercialisation), expertise which is not resident in the NHMRC secretariat.

In so far as it protects the intellectual property of publicly funded research, and encourages the exploitation of such intellectual property by its Administering Institutions, the NHMRC's approach to intellectual property has similarities with the USA's Bayh-Dole Act[8]. The intent of the Bayh-Dole Act, as it applies to federal funding of research, is to maximise the economic benefits of such funding, by encouraging research funding recipients to take full advantage of the appropriate commercial opportunities.

With funding schemes that clearly promote commercial outcomes, the NHMRC requires that an agreement concerning intellectual property is in place between all parties, prior to commencing any funding, to minimise the chances of disputes between parties once a commercially viable discovery is made.

The NHMRC has identified that there is a need to collect more sophisticated data such as patent applications in Australia and internationally, awarded patents, patents that have been licensed and to whom, and commercial returns from the patents.

- **skills and business knowledge;**

An informed research workforce that is both willing and capable of engaging with the commercial world is essential. However, Research Australia surveys[9] have found that there is a negative perception of commercialisation specifically, and research application generally, among many Australian scientists working at the basic end of the research endeavour, with a need to address this weakness.

The extent to which a research funding body such as the NHMRC as compared to a research undertaking body (for example Medical Research Institutes, Universities) should be responsible for providing such support is however unclear.

- **factors determining success;**

  - A research community that values commercial awareness, entrepreneurial skills and training.
  - Sufficient business and project management skills in the research sector to access appropriate technologies and achieve development milestones in a timely manner.
  - Ensuring entrepreneurship is encouraged and rewarded, and the issue of salary competition from other countries is addressed.
  - It is critical to encourage projects that are based on science of the highest quality. Funding research on such a basis significantly enhances the

[8] The US Bayh-Dole Act (The Patent and Trademark Law Amendments Act)
[9] *Health and Medical Researcher Opinion Poll 2003* Research Australia

likelihood of successful outcomes.

- The availability of enough flexible funding to take the project from the basic stage to the point where it is commercially attractive, without jeopardizing the basic research effort. The goal should be to ensure that both basic and applied research can be done with confidence and vigor.
- The availability of adequate resources and infrastructure for research.
- A clear focus on commercial outcomes when funding research, and dedicated funding to encourage projects driven by scientists who consider providing a return (clinical benefit, job opportunities, investment, export income) on the investment of public funds in medical research to be a core responsibility, rather than a distasteful task to be avoided.
- Support for, and encouragement of, both national and international collaborations and joint ventures. Literature highlights that geographical clusters are particularly effective in promoting innovative activities.
- A tax environment that encourages investment in research and development.
- Strategies to address the limited availability of venture capital.
- Strong and effective industry / research links that improve Australian industry's responsiveness to the opportunities inherent in commercial innovations.
- An appropriate balance being maintained between Australia's ethical standards and the requirements for health and medical research. For example, the needs of researchers requiring appropriate access to current "raw materials" for health and medical research such as stem cell material and the data of individuals, as against the need for ethical standards and government regulation.

At an institutional level, the Institute of Molecular Biosciences (IMB) at the University of Queensland (which receives considerable NHMRC funding) has the most innovative approach to commercialisation and engagement with their stakeholders. Their infrastructure allocation from the Queensland State government is tied to Key Performance Indicators set by State Treasury. IMB reviews its staff annually and commercial activity is measured and valued. IMB Com, the commercial arm of the IMB, has 12 staff for an Institute of 500 or so staff, and pro-actively focuses the scientists on the need to commercialise their research outputs.

The NHMRC suggests that Professor John Mattick, Director, IMB, be invited to provide his expert views concerning this area to the Committee.

➢ **strategies in other countries that may be of instruction to Australia.**

- Collaborations at all levels are important for innovation and commercialisation, and links formed between researchers early in their career path have been found to be particularly resilient and productive longer-term links. A scheme similar to the European Union's (EU) Marie Curie Fellowships but on a smaller scale, might be considered for the Asia Pacific region with a view to growing such relationships between Australian and regional researchers.

Marie Curie Actions - Mobility for Researchers
Under the Framework Programmes, a number of the programmes under the Human

Resources and Mobility (HRM) activity are available to researchers from countries outside the EU. This activity has an annual budget of €1,580 million (approx. AU$2,758 million) and is largely based on the financing of training and mobility activities for researchers. These activities, known as the **Marie Curie Actions**, are aimed at the development and transfer of research competencies, the consolidation and widening of researchers' career prospects, and the promotion of excellence in research. Most of these actions are open to researchers of all ages and nationalities in all fields of scientific and technological research. Eligibility for the various schemes is based on research experience and expertise.

Marie Curie Fellowships
In an effort to enhance networking between researchers, the EU provides Fellowships for researchers coming from third countries, such as Australia, to train in Europe.

Incoming International Fellowships The *Incoming International Fellowships* target experienced researchers from outside the EU who want to move to Europe to take part in research training. Fellows must have at least four years experience and must agree to a work programme with a research organisation in an EU country before applying. The Award is for one to two years duration.

Outgoing International Fellowships
Also available to Australian Research Institutes is the opportunity to employ experienced researchers from Europe on *Outgoing International Fellowships*. These fellowships aim to broaden the international research experience of European researchers by allowing them to spend time at a research centre outside the EU. Typically the researcher will spend one to three years on this fellowship before returning to the EU.

Further information on Marie Curie Actions is available on the following websites:

http://europa.eu.int/comm/research/fp6/mariecurie-actions/action/level_en.html

http://www.cordis.lu/fp6/find-doc.htm

Impediments to technological innovation and commercialisation

When asked to identify issues they viewed as current major potential impediments to technological innovation and commercialisation in the Australian environment, scientific experts with a background in commercialisation associated with the NHMRC nominated the following:

1. The size and strength of the Australian market. The small size of the Australian market limits what can be produced within Australia. Researchers considering potential innovations must often aim to meet the requirements of an international market, which are over and above those of the local market.

2. Lack of knowledge and expertise in translating innovation into a commercial product. For example, business models and expertise for commercialisation that are appropriate for large institutes, may not be useful for smaller organisations.

3. The lack of strong interchange and interaction between individuals in the

research/academic community, the corporate sector and government, along the lines seen in the USA and Scandinavia, where key personnel move freely and frequently from one sector to another. The NHMRC's Development Grants and Industry Fellowships aim to address these issues.

4. Views within the research community
   - There is a negative perception of commercialisation specifically, and research application generally among many Australian scientists working at the basic end of the spectrum. This is also well documented in a researcher opinion poll conducted by Research Australia[9]. There is a lack of desire to take basic discoveries and develop them to the point where they are of interest to the commercial world.

   - There is a perception that insufficient value is placed on commercialisation activities by government funding bodies, compared with efforts in academic scholarship. Altering the balance between how commercialisation is valued in grant assessments relative to publications and citations will affect researchers' behavior.

5. Lack of funding in the initial stages of research and development
   - It is claimed that there is a lack of funds to take basic discoveries and develop them to the point where they are of interest to the commercial world. The funding gap between the conclusion of a successful NHMRC grant and the stage of development now required for big pharmaceutical interest has widened considerably. NHMRC's Development Grants aim to begin to fill this niche, however the quality and number of applications has been disappointing (this may reflect the negative attitude of researchers to commercialisation).
   - Sources of additional funding for patent protection and defence are scarce.
   - Sources of additional funding for academic business development offices are scarce.

6. Lack of funding in later stages of research commercialisation
   - The lack of a major pool of venture capital money, accessible locally, and run by people who tolerate the realities of risk taking in this area.
   - Downstream, the lack of a meaningful capital market and unsophisticated valuation of technology has led, on the one hand to companies inappropriately using Initial Public Offerings (IPOs) as their initial vehicle for raising capital and secondly, to companies that should be at the IPO stage raising small amounts of capital compared to what US companies of a similar ilk can raise from their special high technology share market (NASDAQ).

7. Specifically in relation to clinical research and translation,
   - The absence of appropriately trained clinicians and hospital environments capable of undertaking translational research is a major problem. The public health system is by necessity so service-oriented that the ability to undertake translational research in Australia has largely been lost.
   - The level of funding required for translational clinical trials is very significant, and to a great extent, unavailable from Australian sources.

SUMMARY

- The NHMRC has responsibility for fostering scientific excellence and knowledge creation in disciplines relevant to human health in order to contribute to improved individual and public health outcomes. As a consequence, it seeks a broad range of outcomes from its investment in health and medical research.
- From the NHMRC's perspective, commercialisation is one of several important mechanisms for research outcomes to be translated into better health.
- Through a range of initiatives, the NHMRC is responding to needs that have been identified to advance innovation and commercial outcomes in the health and medical research sector.
- Despite a number of recent commercialisation success stories, it must be noted that there is a long timeframe between initiating programs targeting commercial outcomes and a large scale attainment of such outcomes.
- There still exist a range of multifaceted and complex issues that need to be effectively addressed in order to maximise the opportunities for commercial rewards from health and medical research.

National Health and Medical Research Council
23 May 2005

ATTACHMENT A - Development Grants					
Grant Type	**Title of Grant**	**Chief Investigator A**	**Institution**	**Lay description**	**Significant features relating to innovation and/or commercialisation**
Development	*Targeting protein kinase C in diabetes management using novel polyunsaturated fatty acids*	Professor Antonio Ferrante	University of Adelaide	Researchers demonstrated that it was possible to target specific protein kinase C isozymes using fatty acid mimetics and that engineered fatty acids can be developed as novel therapeutics to control diabetic complications by targeting protein kinase C.Specifically they demonstrated that a novel fatty acid, MP5 is able to supress the ability of glucose to cause kidney damage in rat models of induced diabetes.	Timely use of the funds enabled proof of concept, creation of IP in the form of a patent application, and a licensing agreement to enable further incubation prior to commercial exploitation. It is a good example of translation outcomes from a Development grant, including proof of concept from sound science, to capture IP and a licensing agreement to secure further commercial incubation. The researchers have been successful in licensing to Peplin Biotech (a Queensland based life sciences company) to develop the next level of value before commercialisation. This fast licensing and engagement of an Australian small medium enterprise is a good example of translation of strong basic research. Broader applications of this approach to commercialisation in pharmaceutical / nutriceuticals are to be expected.

Development	*Reducing the Burden of Joint Replacement: An Innovative Biofeedback Device for Post-Surgical Rehabilitation*	Professor Julie Steele	University of Wollongong	Project aims to develop device capable of providing immediate audible feedback with respect to knee motion for enhanced post-knee replacement surgery.	Project is yet to be completed. Current unmet need for such wearable biofeedback devices. Anticipated that the project will lead to intellectual property generation, strengthened partnerships and identification of an industry partner to commercialise the technology.
Development	*RNA Interference in model systems of macular degeneration*	A/Professor Levon Khachigian	University of New South Wales	Exudative age-related macular degeneration (AMD) is the most common cause of irreversible severe vision loss in the elderly. Project will use novel gene-targeting agents to provide preclinical proof of principle evidence of their therapeutic potential in established animal models, pre-empting Phase 1A safety trials in AMD patients	Project is yet to be completed. A safe, specific and effective pharmacologic agent for AMD has enormous therapeutic, social and economic benefits.

Development	*Bronchoprovocation testing in children using mannitol powder aerosols*	A/Professor Hak - Kim Chan	University of Sydney	Asthma costs the health care system $585 to $720 million per year, and is the major cause of childhood hospitalisation and long-term morbidity. A new diagnostic test that involes inhaling a dry powder of mannitol has been developed in Australia, which is not available for young children due to a lack of a suitable delivery system. This project aims to develop a delivery system so that a reliable objective assessment technique of bronchoprovocation testing using inhaled mannitol powders will become available.	Project is yet to be completed. Concept has been validated in vitro, and a prototype device is available at the University of Sydney with a provisional patent being filed. The results produced in this project will be used to optimise the design and refine the further development of the delivery system so that it can become commercially available.

Development	*OPAL immunotherapy for AIDS*	A/Professor Paul Mulvaney	University of Melbourne	Quantum dots, a type of nanocrystal, have been shown to emit light at a very precise wavelength. Quantum dots can be conjugated to a microsphere. One can change the Quantum dot emitted light by changing the surface of the microsphere. This project seeks to exploit this principle to create a new class of ultrasensitive detector which can be used in many sorts of applications such as medical diagnostics and biosensing.	Project is yet to be completed. Potential applications in medical diagnostics and biosensing.
Development	*Development of a serum based test for aggressive prostate cancer*	Professor Gail Risbridger	Monash University	A critical phase in the progression of prostate cancer is the transformation of latent or dormant to aggressive tumours. The project aims to deliver a test utilising the inhibin/activin proteins as surrogate markers of aggressive disease.	Project is yet to be completed. Potential application in serum based testing for aggressive prostate cancer.

Development	*Automated seizure in the newborn*	Professor Paul Colditz	University of Queensland	Newborn babies are at risk of becoming short of oxygen during delivery and sustaining brain damage. Seizures may cause further damage to the brain because they release damaging chemicals or make extra energy demands on the brain that cannot be met. The project proposes to automatically detect and count seizures, building on prior research work concerning fundamental EEG signal processing .	Researchers anticipate that the product will be of major commercial interest.

ATTACHMENT B - Industry Fellowships				
Type of Award	**Name of Researcher**	**Institution**	**Title of project**	**Current status**
Industry Fellowship	Dr Michael Slater	University of Sydney	*The production and marketing of a diagnostic kit to identify the presence and developmental rate of preneoplasia*	Yet to be completed
Industry Fellowship	Dr Paul Egan	Walter & Eliza Hall Institute	*Evaluation of cytokine inhibitors in animal models of rheumatoid arthritis*	Yet to be completed
Industry Fellowship	Dr Karen Vickery	University of Sydney	*Biofilm: Investigation, Monitoring and Control*	Yet to be completed
Industry Fellowship	Dr Michael Rolph	Garvan Institute	*Discovery and validation of therapeutic targets for inflammatory disease using genomic technologies*	Yet to be completed
Industry Fellowship	Dr Geoffrey Dandie	University of Adelaide	*Identification of bioactive molecules associated with the regulation or control of inflammatory bowel disease*	Yet to be completed
Industry Fellowship	Dr Amanda Edgley	Monash University	*Targeting Obesity: manipulating metabolism using genetically modified mice*	Yet to be completed
Industry Fellowship	Dr Kong-Nan Zhao	University of Queensland	*Matching between codon usage and tRNA abundance determines the expression of targeting genes in mammalian cells*	Yet to be completed
Industry Fellowship	Dr Bronwyn Battersby	University of Queensland	*Disarming Deadly Viruses: High Throughput Protease Screening using Massive Peptide Libraries*	Yet to be completed
Industry Fellowship	Dr Christopher Jolly	University of Sydney	*Production of human monoclonal antibodies in vitro*	Yet to be completed
Industry Fellowship	Dr Benjamin Kile	Walter & Eliza Hall Institute	*A phenomic and genomic approach to identifying pharmaceutical targets for the amelioration of hematopoietic deficit*	Yet to be completed
Industry Fellowship	Dr Robert Bischof	University of Melbourne	*Development of antibodies to Il-13 receptor and their preclinical testing in a sheep model for human allergic asthma*	Yet to be completed

ATTACHMENT C - Project Grants					
Grant Type	**Title of Grant**	**Chief Investigator A**	**Institution**	**Lay description**	**Significant features relating to innovation and/or commercialisation**
Project	*Genetic dissection of the biogenesis and function of Type IV fimbriae of Pseudomonas aeroginosa*	Professor John Mattick	University of QLD	Established extracellular DNA is needed for biofilm formation, demonstrated quorum sensing is not required for twitching motility and characterisation of two systems controlling twitching motility including the most complex signal transduction protein yet described.	Research carried out is outstanding in terms of scientific impact, importance to individuals with a health problem, and to biotechnology or pharmaceutical companies. Research has produced three fundamental discoveries that could make major contributions to infectious disease and the discovery of novel antibiotics and anti-biofilm agents. The basic research is likely to contribute to new approaches to biofilm management and identifying antibiotics not detected in conventional bacteriostatic and bacteriocidal
Project	*The vasoprotective actions of flavonoids in ischaemia and hypercholesterolaemia*	A/Professor Owen L Woodman	University of Melbourne	Experiments focused on the ability of flavonols and isoflavones to enhance endothelium-dependent relaxation and the determination of the mechanism of action of that effect.	Work carried out is of outstanding importance to Biotechnology or Pharmaceutical industries. Research has led to formation of a start up company to develop drugs to treat ischaemia.
Project	*The role of dendritic cells in graft-versus-host disease after allogeneic stem cell transplantation .*	Dr Geoffrey R Hill	Queensland Institute of Medical Research	Project was aimed at understanding the mechanisms by which myeloid growth factors inhibit alloreactivity and to further study the effect of FLT-3L based cytokines on graft-versus-host disease.	Research is outstanding in terms of scientific impact, importance to individuals with a health problem, to the community in general, policy makers and health service providers and to biotechnology or pharmaceutical companies. Has enhanced understanding of stem cell mobilization and transplant tolerance, using G-CSF receptor agonist (ProGP-1). Many patents, publications and avenues for new therapies and better health outcomes.

Project	*Diagnosis of brain abscesses by magnetic resonance methods .*	Professor Tania Sorrell	University of Sydney	Magnetic resonance methods for automated, non-invasive diagnosis of focal brain infections	Research carried out is outstanding in terms of scientific impact, importance to individuals with a health problem, and to biotechnology or pharmaceutical companies. Cutting edge technology. One provisional US patent pending.

ATTACHMENT D - Program Grants					
Grant Type	**Title of Grant**	**Chief Investigator A**	**Institution**	**Lay description**	**Significant features relating to innovation and/or commercialisation**
Program 144105	Epilepsy: a collaborative research propgram from genome to patient	Professor Samuel Berkovic	University of Melbourne	Epilepsy: a collaborative research propgram from genome to patient	**International Patent** - Apparatus and method for direct detection of electrical activity of electrically excitable tissues in biological organisms - 30 July 2004 - Inventors: GD Jackson, DF Abbott, JW Prichard: **National Patent** - Apparatus and method for imaging biological tissues - 17 May 2004 - Inventors: GD Jackson
Program 225108	Heart failure and its antecedents: Pathophysiology, prevention and treatment	Professor Garry Jennings	Baker Heart Research Institute	Advanced Cardiac Disease and Heart Failure	**Australian Provisional Patent** - Methods of activating AMP kinase and nitric oxide synthase - 2004 - B Kingwell, D Kemp: **Australian Provisional Patent** - Methods of treatment of cardiovascular disease - 2003 - DM Kaye: **Australian Provisional Patent** - Amino acid analogues - 2003 - DM Kaye, N Ede: **Australian and International (US)** - Treating valve failure - 2004 DM Kaye,JM Power, C Alferness

ATTACHMENT E - Examples of other successful commercialisation based on NHMRC funding				
Grant Type	**Area of research**	**Chief Investigator/s**	**Institution**	**Significant features relating to innovation and/or commercialisation**
Block	IL-13 receptor	Professors Nick Nicola and Doug Hilton	Walter and Eliza Hall Institute	Developed as part of a collaborative research agreement with AMRAD and licensed to Merck. In the last 2 years US$14M of a potential total of US$112M in license fees have flowed back to Australia.
Early research was funded by NHMRC	Human papilloma virus vaccine	Professor Ian Frazer	University of Queensland	International collaboration with gynaecologists from many Brisbane hospitals, and from Wenzhou in China. A possible therapeutic vaccine (CerVax TM16), developed in conjunction with CSL Ltd, an Australian biopharmaceuticals company, has recently completed encouraging Phase I trials. A vaccine therapeutic for genital warts is in early phase clinical trials, and further vaccines targeted at other infectious diseases are in laboratory development, some in conjunction with Coridon Pty Ltd.