Australasian Society for Stem Cell Research Submission to the McKeon Review of Health and Medical Research in Australia

The Australasian Society for Stem Cell Research

The Australasian Society for Stem Cell Research (ASSCR) is the primary society for stem cell researchers and related professionals in Australia and New Zealand, with over 250 members. Australia has an established stem cell research legacy in hematopoietic and cancer stem cells, livestock cloning and regeneration biology, and both countries have growing numbers of scientists involved in stem cell research. The ASSCR has three main objectives:

- To support stem cell research and encourage scientific exchange to promote research within our region, involving networks within the stem cell research community in Australia and New Zealand and worldwide.
- To provide access to information relating to scientific, medical and ethical advances in the broad field of stem cell research with emphasis on communicating to the general public.
- To develop stem cell research and dissemination of information within the Australasian region.

Research conducted by Australian scientists makes a valuable contribution to knowledge about human stem cells and the potential applications of regenerative medicine. Regenerative medicine is the translation of stem cell research and includes therapies to replace or re-grow human cells, tissues or organs for normal function. Publically funded stem cell research groups based in Universities and Institutions are involved in adult and embryonic stem cell research. There are a few private companies developing stem cell research based technologies.

1. Why is it in Australia's interest to have a viable, internationally competitive health and medical research sector?

TOR 1. The need for Australia to build and retain internationally competitive capacity across the research spectrum, from basic discovery research through clinical translation to public health and health services research.

Australian researchers are at the forefront of stem cell research and regenerative medicine. The Australian government has recognised the importance of this sector with a number of initiatives. However, this is an internationally competitive field and there is still a need for Australia to become more competitive to secure our investment in clinical trials, effective translation of new discoveries and for tax-payers to benefit from their investment. Any strategy to invest in this sector needs to involve assessing the future and considering what future society Australians want, what will be the major health issues and how will emerging industries, such as stem cell research, facilitate that future. Such

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strategies need to incorporate economic and social impacts as well as community values. As the development of regenerative medicine requires an inter-disciplinary approach this needs to be integrated into funding programs. Establishing networks for collaboration between researchers, industry and the public, tailors research towards community needs and potentially establish new funding models. So that Australians can take advantage of new discoveries and emerging technologies, public participation is needed during the innovation process.[1]

TOR 6. Strategies to attract, develop and retain a skilled research workforce which is capable of meeting future challenges and opportunities.

The most important resource in science is people. Investment in people should be at the heart of policy to support a medical research sector sustainable for future generations. Many different types of people work in science. They vary in their level of education, training and career trajectory. It takes many years of highly specialized training to develop the expertise and skills to work in laboratories. Scientific knowledge is acquired over decades. It often requires personal, financial sacrifice and supplementation by tax-payer funded grants or other research funds. Therefore, funding strategies need to be long-term to ensure this investment in people is not lost. Currently, the funding process focuses on outputs that may not be indicative of potential benefit. There are few initiatives that focus on an individual, their talents and that of their research team, except for a small percentage of fellowships where individual worth is a minor component. Often, scientific outcomes are not predictable and only eventuate after a long period.

To support the medical research workforce, a holistic approach and commitment is required, with across-government strategies for science in schools, a more creative university environment and diverse, sometimes inter-disciplinary career structures up unto retirement. The sector cannot be sustained until commitment to science and medical research is embedded within most government policies. Currently, funding strategies focus on the various career steps of a medical researcher often resulting in senior researchers not being funded due to the ad-hoc, competitive nature of grant funds. Strategies need to build an environment that provides longer-term support and training for the many different careers that are integral to the medical research sector.

A further strategy to attract a skilled research workforce is to continue and further develop funding strategies for 'blue-sky', basic research. The recently published UK Royal Society report recommends that "sustained investment in curiosity-driven research, is not only fundamental to future scientific discoveries but will attract good medical researchers, provide training for future researchers and be fundamental for our knowledge based society."[2]

The insufficient levels of medical research funding has resulted in an imbalance in the personnel conducting research in Australia, which impacts on how research is being done. For example, over the years, there has developed reliance on PhD students, more than postdoctoral fellows, to perform the experiments necessary to propel the sector.

This is evident in the disparity between the growing number of graduating PhD students and the available number of postdoctoral and subsequent early/mid-career academic

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[1] Newfield C, Chapter 14. in Block F and Keller MR (eds) (2011) State of Innovation: The US Government's Role in Technology Development. Paradigm Publishers, USA.
[2] The Scientific Century: securing our future prosperity. The Royal Society, 2010.

positions.[3]. These career stages are precisely the time in which this highly-skilled workforce can be most productive. In the short-term this structural imbalance is increasing the number of skilled workers available to the Australian economy, which will benefit the community and is a stated aim of the Federal Government[4] . However, if this structural imbalance is not addressed in the mid- to long-term it will result in economic inefficiencies, as highly skilled postdoctoral workers never achieve the full potential economic benefits associated with the community's (and their personal) financial investment in their education. This precise situation has been experienced in other countries and should not be allowed to develop in Australia [5]

Strategies to address this could include:

(i) Increased research funding to provide more research job opportunities for the postdoctoral workforce

(ii) Increased breadth of PhD training to better match career paths: almost half of Australian PhD students plan on non-academic careers.[4] Moreover, it is widely accepted that fewer PhD graduates are becoming employed in academic research and that this trend will continue[3]. As such, there is a growing realization that PhD students need additional skills that will enable them to more effectively integrate into likely career paths (*e.g*., industry, government, ethics, policy/politics, journalism, law). However, the need to retain quality research training means that the current three- to four-year maximal PhD scholarship funding places limitations on the breadth of training a PhD student can obtain. Extension of PhD scholarships to four years would allow time for six months additional training in skill sets desired by, and relevant to employers in biotechnology and clinical settings. These additional skills could include: bookkeeping/accounting (*e.g*., budget forecasting, stocktaking, financial projections); communication (*e.g*., people management, writing, marketing styles, negotiation techniques, emotional intelligence, networking techniques, media interactions); policy development (*e.g*., commercial policy development pipeline, government policy development pipeline, labour market principles); and education (*e.g*., education methodologies, mentoring, entrepreneurship). Importantly, these additional skills are highly relevant to both non-academic and academic career paths alike, and would therefore increase individual job efficiency in all sectors. This additional vocational training would also accelerate cross-sector interaction between academia, industry, government and the clinic by providing a common understanding of the requirements of each sector.

(iii) Inter-disciplinary courses offered within undergraduate science degrees.

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[3] Nature (2011) 472, 259-260

[4] Regenerating the Academic Workforce, ACER Edwards, Bexley, Richardson

[5] OECD: Japan Science and Technology Labour Markets: Changes in the Science and Technology Labour Market and its Future: Are There Too Many PhD Graduates?

2. How might health and medical research be best managed and funded in Australia?

TOR 2. Current expenditure on, and support for, health and medical research in Australia by governments at all levels, industry, non-government organisations and philanthropy; including relevant comparisons internationally.

Government funding for stem cell research in Australia
The majority of stem cell researchers compete for Australian Government funding through Government agencies, the National Health and Medical Research Council (NHMRC) and Australian Research Council (ARC). A few Australian government initiatives have been specifically targeted for stem cell research. A Biotechnology Centre of Excellence funded the Australian Stem Cell Centre ($120 million) from 2003 to June 2011. A National Adult Stem Cell Research Centre at Griffith University was established with funding of $20 million over four years. More recently, the ARC funded a consortium of researchers ($21 million) called Stem Cells Australia for seven years. This consortium includes around eight Australia-wide Universities, Institutes and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Funding ($155 million) from the Australian and Victorian government and Monash University set up a joint initiative between European Molecular Biology Laboratories (EMBL) and Australia, providing a further network between four universities and the CSIRO.

There has also been State government funding for stem cell research. The New South Wales government provided one-off funding for collaborators to develop research into generating novel human stem cell lines. More recently, the California Institute of Regenerative Medicine linked with the Victorian State government to establish collaborations between research groups based in California and Victoria. The Victorian government funds the Victorian based partners.

Worldwide, regenerative medicine has had significant public funding and more recently investment from pharmaceutical companies and private equity[6].

Examples of Funding Initiatives for stem cell research - the United Kingdom Government
The UK Government has invested over £200 million from 2005-2009 with £38 million from philanthropy. The Medical Research Centre (MRC) provided £38 million on competitive grants for stem cell research in one year (2009-2010). Two MRC Centres for stem cell research were established with £3.4 million. In 2008, the MRC set up the Translational Stem Cell Research Committee to fund clinical and drug applications. To date, £21.6 million has been awarded. The Engineering and Physical Sciences Research Council has funded convergence of these disciplines with stem cells. Further research councils have led public-private partnership, with funding of £23 million to small to medium size enterprises (SMEs) and pharmaceutical companies. The UK Technology Strategy Board funds a £21.5 million RegenMed programme to support R&D partnerships. A further R&D strategy funded by the UK government over five to ten years is to set up a Cell Therapy Technology and Innovation Centre.

In 2002, the MRC co-funded establishment of the world first quality controlled stem cell bank, which is now an internationally acknowledged leader in stem cell banking.

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[6] Taking Stock of Regenerative Medicine in the United Kingdom (July 2011) Dept for Business Innovation & Skills, UK Government

To further support stem cell research the UK National Stem Cell Network, funded by UK Research Councils coordinates and promotes UK stem cell research and its translation.

European Union
The European Commission's Seventh Framework Programme for Research and Technologies Development has an allocated a budget of €50 billion for 2007-2013 and a further €50 million was committed towards the Innovative Medicines Initiative in 2011 with human induced pluripotent stem cells being targeted as a "Think Big" topic.

The mission of the European Research Council (ERC), established in 2007 is to fund competitive 'investigator-driven' research in order for researchers to identify new opportunities and directions in their field, 'rather than being led by priorities set by politicians.'[7] There is an emphasis on funding the idea rather than a research area and thus rewarding innovative proposals or frontier research. The Council expect this goal will result in novel scientific and technological discoveries, which will form new industries. Grants range from €1.5- to €3- million over five years. The ERC is a long-term model with an overarching aim to strengthen the European research system.

Australian Stem Cell Funding Shortfall
In 2011, in the USA, the National Institute of Health (NIH), awarded $3.4 billion in new grant funding commencing in 2012 [8], of which $1.2 billion went to research projects that in some way made use of stem cells. In the same year, the Canadian Institutes of Health Research awarded approximately$31 million in new operating grant funding (equivalent to NHMRC project grants) for stem cell research[9], in addition to the ~$6.5 million new grant funding annually awarded by the Canadian Stem Cell Network. Thus Canadian stem cell researchers received in the region of $37.5 million in new grant funding in 2011 alone. It is worth noting that these funding levels have been achieved despite the continuing challenging financial situations experienced by both the US and Canada as a result of the Global Financial Crisis.

In contrast, new NHMRC project grant funding awarded for stem cell related projects in 2011 totalled approximately $6.5million (from the $604 million total NHMRC project grant funding awarded in 2011)[10]. Even taking into account the ARC Special Initiative funding for Stem Cells Australia that was announced in 2011 (providing $21 million over 7 years, or ~$3million per year), the combined new stem cell-specific funding announced in 2011 was effectively around $9.5 million. This low level of Australian stem cell funding relative to the US and Canada places Australian stem cell scientists at a significant competitive disadvantage in spite of the relative resilience of the Australian economy.

Since advances in basic stem cell science will drive future innovation, clinical translation and return on grant funding investment[6,11], the ASSCR recommends a large, multi-million dollar increase in annual stem cell funding and investment, to enable Australian stem cell scientists to remain competitive with other nations. This would fund a long-term strategy for an annual, competitive stem cell-specific funding scheme open to all

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[7] http://erc.europa.eu/mission. Viewed 29/03/2012
[8] http://report.nih.gov/budget_and_spending/index.aspx. Viewed 29/03/2012
[9] http://webapps.cihr-irsc.gc.ca/cfdd/search_e. Viewed 29/03/2012
[10] http://www.nhmrc.gov.au/grants/outcomes-funding-rounds. Viewed 29/03/2012
[11] Deloitte Access Economics. Extrapolated returns on
investment in NHMRC medical research. Australian Society for Medical Research. 17 February 2012

Australian researchers. Such a scheme would provide the flexibility needed to exploit the latest stem cell advances. In doing so, it would build critical Australian stem cell knowledge and skills by encouraging new ideas and collaborations with an emphasis on industry and clinical translation.

TOR 3. Opportunities to improve coordination and leverage additional national and international support for Australian health and medical research through private sector support and philanthropy, and opportunities for more efficient use, administration and monitoring of investments and the health and economic returns; including relevant comparisons internationally.

TOR 7. Examine the institutional arrangements and governance of the health and medical research sector, including strategies to enhance community and consumer participation. This will include comparison of the NHMRC to relevant international jurisdictions

Peer-Review Reform

It is critical that public funds are allocated to researchers who will support the best scientific research, achieve their outcomes, stimulate new ideas or areas for discovery and train the next generation of scientists. Funding models need to support scientific careers until retirement. Most grant agencies assess projects rather than people, which often restrict researchers who can see beyond the conventional scientific dogmas. Evaluation of 'excellence' in research is difficult. Often novel ideas are difficult to understand and convey and therefore, are less likely to be funded. Routinely, peer review is used to make this assessment. However, the peer review process has flaws and is problematic in Australia as the medical research community is relatively small, exacerbating potential for bias. As Professor Donald Forsdyke wrote "a quest for the support of excellence in medical research should be accompanied by a quest for excellence in the evaluation of that excellence."[12] An Australian study of NHMRC grant review panels by Nicholas Graves (QUT) showed a high incidence of randomness in the scores by panel member[13]. Graves suggests that due to this and the high-level of competitiveness potentially risky proposals are unlikely to be funded, as review panels tend towards being risk adverse. Further, being an expert on a grant review committee doesn't guarantee good decision-making.[14]

Forsdyke observes that as grant writing is marketing, the skills required to successfully market are not necessarily skills required for the successful researcher[15]. Some points to consider are that public funds should be distributed on the basis of past research and budgetary performance rather than a future 'promise' and funding more applicants using a sliding-scale approach with milestones based on further support.

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[12] Donald Forsdyke. Tommorrow's Cures Today – How to Reform the Health Research System (Harwood Academic publishers. 2000)

[13] Graves N (2011) Funding grant proposals for scientific research: retrospective analysis of scores by members of grant review panel. BMJ: 343

[14] Kathryn Shulz (March 2011) Why Experts Get the Future Wrong, New York Times. Review of Dan Gardner 'Future Babble'.

[15] http://post.queensu.ca/~forsdyke/peerrev.htm#The%20Argument%20in%20a%20Nut-Shell, viewed 26/03/12.

Make the Grant Application Process More Efficient
The study by Graves, who looked at 2,983 grant proposals submitted to the NHMRC in 2009, showed that most researchers spend from 20 to 30 days preparing one grant proposal, with some spending up to 65 days.[13] The overall costs of grant writing were $47.5m, with applicants paying 85% of the costs. Top scoring applicants (9%) are always funded, whereas for the next ranked (29%) it was uncertain and the remaining 61% were not funded.

The ASSCR recommends the McKeon Review Panel calls for an assessment of the peer-review system and whether it is achieving its aims as well as new ways to select and allocate publically funded grants. Some areas to consider:

(i) assess other models and processes to assess and allocate grant funds

(ii) ensure funding allocation rewards and not inhibits new ideas

(iii) make the grant application procedure simpler, less time-consuming and costly for the applicant and grant agencies

(iv) increase the number of years a proposal is funded

Specific suggestions and examples are highlighted below:

- NHMRC project grants to be limited to four per Chief Investigator A. The grant period to be extended to five years of funding so that Australian researchers are competitive with overseas colleagues. There could be a major report for each grant in the third year. This report could be assessed via the Grant Review Process (GRP) that would require majority support of the panel without external review, to determine whether the grant gets funding in the fourth and fifth years. This will reduce the number of new grant submissions conducted per year.

- The stream lining of grant writing and extension of grants to four or five years depending on progress reports will keep Australia competitive with overseas colleagues.

- Develop more efficient grant funding models. Some examples:

  - US based National Science Foundation (NSF). Divisions of the NSF have changed funding applications to a four-page pre-proposal with a short biographical sketch, including ten best publications. Following assessment, successful applicants then submit a longer application.

  - A discovery grant based on the Gates Foundation applications. The Gates Foundation has grant rounds for targeted funding initiatives. This involves submitting a two-page application for one year funding (say $100k). The application involves the proposal and how the applicant can achieve their goals. After a year a submitted progress report is assessed and further funding can be provided. The Gates Foundation, offer substantial further funding ($1 million over four to five years).

- The Fellowship scheme particularly for Junior Fellows needs to be re-structured. Australia is losing a lot of young smart people from the research sector.

- Universities/Institutes should be made to support the positions of senior successful researchers who have held a Senior Programme Research Fellow for two or three rounds.

- Research positions are never fully funded. There is always a gap which institutions or universities have to meet.

- Schemes that establish a bridge between Early Career Researchers and Fellowships. Currently, too many junior researchers are falling off this path and are lost. They represent a valuable resource that the research community is wasting.

- Investigate greater across-government approaches and collaboration to fund medical research. One proposal could be development of a single granting scheme combining both ARC and NHMRC for the management and peer review of grants, including database management system. Simplify the rules for more flexible eligibility of applications in either ARC or NHMRC arms. . Streamlining and not having double entry for research applications would reduce workload for many who apply to both schemes.

Tax-Payer Funded Science Needs to be Publically Accessible
Research in Australia is largely tax-payer funded as well as public and philanthropic donations to not-for-profit organisations. This is a fundamental investment by the tax-payer for the advancement of science on their behalf.

Researchers employed by tax-payer funding generate data, then write and extensively format manuscripts for submission to journals. Manuscripts, publicising the scientific research data are evaluated by peer-review. These same researchers voluntarily review and edit submitted manuscripts to both co-ordinate the peer-review process and to provide external assessment of research quality and relevance. All of these time-consuming roles (that delay other research tasks from being performed) are critical for data dissemination and are performed by researchers voluntarily. However, the manuscripts that result from these extensive and tax-payer funded research, review and editing efforts are then ‘donated’ to publishers who subsequently own copyright over the published material.

In addition to publication fees paid by the researcher, publishers then charge large fees to Universities, researchers and the general public for subscription access to the results of tax-payer funded research efforts. The tax-payer is thus being charged to access the data they paid for in the first place. This represents a huge waste of public investment that could be better used to fund additional research projects. Moreover, this publication model slows down research progress by making it more difficult for researchers to access the most recent data. Worryingly, this publication model has enabled enormous and increasing profits to be generated by scientific publishing houses; for example, in 2011 alone, Elsevier reported a profit of £768 million[16]. In some countries, these same publishing houses are attempting to entrench this imbalanced publishing model through legislation (for example, via the Research Works Act, USA).

[16] Taylor M (2012) Academic publishing is broken. The Scientist. 19 March 2012.

In an effort to circumvent these costly restrictions to access tax-payer funded research, open-access publishing models have been established that only require fees to cover publication costs (i.e., no subscription fees charged). Currently less than 10% of journal articles are published under this open-access model. This is due to the reliance on impact factors as a measure of research quality. New open-access journals have no initial impact factor and thus find it difficult to attract high-profile research articles. Thus, relatively more high impact articles are accessible only from subscription-based high-impact factor journals, perpetuating the impact factor advantage of subscription-based journals.

Attempts are being made at circumvent using impact factors to measure research quality (*e.g*., Excellence in Research for Australia; Seeding the Commons). However, these efforts are unlikely to remove impact factor reliance in the short- or medium-term, particularly when assessment of Australian researcher quality is made outside of Australia. Additional efforts are therefore needed to promote open access to publicly funded research.

The NIH has adopted a public-access policy that requires NIH-funded research to be made publicly available within twelve months of publication through the website PubMed Central. In Australia, the ARC policy is that researchers can use 2% of awarded grant funds to disseminate results. However, this approach does not overcome the issue as tax-payers are still required to pay publishing house access fees (in addition to publication fees) to make articles publicly accessible using funds that would otherwise have gone to research. These fees typically range from $1500 to $3000 per article. A recent change to the NHMRC policy states that NHMRC-funded research should be deposited in an institutional repository within 12 months of publication[17].

The ASSCR welcomes these initiatives but believes that neither of these policies are adequate for public access to tax-payer funded research. Instead, the ASSCR recommends that all tax-payer funded research should be made publicly available immediately upon publication, or within six months at the latest. In addition, the ASSCR recommends that continued efforts should be made to decrease reliance upon impact factors as a measure of research quality.

3. What are the health and medical research strategic directions and priorities and how might we meet them?

TOR 5. Likely future developments in health and medical research, both in Australia and internationally.

The Australian population is ageing – by 2050 fifty percent of Australians will be over the age of 50 and 25% older than 65 years of age. This contrasts with now where 33% and 13% are older than 55 and 65 respectively[18][19][20]. This trend will escalate health care costs from $96.5 billion to $246 billion by 2033[21], with a continuation in the rapid

17 Hare J (2012) The Australian. NHMRC CEO supports Elsevier boycott; says all research must be made open access. 22 February.

18 Access Economics. Exceptional Returns II: The Value of Investing in Health Research & Development in Australia. In; 2008

19 Australian Bureau of Statistics media release, "Australia in 2051: almost half the population older than 50 years", 29 Nov 2005

20 Australian Bureau of Statistics media release, "One in four Australians aged 65 years and over by 2056: ABS", 4 Sept 2008

21 Intergenerational Report April 2007

expenditure growth of the PBS within the health budget. Government funding for aged care homes was approximately $7 billion in 2009-10.

As a major strategic health issue, the health consequences for an ageing population should be subject to extra funding from the Commonwealth Government over a specific time frame. The current NHMRC funds are important for the advancement of knowledge in all areas of medical research. However, different health issues that have or are likely to have a major impact on the Health System should get additional funding over five years outside of the normal NHMRC funding budget. These strategic initiatives would be chosen based on a review every five years on the current and projected medical issues that are having the biggest effect on the population and Health System. The allocation of money could be focussed in two or three areas for each funding round.

Stem cell research offers unique opportunities to deliver new and more effective ways of treating debilitating diseases and injuries that are currently poorly treated or not treatable at all. In particular, treatments are being developed for diseases associated with ageing, such as Parkinson's disease, Studdgart's Macular Degeneration and osteoporosis. Importantly, stem cell research has transitioned from the research phase into direct clinical applications. For example, the initiation of clinical trials in the United States using neural cell derivatives from human embryonic stem cells to treat spinal injury and macular degeneration. Regenerative medicine is not a new research area with successful bone marrow transplants being conducted over the past fifty years. Since the isolation of human embryonic stem cells in 1998, a wider use for stem cells to develop unique clinical applications have been pursued. However, many scientific disciplines are a part of modern regenerative medicine, such as material sciences, and developmental biology.[22] Further, modern regenerative medicine aims to better treat diseases earlier. This will have huge economic impacts, as 80% of healthcare costs are to treat late stages of illness, such as heart failure. This could be cured or managed with cell therapies. [6]

Moreover stem cell biology embraces the relatively new paradigm of the cancer stem cell (CSC). The CSC is a vital new target in treatment of all cancers and in particular, the most clinically intractable aspects of cancer – relapse and metastasis, which are associated with the poorest prognoses and the greatest financial outlay in cancer services. There is considerable evidence to suggest that targeting CSCs will provide significant benefits in reducing disease burden. The extent to which stem cells exist in cancer is under debate amongst the scientific community however, in some cancers such as leukaemia and breast cancer the role of stem cells and the benefit of designing therapies that influence stem cell behaviour is undeniable. A number of Australian scientists have made key discoveries in defining the biology of CSCs and this field remains a key focus in developing cancer treatments. Australia has the opportunity to make a significant impact.

The UK Government published a report *Taking Stock of Regenerative Medicine in the United Kingdom*[6], recommending a national strategy for regenerative medicine, "in recognition of its potential as a driver for the UK economy and future healthcare". Although the Australian government has funded special initiatives for stem cell research and regenerative medicine there have not been any specific competitive grant rounds. It is worth noting that the NHMRC (the sole source of project funding for Australia's stem cell scientists) funded less than 25% of the Project Grant applications it received in 2010. This is despite 70% of all the Project Grant applications received last year being rated as

[22] A Strategy for UK Regenerative Medicine. (March 2012) MRC

worthy of funding due to the novelty, quality and competitiveness of the research proposals[23].

The ASSCR recommends that the Australian Government develop strategic approaches to fund promising research fields, such as stem cells and regenerative medicine and to recognise their integration and convergence with other scientific disciplines. In Australia, funding allocations are often politically motivated and diverse community views about stem cells have influenced this. Rather than sporadic funding to benefit relatively few Australian stem cell researchers, developing a more sustainable, long-term strategy to support competitive funding for stem cell research and its translation will be essential for Australia to be competitive in this area.

Further, to better enable Australian scientists, and stem cell researchers in particular, to aid development of novel therapies that will help address Australia's dramatically increasing health care costs, the ASSCR believes it is wise to increase NHMRC funding in real terms in the 2011 Federal Budget. By doing so, the research investment that underpins Australian scientific discoveries, saves lives and money, and is consistent with Australia's long-term economic interests will be protected.

TOR 8. Opportunities to improve national and international collaboration between education, research, clinical and other public health related sectors to support the rapid translation of research outcomes into improved health policies and practices. This will include relevant international comparisons.

As outlined in the above response to TOR 6, providing vocational training during PhD studies (in addition to the current 3.5 year research training) would improve cross-sector interaction between academia, industry, government and the clinic. Equally important, this type of vocational training will increase the productivity of PhD graduates in non-academic research positions, by giving them a solid understanding of the required theory and practice (thus reducing the costs for on-the-job training). Related models for this vocational training include:

Postgraduate Certificate in Transferable Skills and Science, U. Warwick, UK
This highly successful course, established a decade ago as part of the Molecular Organization and Assembly in Cells Graduate Program, requires students to complete an accredited Postgraduate Certificate in related vocational training that includes project management, decision making/leadership, networking and science communication.[24]

Grad Cert and Diploma in Clinical Supervision UTAS
Established for employees of Sydney South West Area Health Service to gain a qualification in the workplace. This course is delivered by distance and mentoring in the workplace, with time specifically allocated for its completion.[25]

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23 NHMRC 2010 Project Grant Funding Round – Funding Statistics
24 www.warwick.ac.uk/go/pioneers/pgcts
25 http://www.ncah.com.au/course-details/graduate-diploma-of-clinical-supervision-and-clinical-leadership/1333/
http://courses.utas.edu.au/portal/page?_pageid=53,32959&_dad=portal&_schema=PORTAL&P_COURSE_CODE=M5J&P_YEAR=2011&P_CONTEXT=NEW
http://www.utas.edu.au/medicine/people/stella-stevens

9. Ways in which the broader health reform process can be leveraged to improve research and translation opportunities in preventative health and in the primary, aged and acute care sectors, including through expanded clinical networks, as well as ways in which research can contribute to the design and optimal implementation of these health reforms.

10. Ways in which health and medical research interacts, and should interact, with other Government health policies and programs; including health technology assessments and the pharmaceutical and medical services assessment processes.

Collaboration between disciplines needs to be developed to tackle major health issues. Funding programs specifically to instigate, promote or assist dialogue and collaboration will be critical. An Australian government report on emerging technologies to assist our ageing population highlighted the need to support broader networks to not only include regenerative medicine but material sciences, ICT experts, nanotechnology, biomimetics, robotics, sociologists and aged-care providers.[26] Co-investment between Intel and the Irish government established a Research Centre for the Ageing with scientists, sociologists and nurses. Developing dialogue between medical researchers and clinicians, patient groups, aged care providers and the elderly could better tailor and innovate basic research to make it relevant for end-users.

Over the past decade stem cell-specific funding by the Australian Government has largely been based upon a silo structure, such as the Australian Stem Cell Centre and Stem Cells Australia. Both organisations received large sums of money accessible to a relatively small proportion of Australian stem cell scientists. While quality scientific breakthroughs have, and will, be achieved through these investments, alternate funding approaches taken in other countries may stimulate greater, and more multidisciplinary, research collaborations.

For example, the Canadian Stem Cell Network is a not-for-profit body funded by the Canadian Government as a Network of Centres of Excellence. The Canadian Government commits funds to the Canadian Stem Cell Network for a period of five to seven years; these funds are then made available to Canadian stem cell researchers through competitive grant processes that prioritize inter-disciplinary approaches, particularly those that have industry and/or translational components.

Advantages of this model include:

(i) a more flexible approach to funding stem cell research capable of rapidly exploiting annual research advances through the annual grant scheme open to all stem cell researchers
(ii) improve collegiality and collaboration between stem cell researchers by providing an annual, stem cell-specific funding scheme open to all stem cell researchers
(iii) promote new industry and translational research collaborations through a mandate to fund applications that demonstrate these inter-disciplinary interactions.

[26] Report of the Enabling Assistive Technologies for the Aged Foresight Workshop, (2010), National Enabling Technologies Expert Forum, Dept of Industry, Innovation, Science, Research, Tertiary Education and Training.