



The Parliament of the Commonwealth of Australia  
Department of the House of Representatives

A submission to

**Inquiry into research training and research workforce  
issues in Australian universities**

House Standing Committee on Industry, Science and Innovation

30 May 2008

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The Australian Academy of Science, as the peak scientific body in Australia, welcomes the opportunity to present its views on the Department of the House of Representatives *Inquiry into research training and research workforce issues in Australian universities* to the House Standing Committee on Industry, Science and Innovation.

The Academy addresses three main issues relating to the inquiry, namely:

1. The overall value of Australian universities in research training;
2. The quality and adequacy of research training provided by Australian universities, in view of anticipated future requirements for tertiary-qualified professionals in a wide range of disciplines; and
3. Factors for graduates that determine pursuit of a career in research, including opportunities for career advancement, overseas career options, and Australia's ability to compete internationally for high quality researchers.

The Australian Academy of Science would welcome the opportunity to appear before the Committee at a public hearing in Canberra should the Committee wish.

## Summary

- Australian universities are invaluable contributors to the research training of postgraduates and postdoctoral researchers.
- Tertiary level research training can only be fully addressed when the fundamental issue of science awareness and promotion at school and teaching level is attended to.
- Inclusion of more cross-disciplinary courses and technical support in Australia's PhD course structure may enhance the careers and future research approach of PhD students.
- The continued inexorable rise in student to staff ratio must be addressed if Australian universities are to maintain their current international standing for educational excellence.
- While the Academy of Science welcomes the Federal Government commitment to double the number of postgraduate scholarships, PhD scholarship stipend rates must be reviewed.
- Research training at universities needs to better prepare postgraduates for the real world. A recent Academy workshop, *Enhancing the quality of the experience of postdocs and early career researchers*, identified the skills and mentoring required by postgraduates to enter careers in universities, research institutes, industry and government agencies.
- Academic salaries must be comparable with private sector salaries in order to attract and hold academic staff from Australia and overseas.
- The Academy welcomes the Federal Government's commitment of funding to create a Future Fellowship scheme for top mid-career researchers, but is concerned that the number of scholarships is unable to create the critical mass needed in research institutions to secure a healthy research environment.
- The Academy suggests a larger investment in Australia's R&D base to address unattractiveness of academic careers and loss of valuable postdoctoral scientists offshore due to lack of suitable positions, decline in long term job security and stability, poor set-up funding, and an overall decline in job satisfaction.
- Movement of researchers between academia and industry would be facilitated if applied solutions developed during time spent working in industry were recognised as much as more conventional academic output in criteria for promotion and remuneration.
- To attract and to retain a larger portion of its female graduates in research, Australia needs to better assist its female scientists through initiatives that will support women to move beyond being strong competitors in their early research careers to becoming research leaders.

## 1. The overall value of Australian universities in research training

In 2006, 89,893 students completed a postgraduate course in Australia<sup>1</sup>. Of the Higher Education Providers who had trained these students, Australian universities accounted for over 98 per cent of the graduates. Of those graduates who were awarded a doctorate by research or masters by research, over 99 per cent had received their research training at Australian universities.

Australian universities are the nation's largest producers of future scientists, innovators and policy makers. Research training for postgraduate students prepares young researchers for the challenges they will face during their diverse careers in academia, government, or the private sector.

## 2. The quality and adequacy of research training provided by Australian universities, in view of anticipated future requirements for tertiary-qualified professionals in a wide range of disciplines

### *The fundamental issue*

Australia must invest great effort in education, training, and research in science and technology to retain any advantages in the global market place, and also to efficiently contribute to global development, in the years ahead. A significant part of this investment is the research training of Australia's next generation of scientific contributors. However, the quality and adequacy of research training available to students in universities is dependent on the more deeply rooted issues of science and technology awareness in Australia, beginning at school level.

In the Academy's recent report, *Research and innovation in Australia: a policy statement*, a direct link in the causal chain leading to the looming shortage of scientists and engineers is identified as the lack of high school students opting to study science subjects.<sup>2</sup> Further, Australia will not be able to heighten its skills in mathematics and science until it ensures that prospective scientists are taught by teachers with degrees in the disciplines for which they are responsible. This includes higher salaries for adequately trained science and mathematics teachers. Only when programs are expanded to encourage high school students to study science and mathematics through teachers with degrees in their teaching disciplines can other issues such as tertiary level research training be fully addressed.

A large number of tertiary students who progress to postgraduate study face suboptimal research training programs. Issues include the structure and access to courses, adequacy of the number of academics per student, and the support and training available to prepare postgraduates for careers in the world outside universities.

### *Course structure and technical support*

Australia's PhD training model, based on a 3-year research project model used in the UK, contrasts with the PhD system used in the USA, in which the first 1-2 years of a 5-year program involve a heavy commitment to course work. While the Australian system works well for the brightest, highly motivated students, the US system may be more suitable for the second rung of

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<sup>1</sup> Department of Education, Science and Training, September 2007. *Students 2006 (full year), Selected Higher Education Statistics*. [http://www.dest.gov.au/sectors/higher\\_education/publications\\_resources/profiles/students\\_2006\\_selected\\_higher\\_education\\_statistics.htm](http://www.dest.gov.au/sectors/higher_education/publications_resources/profiles/students_2006_selected_higher_education_statistics.htm)

<sup>2</sup> Australian Academy of Science, September 2007. *Research and innovation in Australia: a policy statement* <http://www.science.org.au/reports/aas-policy-2007.pdf>

students as it imposes discipline through organised courses and provides structured information about issues outside the immediate discipline area, potentially enhancing future research areas and careers. Highly technical areas that depend on the provision of training and access to limited numbers of expensive and complex instruments (eg. synchrotrons, telescopes, research reactors, high field NMR spectrometers) present particular challenges due to present funding models being based on 'effective full time students'. The Academy recommends that Australia preserves the positive aspects of its current PhD training system, particularly its focused and closely supervised nature, but that it expands the availability of courses that can be chosen by students. This will require funds to sustain the requisite courses and funds to accommodate students who move to centres of excellence for their training.

#### *Adequacy of academics per PhD student*

A widespread method of coping with increased student numbers without a corresponding increase in expenditure is to allow student numbers to increase without a corresponding increase in academic staff numbers. According to researchers from the University of Technology in Sydney, the extent of 'casualisation' of the academic workforce (almost a quarter of fractional full-time staff are included) threatens course quality.<sup>3</sup> The expanded workload and job uncertainty for academic staff results in insufficient research training for students.

It is difficult to determine precisely how many academics are available per postgraduate student. In 2006, 40,511 students were undertaking a doctorate by research.<sup>4</sup> In the same year, a full time equivalent of 35,151 academic staff were employed in higher education<sup>5</sup>, equating to 1.15 PhD students per academic. However, given that many academic staff may not be involved in supervising students, and given that the 40,511 doctorate by research students were among a total postgraduate cohort of over 270,000, the number of postgraduate students per academic increases manyfold.

Further, the issue is compounded by the academic emphasis on research as promotion criteria, leading to an increasing number of academics spending more time in research and less in teaching activities. A culture in which teaching has a higher value is required to address this trend.

There are no simple figures which prescribe the optimal ratio of staff to student. Supervision requirements vary substantially across different disciplines. However, the quality of supervision is of primary importance across all disciplines, and quality cannot always be guaranteed in the current state of Australia's academic institutions. As urged in the Academy's recent policy statement, the continued inexorable rise in student to staff ratio must be addressed if Australian universities are to maintain their current international standing for educational excellence, let alone improve their position.<sup>6</sup>

#### *Support & training to prepare graduates for the real world*

The quality of support and training received by postgraduates is also of concern. The Academy welcomes the Federal Government commitment of \$209 million over four years to double the number of postgraduate scholarships available to higher degree students by 2012, from 4,800 to

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<sup>3</sup> Brown, T., J. Goodman, K. Yasukawa. January 2008. 'Casualisation of Academic Work: Industrial Justice and Quality Education'. In *Dialogue*. 27. Australian Academy of Social Sciences. <http://www.assa.edu.au/publications/Dialogue/dial12008.pdf>

<sup>4</sup> Department of Education, Science and Training, September 2007. *Students 2006 (full year), Selected Higher Education Statistics*.

<sup>5</sup> Department of Education, Science and Training, September 2007. *Staff 2006: Selected Higher Education Statistics*.

[http://www.dest.gov.au/sectors/higher\\_education/publications\\_resources/profiles/staff\\_2006\\_selected\\_higher\\_education\\_statistics.htm](http://www.dest.gov.au/sectors/higher_education/publications_resources/profiles/staff_2006_selected_higher_education_statistics.htm)

<sup>6</sup> Australian Academy of Science, September 2007. op. cit.

nearly 10,000.<sup>7</sup> The Australian Postgraduate Award (APA) scheme ensures that the nation's top students are encouraged to go on to higher degrees in research. However, while the increased quantity of scholarships is to be commended, the Government's commitment does not include an increase in the funds available for each scholarship.

Keeping Australia's top young researchers above the poverty line is crucial to reduce suboptimal performance due to late night and weekend shifts in supplementary casual work. Professor Ian Chubb, Vice Chancellor and President of the Australian National University, recently noted that the student income support system for basic living costs has not been properly reviewed since 1992.<sup>8</sup> The Council of Australian Postgraduate Associations (CAPA) have also released data showing that while average weekly earnings had almost doubled in the past 15 years, the stipend for PhDs had increased by a mere \$5747, from \$14,260 to \$20,007.<sup>9</sup> This rate will slip below the poverty line by the end of 2008. The Academy advises that the current APA stipend rates for 2008 (\$20,007 for full-time students and \$10,710 for part-time students) are not adequate.<sup>10</sup>

Further, while the increased number of APA's is a welcome development, scholarship places must be accompanied by research training that will better prepare postgraduates for the real world. Postgraduates need training that will take them beyond their university department, to prepare for careers that may be in a very different environment. Having been trained almost exclusively in research, they are suddenly expected to become expert teachers, PhD supervisors, to be accomplished in publishing, public speaking and in raising public awareness of science, and in seeking financial support for and managing their laboratories and research teams. They are also expected to be fully prepared for work in industry and the private sector. All this while keeping ahead in their respective fields, and all this at a time of juggling the balance between professional and personal lives. The Business Council of Australia also expresses concern at the lack of certain skills being delivered:

Many business leaders are of the view that the education and training system has the potential to better provide students and trainees with the requisite skills for innovation success... Furthermore, many companies argued that the education and training systems in Australia are not providing students with the requisite 'soft skills' that innovative workers need in a modern economy, such as those associated with communication, teamwork, problem solving, ongoing learning, creativity, cultural understanding, entrepreneurship and leadership.<sup>11</sup>

A discussion paper released by Universities Australia in May 2008 suggests that a national internship scheme would provide a link between study and relevant workplace skills.<sup>12</sup> The paper argues that the scheme would "increase the employability of a wider set of university students, increase their earning capacity while they're students, and advance their studies by linking the work to their studies."

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<sup>7</sup> Hon Kim Carr media release, 13 May 2008. *Government to give more postgraduates a head start.*

<http://minister.innovation.gov.au/SenatortheHonKimCarr/Pages/GOVERNMENTTOGIVEMOREPOSTGRADUATESAHEADSTART.aspx>

<sup>8</sup> Lecture by Professor Ian Chubb, 20 February 2008. *Higher Education: It's time... to change the policy framework.* ANU Public Lecture Series

<http://www.go8.edu.au/policy/papers/2008/Ian%20Chubb%20ANZSOG%20speech%2020.2.08.pdf>

<sup>9</sup> Council of Postgraduate Associations. 30 April 2008. *APAs to break poverty line.* (media release) <http://www.capa.edu.au/media-releases/2008/apas-break-poverty-line>

<sup>10</sup> Department of Education, Employment and Workplace Relations, *About the Australian Postgraduate Awards*

[http://www.dest.gov.au/sectors/research\\_sector/programmes\\_funding/programme\\_categories/fellowships\\_awards\\_prizes/australian\\_postgraduate\\_awards\\_scheme.htm](http://www.dest.gov.au/sectors/research_sector/programmes_funding/programme_categories/fellowships_awards_prizes/australian_postgraduate_awards_scheme.htm)

<sup>11</sup> Business Council of Australia, July 2006. *Submission to the Productivity Commission Study on Public Support for Science and Innovation.*

<http://www.bca.com.au/Content/100900.aspx>

<sup>12</sup> Universities Australia. May 2008. *Universities Australia Position Paper No. 3/08 – A National Internship Scheme.*

<http://www.universitiesaustralia.edu.au/documents/publications/discussion/National-Internship-scheme-May08.pdf>

In line with the Academy of Science's policy recommendation "That Australia gives urgent attention to nurturing rewarding and secure career paths for talented early-career researchers"<sup>13</sup>, the Academy held a two-day workshop entitled *Enhancing the quality of the experience of postdocs and early career researchers* in February 2008. Participants were selected early career researchers from universities and other research institutions across Australia. The young scientists contributed to discussions aimed at determining what skills and mentoring are needed by scientists entering careers in universities, research institutes, industry and government agencies. The outcomes of the workshop are being used by the Academy to create a best-practice guide for research management for wider use.

Several recommendations emerged from the workshop, including:

- The need for good mentoring at the PhD level to prepare for postdoctoral life (external and internal, and co-mentorship);
- Data management training as a core skill that graduate and postgraduate science students receive;
- Greater awareness of career progression and gaining independence;
- More opportunity for early career researchers to communicate and present their work;
- Support for international exposure and collaboration early in a career;
- Greater awareness, exposure and access to other fields of research, for example in industry;
- Better science communication skills, especially to the non-research community;
- Access to learning project management skills, including competitive grant writing, budgeting, and time management.

### **3. Factors for graduates that determine pursuit of a career in research, including opportunities for career advancement, overseas career options, and Australia's ability to compete internationally for high quality researchers**

The Productivity Commission's recent report in public support for science and innovation makes the following observation:

"Job satisfaction amongst scientists appears to be falling, with potential consequences for productivity and future recruitment. This morale problem reflects scientists' concerns about poor career pathways, excessive use of short-term contract employment and a burgeoning non-research workload."<sup>14</sup>

The Academy of Science agrees with this statement, and identifies the following issues of crucial importance in the pursuit of a career in research:

- Academic salary levels
- Career structure, security and stability
- Lack of mobility
- Women in science

#### *Academic salary levels*

The Productivity Commission report notes that academic salaries have declined in relative terms for most of the past 25 years.<sup>15</sup> The salary of a professor and a senior lecturer declined around

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<sup>13</sup> Australian Academy of Science, September 2007. op. cit.

<sup>14</sup> Productivity Commission, 2007. *Public Support for Science and Innovation*, Research Report, Productivity Commission, Canberra. pp xxiv

<sup>15</sup> *ibid.* pp 261

25 per cent between 1977 and 2002 relative to average weekly earnings, and the salary of a lecturer and an associate lecturer declined around 15 per cent in the same time. Due to the relative uncompetitiveness of Australian academic salaries with comparable private sector salaries in Australia and some overseas academic salaries, universities are forced to extensively use salary loadings and other incentives to attract new staff and hold existing staff. Australia's ability to recruit quality academics from overseas is declining.

### *Career structure, security & stability*

The Academy welcomes the Federal Government's commitment of funding of \$326 million over four years to create a Future Fellowships scheme for top mid-career researchers.<sup>16</sup> The scheme, which will offer 1,000 Australian and international mid-career researchers four-year fellowships of up to \$140,000 a year, will assist in supporting some of Australia's most talented scientists. However, when distributed among Australia's research institutions and research disciplines, the fellowships will be sparsely spread. The Academy is concerned that the number of scholarships is unable to create the critical mass needed in research institutions to secure a healthy research environment.

The Academy agrees with the Productivity Commission's finding that career structures for early- to mid-career researchers require urgent attention. Academic careers have become unattractive due to a lack of suitable positions, a decline in long term job security and stability, poor set-up funding for early-career researchers, and consequently a decline in job satisfaction. In particular, the absence of secure positions with remuneration, research funding and the expectation of employment of a par with that overseas, is attracting and keeping Australia's best talent overseas. This has created a cycle of less people deciding to study the core science subject, find a career in research, or become science and mathematics teachers to train and inspire the next generation.

To address these critical issues, the Academy suggests a larger investment in Australia's R&D base in universities, research organisations and small-to-medium sized enterprises. With regards to the nation's loss of valuable post-doctoral scientists offshore, the Academy has suggested a 'boomerang scheme' to tempt Australians back to the country before they become too settled overseas. The scheme would involve substantial start-up funds, a salary equivalent to Australian peers and job security.

### *Restricted mobility*

The CRC and ARC Linkage schemes were set up to address the transfer of skills and knowledge from universities to industry and in return industry has provided a sense of urgency and direction for basic research done at universities. This type of interaction has been very successful. However, it also highlights challenges in maintaining parity between researchers primarily involved in academic advancement via basic research and those engaged with industry, and for industry to gain tangible rewards for linking up with universities and their training of PhD students.

### *Women in science*

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<sup>16</sup> Hon Kim Carr media release, 13 May 2008. *Future Fellowships for outstanding mid-career researchers.*  
<http://minister.innovation.gov.au/SenatortheHonKimCarr/Pages/FUTUREFELLOWSHIPS.aspx>

Young women in research face particular problems, with a huge drop-out rate during child-bearing years testament to the insufficient support available to women. Female scientists are receiving inadequate quality of childcare and insufficiently flexible employment after return from maternity leave. Additionally, women often face greater challenges in gaining independence in research.

It is generally acknowledged that postdoctoral experience overseas is an advantage for later professional advancement. It signals a broader outlook on scholarship and wider personal linkages internationally. Young women may be less likely or less able to undertake their first postdoctoral role overseas. This would in turn limit their career opportunities. In addition to an improvement in Australia's child care facilities for Australian researchers, Australian scientists going overseas should be allocated child care funding on a needs basis.

The Academy supports programs to specifically assist female researchers. The L'Oréal Australia for Women in Science Fellowships, for example, is a national scheme that recognises scientific excellence by female early-career researchers who have completed their PhD or equivalent in the last five years.<sup>17</sup> The Fellowships are endorsed by the Australian Academy of Science, and are intended to help to recipients consolidate their careers and rise to leadership positions in science. Three Fellowships are awarded per year, each for \$20,000. They are intended to help finance the scientific research of the Fellows, but may also be used for child care.

To attract and to retain a large portion of its graduates in research, Australia needs to better assist its female scientists through initiatives that will support women to move beyond being strong competitors in their early research careers to becoming research leaders.

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<sup>17</sup> L'Oréal-UNESCO Foundation, <http://www.loreal.com/en/ww/index.aspx?direct1=00001&direct2=00001/00001>