



The House of Representatives

STANDING COMMITTEE ON EDUCATION, EMPLOYMENT AND TRAINING

Submission to the Inquiry into Funding Australia's Research

School of Biological Sciences
Monash University

12th June 2018

Dear Ministers,

Please accept our submission into this inquiry into funding of Australia's research.

In this submission, we

- Benchmark the performance of Australian science relative to our international counterparts
- Show that Australian science is at immediate risk of being outpaced by our international counterparts
- Call for increased and long term investment into the Higher Education Research and Development (HERD) sector, through expansion of funding of non-targeted Australian Research Council schemes, and an increase in block funding in line with the true costs of research in Australian universities
- Outline recent examples from Monash University, in which ARC-funding of research projects catalysed research programs of international impact, benefitting the health and wellbeing of millions of people around the world

Research and innovation in science are key to the competitiveness, future prosperity and well-being of our nation. New discoveries lead to new products, services, a sustainable economy and environment, and the capacity to forecast and overcome emerging economic and environmental threats to our society. Scientific discovery is the cornerstone on which our economy will prosper, and it provides the advances that enable us to embrace the opportunities that will ensure Australia is placed as an international leader and innovator in a global economy undergoing rapid change.

Australia is indeed well positioned to consolidate its standing as a world leader in scientific research and innovation. Relative to our modest population size, we undoubtedly leave our mark on the global stage. We boast, for example, six universities that rank among the world's top 100¹.

However, Australian science is also at immediate risk of being outpaced by our international counterparts. Australia ranked 12th for research outputs in the most recent assessment of global research performance (Nature Index 2017 Tables). On the one hand, this could be interpreted as a strong contribution that reflects the ingenuity and capacity for excellence of our nation's researchers.



On the other hand, it must be stated that this contribution is notably lower than major European economies, including those of Spain and Italy that have been operating through years of austerity.

Furthermore, while our nation's research capacity, as gauged by quality outputs, has increased by 7% since 2013, this increase has been stymied by a decrease of 4.5% over the last two years². This indicates that strong gains made early during the last five years have since been eroded. These gains are at risk of further deterioration in the absence of a sustained and long-term strategy of investment into basic scientific discovery in our Higher Education Research and Development (HERD) sector. Tellingly, this decrease in quality output over the last two years mirrors a decrease in investment of 14% to the Australian Research Council since 2013-14³.

The system of funding to the HERD sector is efficient and effective. The structures and frameworks are in place to support innovations and advances in the basic foundational sciences that are the envy of our international counterparts. The dual funding system of Australian research, via competitive grants to researchers and institution-based performance block grants, is conceptually appealing and vital to supporting a healthy HERD sector; although we note the associated infrastructure costs fall well short of the actual cost of delivering such research. This system enables the academic community of peers to recommend the highest quality science for funding through Category 1 Nationally Competitive Grant Schemes, while provisioning high-performing institutions with the budget to invest flexibly in building strategic programs of research excellence that will lead the world.

However, we are operating in an underfunded system, both in terms of investment into nationally-competitive grant programs administered through the Australian Research Council, and in terms of research block grants. Many field-leading research projects are not funded by the Australian Research Council, and of those that are funded, many receive too little funding to capitalise on the opportunities inherent to the project. Furthermore, research block allocations are insufficient to cover the true costs of research. In 2018, each \$100 of Category 1 funding acquired by Monash University was accompanied by \$23.58 in block funding, which is less than half the amount required to cover the costs of implementation of this research. This threatens the international reputation of Australia's HERD sector in the immediate term, and will have long lasting effects on downstream translation of science into economic innovations, services and health.

In 2016, Australian Government investment into basic research represented just 0.62% of our GDP⁴, lying outside the top 10 for OECD countries⁵. This is despite the fact that we have the third highest numbers of researchers working in government and higher education sectors per thousand workers in the OECD⁶. The viability of the HERD sector is not undermined by a lack of personnel capacity, or technical expertise. It is undermined by the lack of funding available to pursue and maintain excellence, as benchmarked relative to our international competitors.

Levels of funding to non-targeted competitive grant schemes must be increased in the long term to entrench Australian research firmly among the world's leading innovators. Non-targeted competitive schemes provide the most effective means to support the highest quality and most innovative research. This is the research that will unlock new doors, and break open new avenues of discovery and innovation, expanding the boundaries of human knowledge. Australian investment into the basic sciences benefits and fosters innovation and impact, measurable at a global scale.

The temptation to move towards targeted schemes of research funding is a mistake. While it may lead to rapid understanding of a narrow set of research priorities, it will greatly narrow the diversity of Australia's research strengths, and hence capacity to respond to future challenges to our economy and society. This will also threaten the stability of career structure, and retention, of our most promising rising stars, resulting in short term gains followed by a decline of the whole sector.

As exemplified time and time again, intellectual freedom in the hands of creative leaders routinely leads to spectacular and unexpected outcomes. Below, we outline three recent case studies of Monash-led projects in the biological sciences, which were founded by investment through the Australian Research Council. These programs are now making international impacts, by improving the health and wellbeing outcomes of millions of people across the globe, securing economic benefits for the long term, and by assuming the world leadership in protecting some of our globes most treasured environments for future generations. These case studies represent just a small fraction of examples across Australia, whereby funding of foundational research through non-targeted competitive schemes provided the mechanism for researchers, spanning multiple cutting-edges of scientific endeavor, to deliver conceptual innovations. These innovations were then directly translated to impact and benefits at the global scale.

Case study 1. The scientific platform underpinning the *World Mosquito Program* (formerly *Eliminate Dengue*), which runs out of Monash, was founded on eight successive Discovery Project grants from 2003. This funding allowed Prof Scott O'Neill and his team to understand the capacity of the intracellular bacterium, *Wolbachia*, to achieve "pathogen-blocking". The research team successfully provided the proof-of-concept that mosquitoes, when infected with *Wolbachia*, were much less likely to transmit Dengue and Zika viruses to humans. This platform of discovery research grew into a global program of innovation and impact, underpinned by further funding through the Bill and Melinda Gates Foundation Grand Challenges Initiative, an NHMRC Centre of Excellence grant and two successive NHMRC Program grants. This program is focused on improving global health conditions and strengthening the capacity of local communities to reduce the threat of mosquito-borne diseases. To date, the program has protected an estimated 1.6 million people, across six countries spanning Asia (Indonesia, Vietnam), South America (Brazil, Columbia) and Australia, from the effects of these diseases. The program has recently been expanded to include a further seven countries (Sri Lanka, India, Kiribati, Fiji, Mexico, New Caledonia and Vanuatu).

Case study 2. Prof Ros Gleadow from the School of Biological Sciences at Monash has developed a world-leading research program focused on improving food security in the face of climate change. One example of this comes from the impacts of her research into the effects of climate change on Cassava. The edible root of the Cassava plant is consumed by more than 1 billion people daily. A major problem, however, is that the root accumulates cyanide, causing ill health, paralysis and death, with children the most vulnerable to the effects. Gleadow and her team have helped reduce the risks to human health from cyanide poisoning by demonstrating that extra care in processing is essential when cassava tubers are harvested from drought-stressed plants. Her program has led to changing attitudes and safer practices amongst subsistence farmers in the Pacific Islands, Mozambique and the Democratic Republic of Congo. Foods imported into Australia are also now routinely tested for compliance with safety standards pertaining to cyanide levels – standards that Gleadow's research helped shape. The foundational research that uncovered the climatic effect on cyanide levels in roots



crops in this area was funded through two ARC Linkage Projects and two Discovery Projects to Gleadow over 12 years.

Case study 3. Three Discovery projects since 2012 enabled Prof Steven Chown of Monash's School of Biological Sciences to resolve the fundamental processes and physiological drivers determining the diversity of insects and invasive species within and across continents. This knowledge led to a key roles for Prof Chown with the *Scientific Committee on Antarctic Research (SCAR)*, where he now serves as President. SCAR provides leadership and data-driven advice into the governance, administration and environmental policy in the Antarctic, and Prof Chown is now overseeing the implementation of the committee's five year strategic plan. Discovery Project funding to Prof Chown also facilitated fundamental insights into environmental change, which were key the development of a major interdisciplinary research project titled *Revitalising Informal Settlements and their Environments (RISE)*. The aim of RISE is to improve environmental and human health conditions in slums, and it is supported by a \$14M grant from the Wellcome Trust's "Our Plant, Our Health" program. The focus of RISE will be on informal settlements in Fiji and Indonesia, and currently the Asian Development Bank is preparing the financing of two infrastructural programs, for integration into these countries.

The available data, summarised in this submission, confirms Australian researchers are performing admirably and efficiently relative to our international counterparts, punching above our weight per dollar of investment. This is possible because our system of funding is effective, and importantly equitable. We applaud the Australian Government's firm focus on ensuring equity and diversity in our HERD workforce, through equity in funding outcomes, and for the continued support of our early- and mid-career researchers through the DECRA and Future Fellowship Schemes. These schemes are vital for ensuring the long term viability of our HERD sector.

However, careful analysis of these data indicates our sector is at risk of being outpaced, resulting from under-investment into Australian Research Council non-targeted grant schemes (Discovery and Linkage Projects). This has implications. New knowledge and new skills leads to new products, greater efficiency in services, and diversity, resilience and sustainability of our economy. Foundational scientific discovery provides the most effective means of overcoming our national challenges and ensuring that Australians can be well placed to transition into the jobs of the future, to continue to receive world-standards of quality health care, to live in a sustainable environment and receive the opportunities and services they deserve.

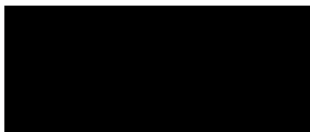
As a nation, we can, and should do better, to secure our children's futures as a nation built on prosperity through innovation. This requires a clear and long term vision for funding of our higher education sector. We call for a long term, bipartisan strategy to increase levels of investment into HERD to levels comparable with other OECD leaders with whom we aim to be outperforming. This will provide the appropriate level of resourcing to our researchers, and the level playing field required, on which we can best make our mark as global leaders in research discovery, innovation and development.



In summary

- Australian science is performing admirably relative to our OECD counterparts, relative to percentage investment of GDP
- Australian Government investment into basic research lies outside the top 10 OECD countries
- Australian science is at immediate risk of being outpaced by our international counterparts
- Non-targeted competitive schemes provide the most effective means to support the highest quality and most innovative research
- We have provided three recent case studies from our own School of Biological Sciences
- We call for a long term, bipartisan strategy to increase levels of investment into HERD, to levels comparable with other OECD leaders
- This should be effected through expansion of funding of non-targeted Australian Research Council schemes, and an increase in block funding in line with the true costs of research in Australian universities

Yours faithfully,



A/Prof Damian Dowling
Research Director



Prof Moira O'Bryan
Head of School



A/Prof Bob Wong
Deputy Head of School



Prof Dustin Marshall
Director, Centre for Geometric Biology

School of Biological Sciences
Monash University
Clayton 3800 Victoria

References

1. <https://www.timeshighereducation.com/world-university-rankings/2018>
2. Nature Index data January 1 to December 31 2016 (<https://www.natureindex.com/>)
3. 2017-2018 Science, Research and Innovation Budget Tables
4. <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8111.0>
5. OECD-i-library Main Science and Technology Indicators, Volume 2017 Issue 2, Table 44
6. Australian Innovation System Report, 2017, Department of Industry, Innovation and Science, Chapter 6.