AUSTRALIAN COUNCIL of DEANS of SCIENCE

Submission from the Australian Council of Deans of Science (ACDS) to the Inquiry into Research Training and Research Workforce Issues in Australian Universities

Preamble

The ACDS represents the Science Faculties/Schools from ***every*** public University in Australia. These Faculties and Schools address many aspects of Science from the enabling sciences - chemistry physics and mathematics - through the biological, medical and computational sciences and agriculture, and in some cases engineering.

The ACDS believes the Faculties and Schools represented by its membership (hereafter referred to as "we") are integral to Research Training and production of a Research Workforce to maintain and enhance Australia's international competitiveness. This is achieved through the training of Higher Degree by Research (HDR) graduates at both Masters and PhD levels, through the supervision of Research Assistants and Postdoctoral Research Associates, and additionally by working with relatively independent postdoctoral personnel (Research Fellows). We provide academic guidance and leadership, and accommodation, facilities and infrastructure support generally for HDR students and the postdoctoral personnel that are supported by a variety of funding processes.

The ACDS comments as below on the terms of reference for this Inquiry.

A. The contributions that Australian universities make to research training in Australia

1. The contribution of research training programs to Australia's competitiveness in the areas of science, research and innovation

The production of quality Masters and PhD graduates in Australian Universities is essential to the scientific and technical research output of Australia. PhD candidates in particular are the principal foundations in developing research capability and furthering knowledge by carrying out fundamental and applied scientific research whilst they gain research, professional and innovation skills.

Training programs through the faculties of science in Australia are not limited to HDR students but extend to a wide range of research assistants and postdoctoral personnel who eventually complement the new human capital in science, research and innovation trained personnel. It is worth noting that Honours programs (strictly part of undergraduate training) form the first stage of research training at most Australian universities. The importance of these programs in the recruitment of future HDR students and in providing much needed research assistants must not be underestimated.

2. The effectiveness of current Commonwealth research training schemes

Commonwealth training Schemes principally accessed by science faculties are the Australian Postgraduate Award (APA) system for HDR candidates and the ARC, NH&MRC etc research funding schemes for support of various PhD and postdoctoral positions – collectively designated under the National Competitive Granting Schemes (NCG).

The effectiveness of university-based training schemes is therefore intimately related to the level of financial support for the APA and APA(I) programs and the various NCG programs – this *financial aspect* is addressed below and also in *Section B, 1*.

We acknowledge and appreciate that the current situation of low numbers of APA scholarships has been addressed in the recently announced doubling of postgraduate scholarships (Budget 2008). With regard to the APA program, however, it is important to recognise that research students are extremely poorly remunerated, with the current stipend levels for Scholarship support resulting in these students living near the poverty level for Australians. The scholarships available in Australia are becoming increasingly non-competitive relative to other countries. In addition the time limits on PhD completions subject PhD candidates and their supervisors to considerable stresses and constrain the ability for HDR candidates generally to gain a wider range of skills (e.g., business acumen, teaching and innovation skills) whilst completing sufficient novel research of international standard to earn their higher degrees.

Many PhD candidates reach the end of scholarship support and begin part-time or full-time employment whilst completing their PhD degrees, producing inefficiencies in completion of degrees, and hence delays in publication and commercialisation of research outcomes.

In many cases, owing to external salary pressures (classic current example being in the geosciences) universities have to top up APA scholarships by substantial levels to attract potential students out of an increasingly rewarding industrial/business environment. These top-up scholarships further stress the already precarious budgets of science faculties and their constituent schools/departments in order to engage students in these important high demand areas.

There is, consequently, increasing pressure to produce HDR graduates rapidly and without scientific rigour and due regard for sufficient maintenance of quality of training and breadth of experience.

All of this (and other deficiencies in funding of support for research training adumbrated further below in *Section B, 1*) will inevitably affect the quality of our PhD graduates. Currently they are generally considered to be of world-class; the danger is an erosion of this level of capability unless the FULL costs of research programs are provided by NCG funding, university funding, scholarships and fellowships

3. The adequacy of current research training schemes to support Australia's anticipated future requirements for tertiary-qualified professionals in a wide range of disciplines

Australia has just under 8 doctorate holders per thousand in its labour force, compared with 28 for Switzerland, 20 for Germany and 11 for the US. Thus we are already behind in this regard.

There is much anecdotal evidence for, and declarations from many prestigious and respected leading Australian scientists regarding impending shortages of suitably trained research personnel in the rapidly developing light manufacturing area and a wide range of areas such as nanotechnology, biotechnology, smart manufacturing, sustainable chemistry and the like.

The shortage of research-trained scientists for replacing the impending retirement of senior academics and researchers in such major areas as CSIRO, also is well documented (see *Section B, 7*).

Encouraging more enrolments in Masters degrees needs to be evaluated as a means of producing research-trained scientists more quickly and at a level appropriate to the needs of some Australian industry and business. In several countries a Masters degree (rather than a bachelor's degree) is considered the normal level for a professional industrial scientist and nations such as Canada and New Zealand place greater weight on research training at this level than we do in Australia. Nevertheless we maintain that a PhD is the minimum necessary requirement for a fully fledged research scientist able to competently run a research laboratory.

On the very positive side of the ledger, there is growing recognition in Australian industry of employing research-trained scientists.

4. Other Comments

It is clear that mechanisms and incentives need to be developed to encourage greater collaboration between universities and Australian and international industry. Industrial postdoctoral fellowships and an increase in the R&D tax concession are clear possibilities.

B Challenges Australian Universities face in training, recruiting and retaining high quality research graduates and staff

1. Adequacy of training and support available to research graduate (HDR)students *and other research personnel* in Australia

There is inadequate funding for science and engineering areas in universities and these are indeed very expensive areas to run and maintain. This lack of proper infrastructure for science faculties generally limits the quality of the postgraduate training experience. Science faculties need infrastructure (equipment and laboratories) to train undergraduate students, postgraduate students and overseas students and to provide facilities where the academic staff themselves and postdoctoral workers can do research. This lack of appropriate infrastructure also restricts the ability of science faculties to properly support the training of research assistants (usually four year graduates) and postdoctoral personnel at all levels (Assistants, Associates and Fellows). Together, these personnel represent the appropriate training environment for the preparation of HDR students for careers in research.

A separate form of financial support (in addition to APA scholarships) is also needed to cover costs associated with the research projects being undertaken by HDR candidates. Often a specific research project has costs which might be an order of magnitude outside of those normally associated with the specific discipline (e.g., access to special internationally based instrumentation, or extensive field trips). Without this additional support, projects and the associated research training will not take place and appropriate

specialist training will not occur. One specific recent example of this is the training of physical scientists in the use of synchrotron-based techniques; now we have our own synchrotron this can be carried out locally more cheaply, but we face a dearth of suitable *locally-trained* synchrotron scientists to actually run and maintain the facility as a consequence of the previous situation.

The current schemes are limited by the availability of sufficient applicants which could be addressed through better stipends, conditions, salaries and enhanced opportunities for research success, e.g. ARC where the success rate lingers in the low 20% region.

2. Attractive schemes to encourage international students to undertake research training in Australia

The training for international students in science areas is of a generally high standard but concerns over local experience in industry and some deficiencies in language for international students, whose first language is not English, continue to be disincentives for recruiting international students, particularly where their expectation is to be employed in Australia.

The major obstacle facing recruitment of international students is the effective double charge imposed (by financial necessity) by universities on these students. They are expected to cover the cost of fees (tuition fees) and as well find a living-support scholarship or subsist on other external funds.

Consideration should be given to following the New Zealand example and abolish discriminatory fees for international students at postgraduate level. Some European countries (e.g., Germany) do not charge any fees for HDR students. Many countries (e.g., the USA in its long-term attraction of Asian students at HDR level) actually encourage international students through funding incentives. Again such schemes cannot be instituted by science faculties, or indeed the tertiary sector in Australia in general, owing to tightness in the budget situation in universities. Universities would need to be supplemented specifically for each and every international HDR student they enrolled.

Therefore, opening up an enhanced APA system to international students would enhance attractiveness of the Australian tertiary research training sector to international candidates, although the loss of this income to universities remains an issue.

Perhaps consideration might be given to moving to the North American system of institutionalising teaching roles for HDR students, especially those contemplating an academic career. For international students this will incorporate improvement to English – a problem noted above.

Design of HDR programs for international students needs serious evaluation – e.g., inclusion of coursework components, greater opportunity for employment skills training within HDR programs, variety of options (e.g., professional doctorates?).

3. Factors for graduates that determine pursuit of a career in research;

Lack of a long-term career structure is a significant disincentive. Among HDR graduates there is a perceived lack of opportunity for building a career. In particular the difficult of securing long-term grant funding is a major barrier, particularly in comparison with the support afforded medical scientists through the NH&MRC. This phenomenon may account for the difficulty in recruiting research-oriented scientists for academic posts – they have moved from research careers and moved into alternative career modes. Quite

obviously the first-hand observation of their own HDR supervisors and their travails must deter young scientists from pursuing research careers, especially in academia.

Career pathways being clearer and better remunerated would be an incentive. A guaranteed pathway immediately following PhD, by way of fellowship or other similar processes would help. In particular in-industry fellowships to encourage postdoctoral personnel to move into research-oriented positions in industry would enhance career pathways, improve industry-university collaboration and prepare graduating HDRs better for industrial research.

Another issue discouraging recent HDR graduates from pursuing research careers is the clear knowledge that NCG schemes are inadequately funded and heavily biased against early career to mid-career researchers.

4. Opportunities for career advancement for research graduates and staff;

We desperately need a more competitive and career focused research fellowship scheme in Australia. The Federation Fellowship Scheme appears to be close to running its course and few research scientists have succeeded in moving their careers to this level. ARC Professorial Fellows are rare and do not inspire people to stay in the research stream long term. While the Future Fellowship Scheme is a great idea, and signals an encouraging new investment in mid-career researchers, Australia still has too few post-doctoral positions for recent PhD graduates. Australia needs greater investment in post-doctoral opportunities. A parallel incentive for industry-based postdoctoral fellowships is also mentioned above (*Section B, 3*).

5. Factors determining pursuit of research opportunities overseas;

Most Australian researchers and academics are of the view that it is still highly desirable for Australian researchers to undertake research activity outside Australia. This should not necessarily be seen as a national cringe against our training quality and the situation in general but the poor state of our facilities and lack of opportunity may indeed be drivers. Nevertheless pursuit of research opportunities overseas should be seen as acquiring global skills. The graduates that we would want to pursue research careers in Australia will benefit from this overseas experience and generally are seen to be very strong and effectively competitive in the international marketplace. The problem is in getting these Australian trained scientists to return to Australia after experiencing the better facilities and support in a number of overseas countries.

Indeed, Australia will soon if not already, have to compete in an international market for excellent research staff and it would appear (see *Section B, 6* below) that Australia is becoming increasingly non-competitive.

6. Australia's ability to compete internationally for high quality researchers;

Australia is becoming increasingly non-competitive in recruiting high quality researchers. Whilst it would appear that the Federation Fellowship Scheme has met with limited success, reports from the science faculties across the country indicate that they are finding it increasingly difficult to recruit high quality, highly qualified overseas researchers. Indicators of this are the relatively higher levels on appointment scales and/or higher salaries that are required to hire applicants from overseas sources relative to the situations in their home countries. There is an increasing inertia for people to move from overseas and given our generally inferior infrastructure support this is becoming increasingly

difficult, particularly when start-up grants as large as $500k are offered to some academics in the USA.

Another more subtle factor is the increasing administrative and in some cases technical support duties being imposed upon research & teaching academics.

7. Whether Australia's academic workforce is ageing and its impact on research capacity.

Anecdotally, scientists have their most productive years early on in their careers, but act upon them later! Some of our most productive researchers are also amongst our oldest, so there is no issue *per se* with the age of staff, except that we must make sure that we have a balanced age profile. In fact the enhanced performance of a number of key academic researchers across the sector may be masking a decline in average performance across all universities. Nevertheless this ageing phenomenon will in the near future have a significant impact on research capacity

All data on the population distributions in the scientific academic workforce clearly show that this workforce is ageing. This is spread across the whole tertiary sector with many of the Universities that started in the late 60s early 70s facing staff turnover issues and the potential moving on of many experienced and excellent staff from younger universities to the older, generally more research-intensive ones exacerbating this effect.

Aging of academic staff and reduction of capacity in those approaching retirement will put stress on the ability of the Australian tertiary sector to provide sufficient research supervisors. This is exacerbated by the reluctance of academic staff to take on HDR students in the latter years of their careers (needing to have up to four years for supervision before retirement) and the congruent reluctance of HDR candidates to be supervised by such academics. Further losses to the research effort result from more mature researchers moving into administrative roles, driven in part by the paucity of accessible research funds. This phenomenon will increasingly exacerbate the shortages of supervisors created by the formal departure of the aging academic workforce, unless sufficient funding is provided to ensure vacancies are filled.

This ageing shift is coupled with unwillingness for younger graduates to enter the tertiary sector on the grounds of lower salaries and clearly deficient facilities and research-support systems.

The impact of the ageing phenomenon is really now just beginning to bite as the consequences of 20 years of neglect in the sector, both in terms of people and research infrastructure, become apparent.