

Trapped in the postdoctoral void: Lack of postdoctoral opportunities in New Zealand forces emerging researchers to exit science or seek employment overseas

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Introduction

For the recent conference ‘Do emerging scientists have a future in New Zealand’ organised by the *New Zealand Association of Scientists* (NZAS) on 16 April 2012, we presented a talk entitled ‘Trapped in the postdoctoral void’ to highlight the plight that faces most PhD graduates in New Zealand. The conference was organised in response to an open letter we drafted to the Ministry of Science and Innovation in September 2011 to voice our concern over funding changes that led to the reallocation of resources from the discontinued Foundation for Research, Science and Technology Postdoctoral Fellowship scheme to the Rutherford Discovery Fellowships. It was signed by 560 New Zealand researchers and catalysed a national dialogue on what the future holds for emerging researchers in New Zealand. Following this meeting, we were invited to write an article to express our concerns about the current New Zealand science system and suggest ways to improve the situation. While our concerns and suggestions are strongly relevant to the natural sciences, many apply to broader academia as well.

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Melanie Massaro received a BSc in biology from the University of Greifswald in Germany. In 2000 she completed her MSc at Memorial University of Newfoundland followed by a PhD from the University of Otago in 2004. Now working at the University of Canterbury School of Biological Sciences and Gateway Antarctica, her primary research interests are in contemporary evolution and behavioural plasticity in animal species under new environmental conditions. In conjunction with her research on endangered New Zealand birds, Dr Massaro runs a science communication project (www.blackrobin.org.nz).

Krithika Yogeewaran received a BSc in Botany and MSc in Plant Science from the University of Madras, and subsequently a PhD in Plant Biology from Cornell University in the US in 2005, researching genome evolution in plants. She arrived in New Zealand in 2007 as a trailing academic spouse and has worked at the School of Biological Sciences at the University of Canterbury intermittently since 2009 on fixed-term contracts as a lecturer teaching plant physiology, genetics and genomics. Dr Yogeewaran is currently researching the biochemistry and cell biology of lipotubuloids in *Ornithogalum* spp. as a research assistant at the University of Canterbury.



Amanda Black graduated from the University of Otago with a BSc in Geology and MSc in Environmental Science. After working for a few years in the public and private sector she returned to research and obtained a PhD in soil chemistry from Lincoln University. Dr Black is an independent postdoctoral fellow (Ministry of Science and Innovation Te Tipu Putaiao fellowship) hosted by the Bio-Protection Research Centre, researching the role of metal-dependent enzymes in carbon and nitrogen cycling.



The importance of postdoctoral training

Postdoctoral training is a crucial and necessary step in most researchers' career development and progression. Postdoctoral positions are typically fixed-term (usually 2–5 years) and often offer the first employment opportunity for aspiring researchers. Contrary to common belief, this apprenticeship period is no longer just 1–3 years post-PhD (Figure 1a). Nowadays, the postdoctoral period can span up to ten years (occasionally longer, Figure 1b). Researchers in many disciplines must undertake multiple postdoctoral positions before they have sufficient research experience and publications to be competitive for a permanent position in a university or research institute.

Postdoctoral training enables PhD graduates to hone and expand the breadth of their research skills and most importantly gain independence as a researcher. Many scientists conduct

Disclaimer

While the authors are currently affiliated with the University of Canterbury and Lincoln University, the views expressed in this article are their own, and do not necessarily reflect those of the institutions. The authors acknowledge that in the absence of statistical evidence, some observations made in this article may be anecdotal in nature and they may not necessarily apply universally to all research institutions in New Zealand or departments therein.

1a. Common belief



1b. Reality

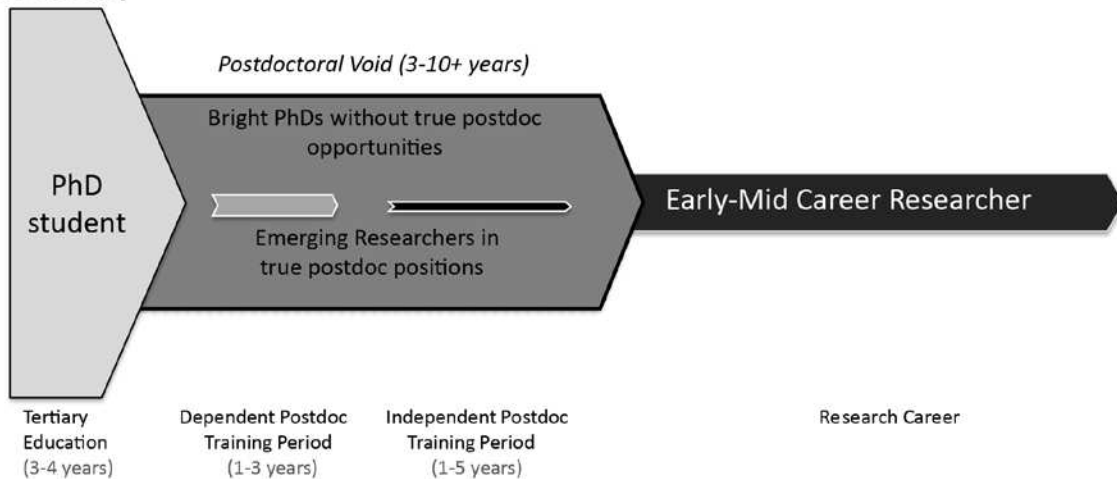


Figure 1. Education and Career Progression of a New Zealand Researcher.

1a. Common Belief

Following 3–4 years of doctoral training in the tertiary education sector, emerging researchers go on to undertake 1–3 years of postdoctoral training after which they transition into continuing, fulltime positions at academic or research institutions, or in the private sector.

1b. Reality

Today, thousands of PhDs are trained in New Zealand's tertiary education sector. However, after PhD completion, postdoctoral opportunities are highly restricted in number, scope and accessibility for New Zealand's PhDs. In order to successfully compete for limited continuing, fulltime research positions, emerging researchers need to have received quality dependent and independent postdoctoral training, and the lack of postdoctoral opportunities in New Zealand forces many talented emerging researchers to go overseas to remain in science.

some of their best research in their postdoctoral years because they have limited lecturing and administrative responsibilities and are likely to take a fresh approach to answering pressing questions. Furthermore, postdoctoral training provides an opportunity to develop valuable transferable skills that are beyond the scope of doctoral training in New Zealand, thus improving both academic and non-academic career prospects for PhD graduates. For example, researchers acquire important communication and management skills while providing hands-on student training and mentoring on behalf of full-time academics, whose time is consumed by other responsibilities. As such, postdoctoral researchers play a vital role in the education of postgraduate students by ensuring the quality of their training and the smooth operation of research laboratories within academic institutions, and hence, have been rightly described as the 'Invisible University' (Curtis 1969, Travis 1992, <http://harvardmagazine.com/2001/05/the-invisible-university.html>).

Dependent postdoctoral positions

Postdoctoral positions are of two varieties. Following the completion of their PhD, graduates typically seek *dependent* postdoctoral positions. A *dependent* position is funded through a grant (e.g. Marsden, Ministry of Science and Innovation,

etc.) that has been obtained by a senior researcher/principal investigator (PI). The research that is carried out by a *dependent* postdoctoral researcher is therefore strongly determined by the PI's interests and research focus. Moreover, the PI leads the research team and controls the budget for the project. This type of postdoctoral opportunity will provide the emerging researcher with enhanced research skills, publications, networking and mentoring opportunities and is especially important for recent PhD graduates.

Independent postdoctoral positions

The other type of postdoctoral opportunity is an *independent* fellowship. In contrast to *dependent* postdoctoral positions, *independent* fellowships, such as the former New Zealand Science, Research and Technology (FRST) Postdoctoral Fellowships, fund the postdoctoral fellows directly. Although a senior researcher acts as a 'mentor', the *independent* postdoctoral fellow conceives the research ideas, executes the project independently and is responsible for overseeing the research budget. So, in addition to the advantages offered by *dependent* postdoctoral positions, *independent* postdoctoral fellowships allow emerging scientists to gain leadership and management skills and to develop a research programme that is their own. Having at least

2a



Figure 2 (above and opposite). *The Amazing New Zealand PhD Machine and New Zealand's Postdoctoral Void.*

(Illustrator: Krithika Yogeeswaran)

2a. The promise

The lure and hype of tertiary education draws many into 'The Amazing New Zealand PhD Machine'.

2b. The slog

New Zealand PhDs get turned out in large numbers and the government rewards universities accordingly. Full of dreams, these emerging researchers are unaware that the 3–4 year 'PhD incubation period' in New Zealand is insufficient to compete with their international peers.

2c. The reality

Welcome to 'New Zealand's Postdoctoral Void'. A few lucky PhDs get scarce postdoctoral fellowship opportunities in New Zealand and are still poorly prepared to compete with those receiving training abroad for limited academic jobs. Some leave New Zealand in order to stay in science. Many circle endlessly on the infinite loop of fixed-term contracts, providing meaningful support to academia but with poor career progression prospects. Some disappear into the abyss as overqualified and unemployed dead capital. Some crawl out and seek alternative career paths leaving science and research altogether.

one *independent* postdoctoral opportunity strongly positions an emerging researcher for academic job success and is clearly a logical second step following a *dependent* postdoctoral position in the sciences.

We strongly believe that both types of postdoctoral opportunities are equally important in a young investigator's training and that they are essential steps in the successful career progression of New Zealand PhDs into permanent research positions.

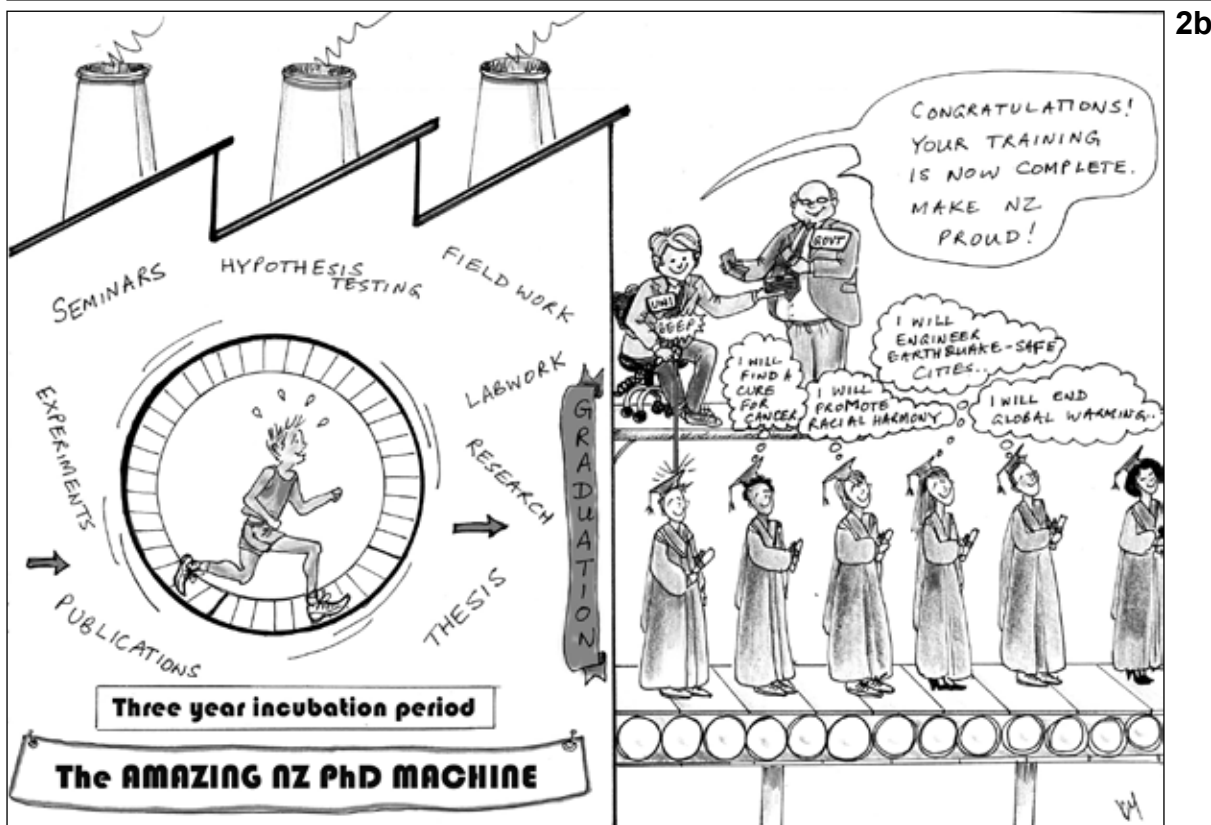
Problems in the New Zealand science system and potential solutions

Problem: Oversupply of PhD graduates and the erosion of quality teaching

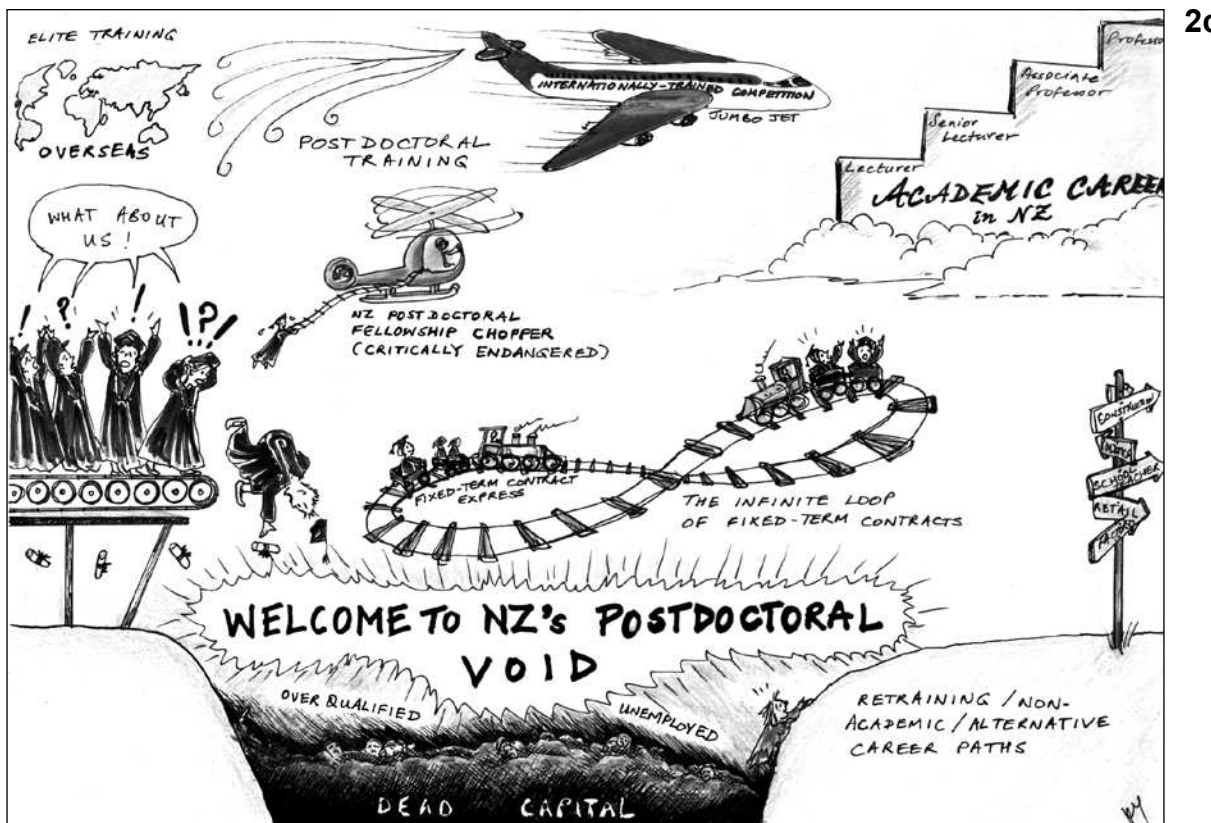
New Zealand universities train thousands of PhD graduates annually, well beyond the number required to fill future positions in universities, research institutes and the private sector, and the number has been steadily rising (New Zealand Ministry of Education data). In 2010, 7,916 students were enrolled in a doctoral programme at a New Zealand University, and of those, 5,120

were domestic students (New Zealand Ministry of Education data). Although supply has far outstripped demand, New Zealand universities continue to encourage more students to enrol in doctoral programmes (Fig. 2a). Financial reasons appear to drive this trend. In addition to a student's tuition for the 3–4 years that it takes to complete the PhD, universities receive considerable funding from the government. For each year the student is enrolled, the hosting university receives a Student Achievement Component, which is currently NZ\$8,189–26,154 /year for up to four years, depending on the field of study (<http://www.tec.govt.nz>). Additionally, universities receive a bonus payment via the Research Degree Component of the Performance-Based Research Fund (PBRF), currently ~\$45,000/student spread over three years, once the student completes a PhD (PBRF-2009 Annual Report; Prof. Paula Jameson, pers. comm.). These financial incentives fuel 'the Amazing New Zealand PhD Machine' (Fig. 2a and 2b).

The logic behind these well-intentioned government incentives is that a highly educated population will drive New Zealand's economic growth and prosperity. However, the focus of



2b



2c

these on quantity, producing as many PhDs as possible, rather than quality, is deeply misguided and at the expense of students. Prospective doctoral students are not presented with the fact that job prospects for careers in science – including those in the private sector – are dismal in New Zealand. Instead they embark on a journey through the ‘Amazing PhD Machine’ without ever realising that they could work extremely hard (Fig. 2b) and still end up in the void that follows doctoral training (Fig 2c).

These government schemes, through which universities are funded depending on student numbers, are problematic not only because they create an oversupply of PhD graduates, but also because they indirectly compromise the standards of teaching and training. Who educates the growing number of PhD students in New Zealand? While the number of doctoral students has almost doubled, from 4,263 students in 2003 to 7,916 students in 2010 (New Zealand Ministry of Education data), the number

of academic staff has not increased accordingly. Because of these financial incentives, university management exerts pressure on faculties to accept a growing number of PhD students into their research groups. Concurrently, the number of postdoctoral researchers, who provide much of the hands-on advice to students, has been declining (Ministry of Science and Innovation). Once again, the 'Amazing New Zealand PhD Machine' is working at the expense of emerging scientists. It creates an oversupply of PhD students, who do not necessarily receive the best possible education and training to ensure that they will be competitive when applying for limited job opportunities. After all, it is the skills that PhD students obtain during their training – not the PhD title – that empower graduates to get jobs.

The disparity of PhD graduate numbers compared with actual job opportunities is not only a problem in New Zealand but is prevalent in many countries (Cyranski et al. 2011; <http://www.economist.com/node/17723223>). Some international scientists have gone so far as to call for a complete reform of their current PhD system (Cyranski et al. 2011; Taylor 2011; McCook 2011). Some countries have recognised that too often PhD graduates leave universities without the right skills to allow them to obtain jobs beyond academia. Hence, governmental science funding bodies have created training centres. Examples include the UK Doctoral Training Centres, and programmes such as the US Integrative Graduate Education and Research Traineeship and the Canadian Collaborative Research and Training Experience Program. These train students in interdisciplinary skills, providing them with a unique but wider set of transferable skills that students can apply in a range of different jobs (McCook 2011; Cressey 2012). We believe that New Zealand would similarly benefit from a careful review of its current tertiary education policies and university operations.

Solution: Suggestions for reform

Universities need to start focusing on the quality of training, not the quantity of students, because lowered standards devalue New Zealand degrees. The role of the government is to kick-start this reform process by rethinking the current funding system for universities and shift support from quantity policies that reward student number and retention, to quality policies that support high-calibre, broad knowledge-based, interdisciplinary training of students and their successful transition into productive careers that benefit New Zealand's economy. After all, this is the ultimate objective of the investment of taxpayer dollars into tertiary education. The current PhD system is not sustainable, and unless universities start focusing on quality education, New Zealand universities will not be able to compete in a world where online education from high-ranking universities across the world is becoming increasingly accessible.

Accreditation

According to the Council for Higher Education Accreditation (USA), 467 government or independently-run, quality assurance and accreditation agencies currently operate in 175 countries and offer accreditation to degree programmes that uphold and maintain high standards (<http://chea.org/intdb/list.asp?key=c>). Accreditation of degree programmes in New Zealand by reputed international accreditation agencies, or by a newly formed New Zealand accreditation agency, is one strategy to help ensure the maintenance of high standards of degree programmes and courses on offer at New Zealand universities. Such accredited degree programmes would attract bright local and international

students and improve their career prospects, by assuring prospective students and future employers of the quality of the education they will receive.

Interdisciplinary and transferable skills training

New Zealand universities are increasingly run like businesses, with colleges, schools and departments competing for limited resources within universities. This forces departments to encourage their students to enrol in courses or programmes within, rather than between departments/colleges. Encouraging students to freely access programmes between departments and learn directly from the best local expertise available would provide them with a quality-assured, stronger and wider knowledge base, and challenge them to look at scientific problems from a variety of angles. For example, coupling PhD training in the sciences with business management for a PhD–MBA degree would provide graduates with a larger set of transferable skills and with the necessary entrepreneurial skills to successfully build start-up companies. Introducing more structured interdisciplinary PhD programmes, in line with current and future needs of New Zealand's economy, may catalyse the kind of innovative start-up culture that could help foster a knowledge economy.

Additionally, all PhD students would benefit greatly from comprehensive courses in writing, statistics and communication, which are valuable skills that are important for success in academia and are transferable to a wide array of alternative career paths. Standardised cross-disciplinary offerings of such courses in our PhD curricula would enhance vastly our students' career prospects.

These approaches enable efficient and optimal utilisation of universities' vast intellectual resources and ensure a vibrant cooperative interdisciplinary environment within universities. Tertiary education providers in post-earthquake Christchurch are currently presented with a unique opportunity for reform. Introducing interdisciplinary programmes would (i) ensure the quality and diversity of programmes on offer and (ii) benefit students' long-term success far more effectively than the systematic axing of programmes with low student numbers. Moreover, it would create a university that is simultaneously robust and adaptable to changes in the real world.

Provide incentives to universities to offer postdoctoral training

It is necessary to recognise that the completion of a doctoral programme is only the first step in the education of an emerging researcher, and postdoctoral training is an important second step. To ensure that more of our brightest emerging scientists can complete their training in New Zealand and be competitive for local and international jobs, government incentives for PhD graduates should be extended to cover postdoctoral opportunities. This would shift the focus to producing high-quality graduates with a full skill set to make them truly job-worthy. At the moment, the government funds universities to train thousands of PhD students, while in contrast, they support only a few hundred postdoctoral researchers per year (323 in 2009/10, see Table 1) and sadly even this number is steadily declining [Dr Prue Williams' presentation at the NZAS conference(<http://scientists.org.nz/files/posts/admin/Williams-NZAS%202012.pdf>)]. This imbalance could be addressed by re-directing some of the governmental funds currently provided to universities for doctoral students towards the training of postdoctoral researchers. This would provide a financial incentive for universities and research

institutions to create and support more postdoctoral employment opportunities, both benefitting emerging scientists who seek post-PhD employment and PhD students, who will receive more hands-on mentoring by postdoctoral researchers.

Problem: Disincentives for creating and maintaining dependent postdoctoral positions

Today, *dependent* postdoctoral opportunities in New Zealand are limited in number (~140 in 2009/10, see Table 1) and scope as they are not equally accessible to all bright PhDs. Due to a number of disincentives, *dependent* postdoctoral opportunities are heavily restricted to grant and resource-rich research groups in a few areas of specialisation, thus hindering the prospects of career advancement for many bright New Zealand PhDs.

High overheads on postdoctoral salaries

One of the main obstacles to overcome when trying to create postdoctoral positions in the current New Zealand science system are large institutional overheads charged on the salaries of postdoctoral researchers. These overheads have fluctuated over the last several years and currently range between 70% and 120% depending on the research institution and the funding source. Principal Investigators (PIs) who wish to incorporate a postdoctoral researcher as part of a project have to find ~NZ\$60,000/year to pay the postdoctoral fellow and an additional ~NZ\$42,000–72,000/year to pay institutional overheads. This cost of ~NZ\$102,000–132,000/year to employ a single postdoctoral researcher is a sum that is equivalent to an Associate Professor's salary. Since research funds are often limited, PIs simply cannot afford to include a postdoctoral researcher on their grant application, because it would leave insufficient funds to conduct the research itself. This disadvantage is most strongly felt by laboratory-based sciences where experiments require expensive equipment and reagents. Including a postdoctoral researcher on a Marsden grant at 0.4 FTE or less – usually an affordable option within a grant budget – would only cover their salary component but not the overheads. Therefore, this is rarely an avenue supported by Heads of Departments and host institutions. In contrast, PhD students only cost ~NZ\$25,000/year on a project and no overheads; hence PIs can theoretically include up to five PhD students for the price of one postdoctoral researcher in a grant application.

Solution

While we understand that there is a cost to including and housing a postdoctoral researcher in an institution, we believe that the current overhead charges on postdoctoral salaries are disproportionately high and should be brought down. Postdoctoral researchers are charged the same amount of overheads as continuing staff, although they do not receive the same level of support from institutions in terms of office space, resources, access to internal funding (capital expenditure funds, etc.) and support from technical staff. Transparency and detailed accounting of the costs involved to house a postdoctoral researcher, including potential interdisciplinary differences in costs, should help resolve this issue. Funding bodies can further encourage transparency of overhead costs by simply capping the amount of overheads that can be charged on postdoctoral salaries unless institutions provide detailed proof to the contrary.

Reducing overheads on postdoctoral salaries will empower all PIs to include postdoctoral researchers in their groups, providing quality assurance to their PhDs in training and postdoctoral opportunities for bright New Zealand PhD graduates. Moreover, from a broader perspective, it will encourage science diversity that will drive innovation and entrepreneurship across disciplines, overall leading to a balanced and healthy New Zealand science system.

Misuse of the Performance Based Research Funding Rankings

PBRF has been around for more than a decade, and this year's round (2012) will be the third assessment of academics' individual research gains and highlights over a 6-year period.¹ The resulting assessment divides an individual's research efforts into three categories – research outputs (ROs), peer esteem (PE), and contributions to the research environment (CRE) (Cupples & Pawson 2012). These categories form the basis of individual academic rankings of an A, B or C in the research active category, or R denoting research inactivity. It is the sum of these individual scores that determines the level of funding universities will receive from government via the Tertiary Education Commission (TEC). The New Zealand PBRF system has

¹ See <http://www.tec.govt.nz/Funding/Fund-finder/Performance-Based-Research-Fund-PBRF/>

Table 1. Number of postdoctoral positions (full-time equivalents) from 2006 to 2009.

(Reproduced with permission from the Ministry of Science and Innovation.)

Funding source*	2006/07	2007/08	2008/09	2009/10
FRST	263	258	207	181
HRC	55	69	74	72
RSNZ	67	59	64	70
TOTAL	384	386	345	323

*FRST – Foundation for Research, Science and Technology. (Please note that the FRST Fellowship scheme provided support for independent postdoctoral fellows and was axed in 2010, hence from 2010 to 2013 the number of postdoctoral researchers on the scheme is expected to reduce to 0.)

HRC – Health Research Council of New Zealand. (Provides dependent postdoctoral support through grants to medical researchers and ~4 independent fellowships to support research into Māori and Pacific Islander health issues.)

RSNZ – Royal Society of New Zealand. (Provides dependent postdoctoral support indirectly through Marsden Grants to academic researchers, and more recently through Rutherford Discovery Fellowships and independent postdoctoral support directly through 2–4 Royal Society of New Zealand Postdoctoral Fellowships.)

many similarities to the preceding British Research Assessment Exercise (RAE), which was subject to much criticism and has since been replaced with the Research Excellence Framework (www.ref.ac.uk). Because the amount of funding received by New Zealand universities through PBRF makes up a substantial amount of revenue, there is considerable pressure from university management to maximise research outputs to gain the highest collective ranking possible.

Any researcher within a university who produced fewer than four publications within a 6-year assessment period is rated 'research inactive' (R). To maximise their overall ranking, some universities choose to penalise their departments for any staff that rank R. However, many new researchers in New Zealand do not have uninterrupted employment during these 6-year evaluation periods and they may have had one or several fixed-term positions that may not even be full-time (< 1.0 FTE, see page 38). Therefore, it is not surprising that some emerging researchers may struggle to produce the necessary output to earn a C rank. Nevertheless, according to the current rules, emerging researchers have to be included in the PBRF assessment. While PBRF recognises that career breaks may occur in the postdoctoral period and have introduced a special category of research inactivity for these cases, institutional policies to charge departments for their R-ranking emerging researchers are still in place. In some disciplines, even postdoctoral researchers with continuous, full-time employment are unlikely to have an extensive publication record, and therefore, may find it difficult to rank higher than a C. Hence, in the current system, departments have adopted tactics that increasingly deny employment to emerging researchers, even those with a potential C ranking, as there is the real risk of financial penalties in the form of decreased revenue. Sadly the PBRF system is becoming more the default measure of employability within universities, and universities are ignoring their wider moral obligations to foster and train emerging researchers beyond the PhD.

Solution

The PBRF scheme rewards longevity, thus there is no real benefit to postdoctoral researchers and researchers on fixed term contracts to undertake this assessment. Consequently postdoctoral researchers and fixed-term contractors should be excluded from direct assessment. Instead, any research output generated by postdoctoral researchers, and their contributions to the research environment (student mentoring, laboratory management), should be recognised, and gain reward for the host department. Just as universities receive a bonus payment via the Research Degree Component of the PBRF, the government could introduce a Research Apprenticeship Component that provides universities with funds for postdoctoral researchers that complete their training. Such an Apprenticeship Component may encourage universities to create more postdoctoral opportunities.

Problem: The lack of independent postdoctoral fellowships

A country's wealth and success increasingly depends on its ability to train, attract and retain quality individuals in every level of the Research and Development chain. The loss of postdoctoral fellowships is a significant break in this chain.

(Professor Geoff Chase, University of Canterbury)

The axing of the single major source of *independent* postdoctoral funding (the *FRST Fellowships*) in 2010, has dealt a severe blow to the number and quality of career research scientists that can complete their training in New Zealand. These FRST fellowships provided grants to early career researchers (0–5 years post-PhD), allowing these scientists to bridge the gap between PhD completion and permanent positions of employment (Dr Prue Williams, pers. comm.). These fellowships provided the fellow's salary and some research funding (~ NZ\$29,000 per annum) for a period of three years. Promising New Zealand PhD graduates were awarded these fellowships to develop their own research interests and gain leadership skills, making this one of the best, forward-thinking postdoctoral schemes. Since these fellowships were only available to researchers with New Zealand citizenship or permanent residency who did not have permanent employment, they also provided fixed-term employment to emerging researchers. At the time of discontinuation of this scheme, the Foundation supported 181 fellows (Table 1). The majority of the funds that were used to support the FRST postdoctoral scheme were diverted to the Rutherford Discovery Fellowships, which do not support postdoctoral researchers to the same extent (see below).

With the last of the FRST fellows running out of support this year, New Zealand will have effectively reduced the number of *independent* postdoctoral fellows in training to only a handful per year. The remaining *independent* fellowships are financed by the Rutherford Foundation and administered through the Royal Society of New Zealand (New Zealand Postdoctoral Fellowships, offering two years of support to 2–4 fellows/year), and the Health Research Council (offering ~4 *independent* fellowships/year to researchers working on Māori and Pacific Islanders health issues). This severe bottleneck curtails the academic career prospects of the majority of New Zealand PhD graduates. Most emerging scientists, including the best and brightest, are forced to emigrate in order to pursue a career in science or re-train for alternative career paths (Fig. 2c) unless this problem is addressed.

Solution

There is an urgent need to support and establish more *independent* postdoctoral schemes that focus on the quality of the applicant and their potential to contribute meaningfully to New Zealand science. *Independent* postdoctoral positions enrich the science sector, because they allow the creation of innovative and novel research avenues that will benefit New Zealand significantly in the future. Funding to create new schemes must come from the government, institutions and the private sector. Creative strategies can also be employed to ensure that postdoctoral researchers are absorbed effectively into the workforce after training. For example, to train leaders in research and development, New Zealand companies should think about investing in *independent* postdoctoral schemes that will enable bright PhD graduates the opportunity to train effectively at research institutions, in exchange for their commitment to work in their companies for a fixed period of time.

Problem: Repercussions of the Rutherford Discovery Fellowships

The Rutherford Discovery Fellowships (RDFs) were created with an aim to *attract and retain New Zealand's most talented early to mid-career researchers and encourage their career development by enabling them to establish a track record for*

future research leadership (Proposal Guidelines for Applicants, Rutherford Discovery Fellowship 2011). The formation of this fellowship scheme was driven by an independent review that found a gap in support for emerging researchers three years after PhD completion (misleadingly referred to as the ‘post-’ postdoctoral problem, see Fig. 1, <http://www.morst.govt.nz/Documents/consultations/Deloitte-MoRST-Support-evaluation.pdf>). The RDFs provide five years of salary (\$70,000–90,000) and research funding to 10 recipients per year, and afford the opportunity to relieve fellows of any teaching and administrative duties during the fellowship period so that they can focus solely on research. In its original format, the fellowship was open to all New Zealanders 3–10 years after completion of their PhD, regardless of their current job status and as long as a New Zealand host institution was willing to support their application, and it stipulated that the fellow needed to be permanently employed by the host institution once the fellowship concluded.

Although not explicitly intended as a postdoctoral scheme, this fellowship has the potential to create employment for New Zealand PhD graduates by creating an *independent* postdoctoral opportunity directly through the fellowship, and indirectly by hiring a fixed-term lecturer to take on the teaching duties of a Rutherford Discovery Fellow. However, the reality is that this well-intentioned scheme has some serious repercussions for postdoctoral researchers and the New Zealand education and science system.

Postdoctoral researchers cannot compete for Rutherford Discovery Fellowships

Since the original version of the RDF required its fellows to have permanent employment in their host institution at the end of the fellowship, resource-tight universities were more likely to support researchers that already held permanent fulltime academic jobs. Supporting their employed academics meant that universities would receive their salaries from the government for five years with no additional burden upon completion of the fellowship. However, to support a postdoctoral researcher it meant that after the completion of the RDF, universities would have to create a full-time permanent position for the candidate at considerable cost. Hence, it comes as no surprise that very few postdoctoral candidates were able to apply for the RDFs in the last two rounds, due to lack of host institution support. To date, of the 20 successful Rutherford Discovery Fellows, 16 already held permanent full-time positions at New Zealand institutions at the time they applied, while only 4 candidates were either brought back to New Zealand and/or did not have a permanent academic job at the time of application (<http://www.royalsociety.org.nz/programmes/funds/rutherford-discovery/>). If the objective of this scheme is to attract and retain New Zealand’s most talented emerging researchers and encourage their career development, why are researchers that have already secured permanent positions in New Zealand universities eligible to apply in the first place? After all, these researchers have already succeeded in securing permanent positions and winning grants to support their research, and therefore they have the least incentive to leave New Zealand.

It is unlikely that the original review that pointed to a gap in support for emerging researchers (<http://www.morst.govt.nz/Documents/consultations/Deloitte-MoRST-Support-evaluation.pdf>) was referring to this small minority of researchers who

have already transitioned into permanent research jobs. These researchers have successfully emerged from the gap and already have access to many departmental, university, and government incentives (Marsden fast-start grants, Otago Research Grants, etc.) to support their career development. However, there are ever-increasing numbers of talented young researchers trapped in New Zealand’s postdoctoral void (Figures 1b and 2c). These researchers have poor prospects for decent-paying research opportunities that allow them to transition into fulltime research jobs (see page 38). This is the group of emerging researchers most in need of support and opportunities.

Solution

Five-hundred and sixty researchers voiced their concerns about the RDF scheme through an open letter to the Ministry of Science and Innovation in September 2011. In response to our letter, a review of the RDF scheme was held earlier this year leading to some minor changes in the rules. In this year’s round, only applicants 3-8 years post-PhD can apply and the requirement for host institutions to permanently employ RDFs at the end of the five-year period was dropped. Unfortunately, these changes do not address the needs of those most desperate for support. One way to ensure that talented researchers escape the void is by restricting the fellowship to candidates without permanent fulltime academic jobs in New Zealand.

Other negative effects of the Rutherford Discovery Fellowship scheme

One of the issues highlighted during the recent Ministry of Science and Innovation review of the RDF scheme was that university departments with significant financial constraints re-distributed the fellow’s teaching and administrative duties to their colleagues (Dr Prue Williams, pers. comm.). The current RDF scheme works at the expense of other permanent staff who must absorb the extra teaching duties, thereby impeding productivity of those staff and creating inequality in these departments hosting Rutherford Discovery Fellows. In addition, the RDF scheme risks the lowering of teaching standards by relieving bright permanent academic staff from their teaching duties. Fellow academics selected to fill the teaching gap may not have the necessary expertise or time to invest fully into teaching these extra courses. Shouldn’t the best young academic staff teach our future researchers? After all, this is what students pay to receive – the best education available.

In some cases, fixed-term lecturers have been hired to fill the teaching gap and this has mitigated these problems to some degree. In theory, these fixed-term positions create employment opportunities for New Zealand PhD graduates, but in reality, internationally trained applicants frequently outcompete nationally trained researchers, further highlighting the need to increase the quality of training in New Zealand.

Solution

To address all the aforementioned problems, it might be worth considering splitting the funding for the RDFs into two separate schemes. The majority of resources for salary and funding can be devoted to creating meaningful *independent* employment opportunities for more than just 10 promising candidates 3–10 years past their PhD without permanent employment in New Zealand. The remainder of funds can be used to create an honorary recognition for talented early career academics with permanent employment in New Zealand.

Problem: Fixed-term contractors – the growing postdoctoral underclass

The number of postdoctoral opportunities in New Zealand has always been limited. However, the concurrent trends of a growing number of PhD graduates and a declining number of postdoctoral opportunities have worsened the problem of ‘New Zealand’s postdoctoral void’ by several orders of magnitude. Thousands of talented PhD graduates wanting to contribute to science are left without any prospects of securing postdoctoral positions, academic jobs, or even jobs in the private sector. What happens to those in the postdoctoral void?

In order to keep their foot in the door, many choose to accept fixed-term contracts to lecture or work as research assistants on various projects. The funding for these types of positions comes from a variety of sources (Marsden buy-outs, institutional buy-outs, small grants, etc.). While some fixed-term contracts are full-time, of reasonable duration (one or more years) and provide favorable salaries (NZ\$40,000+), many of these contracts only offer part-time and short-term (<1 year) employment. Many contractors only earn ~ NZ\$5,000–20,000 /year – less than a PhD scholarship. A fixed-term lecturer is paid the equivalent of a day’s worth of lecturer salary (~ \$250) per lecture delivered and is generally contracted to teach a fixed number of lectures. A research assistant with a PhD will be paid for a fixed number of hours (depending on the amount of money available) at a rate of NZ\$25–29/hour. For a fixed-term researcher/lecturer with research career ambitions, these opportunities are taken in the absence of proper postdoctoral positions. To make the most of these opportunities, contractors often invest many unpaid hours to update and develop innovative curricula for the courses they teach or to push their research contributions to the point that they can publish. Hence, they provide quality teaching and research for the institution at a fraction of the cost of a true permanent academic or postdoctoral researcher. But for young scientists, these contract jobs seldom cover the household bills or offer sufficient training, and provide only a limited scope for career progression and improvement. Very few PhD graduates on the endless loop of fixed-term contracts are successful in eventually transitioning into full-time positions, regardless of their talent and potential. Instead, they form the growing underclass that has developed from the postdoctoral void, providing meaningful contributions and support to academia and full-time academics at the expense of their own careers. Soon fixed-term contract work may be the only post-PhD experience available in certain fields. As more and more PhD graduates are turned out, the supply of this cheap labour force will only increase – who will look out for their interest?

Solution

While it is clear that all PhDs and postdoctoral researchers cannot expect to secure fulltime research positions, there is still a need for quality support at all research institutions, as highlighted by the number of fixed-term contract workers. In some institutions, research support positions like technicians, laboratory managers and tutors exist, but having a PhD may be considered an over-qualification for these more secure jobs with clear career-progression pathways. This should not be the case, and PhDs ought to be considered seriously for these jobs. In other countries, ‘research associate’ positions exist, with responsibilities to support research at the institution. Unlike fixed-term positions, these positions are long-term and come

with benefits and better pay, providing better job security and alternative career paths for qualified PhD graduates. Incentives that encourage research institutions to allow high-quality fixed-term staff the opportunity to transition into such research-associate positions would be beneficial for the career prospects of PhD graduates and would allow these highly trained individuals more meaningful opportunities to do what they have been trained to do for a living.

Summary and Conclusions

Postdoctoral training is an important intermediate step bridging the completion of a PhD with securing a long-term job. Postdoctoral researchers play a crucial role in training students and are a key component of a thriving research community. The current state of affairs in the New Zealand science system is cause for much concern, with universities training ever-increasing numbers of PhD students and all research institutions supporting declining numbers of postdoctoral positions. The increasing production of PhD graduates is an international phenomenon, creating a worldwide problem of insufficient research jobs for a growing number of emerging scientists. However, the alarming reduction in postdoctoral training opportunities is unique to New Zealand and is highly detrimental to the career progression of bright emerging researchers. Both trends appear to be strongly driven by financial motivations. This pattern leads to an erosion of quality tertiary education that will be unsustainable in the long-term.

We have made several suggestions that could help alleviate this imbalance through reform of New Zealand’s tertiary education system and changes to current funding models. Urgent support is required for strategies and initiatives that will help:

- Focus on production of quality PhDs in New Zealand that are highly competitive for limited job opportunities, and assist them in the successful transition into academic and non-academic career paths,
- Remove the financial disincentives for creating and maintaining postdoctoral positions in New Zealand, and
- Increase the number, quality and types of postdoctoral opportunities in New Zealand, allowing talented PhDs of all specialisations to gain the full spectrum of postdoctoral training in New Zealand to be job-worthy.

If the science community is to thrive and New Zealand is to be ‘*the place where talent wants to be*’ (the late Professor Sir Paul Callaghan, McDiarmid Institute), then the New Zealand government and institutions need to recognise that postdoctoral researchers are a valuable asset to the tertiary education sector and are worth investing in. Concomitant with improvements in training, importance must be given to teaching widely transferable skills that can ensure effective transition to employment of our educated youth in a manner that will best benefit New Zealand’s economy.

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