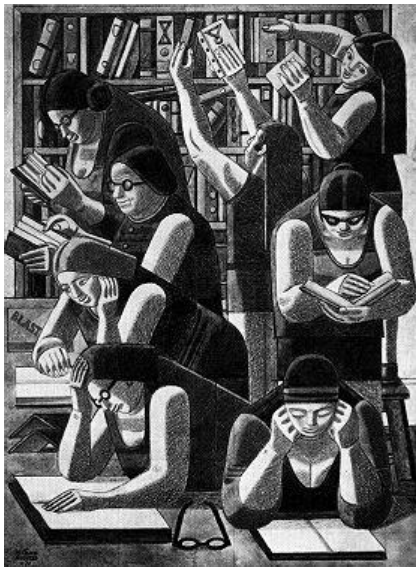




**BUILDING RESEARCH CAREERS –
THE POSTDOCTORAL EXPERIENCE**

PROCEEDINGS OF A SYMPOSIUM



4TH / 5TH MAY 2005

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Introduction

Over the last decade, the Irish university research system has been revolutionised. Massive investment in buildings, equipment and people have transformed university campuses and filled research laboratories and libraries with young researchers not only from Ireland, but from across the World. In a sense, we are regaining a position not seen in Ireland since the C8th – for a thousand years.

But rapid growth brings its own challenges –three of which are particularly relevant to postdoc research and their associated careers.

- Most obviously, literally thousands of new researchers from Doctoral and Postdoctoral to Principle Investigator and Professor level are engaging in, for Ireland, new activities in which the ground rules and relationships of authority, status and career are still ill defined.
- In addition, when large amounts of public money are provided, there is nowadays an absolute expectation of efficient, effective and transparent administration. Yet such accountability structures may seem to hamper the speed and flexibility needed in research – and even to challenge the traditional independence of the universities.
- But there are yet deeper issues. The role of the university is changing in society and in the economy. And this is a global phenomenon. The Irish Government is investing in university research in a belief that the investment will help to sustain Irish economic and social development: advancing the boundaries of knowledge would not be an argument understood by many Government Ministers.

To address these issues at the postdoctoral level, the Conference of Heads of Irish Universities brought together senior researchers, policy makers and administrators along with postdoctoral researchers themselves to debate the future requirements and reforms needed in the Irish Postdoctoral system. This symposium, *Building Research Careers: The Postdoctoral Experience*¹, is in direct response to recommendation in recent reports including the OECD Review of Higher Education in Ireland and Building Ireland's Knowledge Economy.

The formal objectives of the symposium were:

- To explore the role of the postdoctoral researcher, and its place in the development of a research career,
- To identify the current strengths and weaknesses of the postdoctoral system – and to make recommendations to improve it.

¹ The Doctoral Researcher has been the focus of a similar CHIU symposium. The proceedings are to be found in CHIU, (2004), "The Future of the PhD in Ireland: Excellence in Research – Quality in Training", Conference of Heads of Irish Universities, Dublin.

The Future Shape of the University

All national university research systems are different, have different administrative systems and different possibilities in terms of the postdocs' careers. There are very broad and open choices to be made in Ireland as we start to shape our own universities and research structures. And it is useful to explicitly and consciously draw out these choices and their possible implications for researchers and their careers.

To help examine these choices, we sketch, rather crudely, four different images of Irish universities. In truth, of course, they are not separate universities but can be already found as elements within all Irish universities, even Departments, possibly even individuals, coexisting more or less peacefully yet struggling for recognition and funding for their own approach.

The World-Class Research University.

- Scholarship and research excellence must be prioritised and all else will flow from this. The time for research, either at a doc or postdoc level is simply too short to have periods in industry or prolonged or peripheral formal training courses or other non-core activities. Researchers are clever people – they will learn it, *if* it is important. The final judgement is publications – in proper journals, competitive research contracts and a professorship – in a *real* university. Only the best (like me) deserve to survive – those of a lesser God will go elsewhere.
- **For the postdoc:** Loyalty is to 1) the research project, 2) the research group and 3) the global specialist community. This triumvirate provides “researcher identity” and the rest of the world doesn’t matter too much. Working conditions are not seen as key issue – unless the PI is truly awful or the research project is weak / not proper science. “Learning-by-doing” training covers all - from research techniques to proposal writing. And Career Prospects²? Specialisation is emphasised as essential in developing original thought and the objective is a tenured academic position or another postdoc position. But if you are out of Ireland, in a Max Planck or even Stanford – that

Different University Traditions

University research across the world has very different traditions and heritages.

- The French Grandes Ecoles have strong Napoleonic roots, while universities can be relatively local. After WWII, the French research developed most strongly through the CNRS as a branch of centralist government with implications for administration and careers and has only recently started to fully integrate with the university system, which itself has a civil service career structure.
- Germany, widely recognised as primogenitor, during the early-mid C19th, of the modern PhD and research university, saw research develop in independent locally oriented universities often with links to industry.
- The US, despite the early imitation of Germany research through establishing Johns Hopkins, developed, initially, at least, the more English “amateur / gentleman scientist” approach in the private university sector supplemented by the Land Grant Colleges in the public sector. However, from WWII, onwards the US university research system became well funded, fiercely competitive and market driven, receiving major research funding from both government and industry.
- At the same time, the UK has similarly moved from a small scale, gentleman-scientist approach to a highly competitive, if not as well funded, basis - but through the Research Assessment Exercise as the main financial allocative mechanism rather than the market.

² As a well known academic was informed about tenure in Harvard Medical School “This is a School not a Home”.

can be tricky³. If you are in the University of East England, you can probably forget it. And if you don't get the post - then the University of Wolverhampton, Mullingar or North Dakota might be a possibility, though there are many fresh-faced Docs trying to get in there too. Of course, employment outside academia might be tricky too – you are so specialised – and now you are so old – especially if you took that second post-doc position – but you knew the risks all along. Anyway there is always contract researchers needed somewhere⁴.

The Progressive Research University.

- The nature of research is changing. The proportion of straight physics or chemistry in *Nature* and *Science* is now small and still falling. And there is even blurring between the physical sciences and social sciences: witness environmental sciences and health sciences. Interdisciplinary research needs far greater support – it is much more effective in both scientific discovery and in innovation. University structures have compartmentalised knowledge – they have frozen it as it was in the late C19th. But we in interdisciplinary research are making the changes. Of course, there will still be a core discipline and a core research area, but now courses and possibly additional input/supervision will be provided from other Departments – possibly, even other Institutions. Of course, it is (usually) recognised that establishing “quality” and achieving university recognition and rewards (employment) is – at least initially – more difficult. But world-class publications are still the goal. .
- **For the postdoc** Loyalty is now less to the “research area and research tools” and moves to what might be characterised as the much broader “research field and research approaches”. The feeling of fellowship is, of course, still to the research group but now this research group is unlikely to be within one room or one laboratory and will probably extend to other Departments and possibly even outside the university. There are, often, still good postdoc and academic career prospects. However, some of the university structures you will have to deal with might be a bit “shaky”: inter-Departmental structures, even inter-faculty or, worse, still inter-University. Funding structures for longer term interdisciplinary work might not be so clear and the proportion of “soft” funding might be high. And an important point: who is eventually going to give you your lectureship – the new go-ahead interdisciplinary research area in which you are a world leader – having published extensively in the new “Interdisciplinary Journal of New Studies” (Impact rating? Not very high, since it's New Studies)? Or, far more likely the Department of Chemistry which you shunned – turning your undoubted skills in spectroscopy not to paleobiology or developmental biology – no doubt peripheral enough for the traditionalist Professor of Macromolecules - but to examining the dietetics of

³ . What have you actually been doing? Leading your own research – or relying on the PI? It's hard to tell from Dublin. And how about getting research contracts? My post-doc here in Ireland has a bit of initiative, is useful at writing grant applications, does publish a good bit, and he knows the labs and we get on with him. You should have kept up better contact with us – invited us out to your conferences – possibly invited us into some of that exciting research you were doing in MIT.

⁴ But of course, I forgot, there are two types of post-doc in my department: those with post-doc fellowships and conditions attached and careers and those that I employ myself from my research contracts – and here further training certainly cannot really be afforded from the budget. The latter have PhDs, and they have contracts but they are different. But they deserve a footnote.

the Middle Ages. Sad loss. However, depending on the research, there may be some prospects of employment outside the university. Thank goodness for those contacts you made in the State Environment Protection Laboratories, and linking the research into working with the Forestry Agency has given me an additional network⁵.

The Modern Research University

- This university, and its research, is funded by Irish Society for Irish Society. Government and industry as funders and users of research are becoming increasingly part of the university research system: academia as the walled garden is giving way to a community market metaphor. There is increasing overlap in the system and universities are becoming entrepreneurial in the widest sense of the word and a partner with industry and government in economic and social change. The university is being reclaimed by the community, and researching their concerns. Research excellence is still, of course, important – no one will tolerate bad research – and quality and benchmarking are strongly supported by government (if not quite yet by the universities) and the results probably linked to a Benthamite funding system. Unlike some universities, which focus only on publications, while still important, there is now recognition that research work with industry, schools and the Health Boards should be rewarded in career terms.
- **For the postdoc:** Rousseau's social contract has pervaded university administration. There are explicit rights (minimal, but sometimes quite good) for the postdocs, and they are patrolled. There is a strong emphasis on the quality of supervision and delivery of the research training. Research identity still lies with the research group, research area and university – but this is now weakened, and the research contractor - society in general, the health system or particular industries – becomes important elements within the researchers' ken. The researcher may have worked closely with them during his post-doc period. And sometimes the research supervision or location is provided outside the university. And if medical companies, and ICT companies seek research in, say, a not overwhelmingly popular – or publishable - area of metal physics and are prepared to pay, the post-doc may be exposed to the warm winds of financial reward. And from the public sector side, there is a greater recognition of and support for research in areas such as education, social welfare and health. So careers are potentially much more varied. There are still the academic careers, but more bridges to other careers have probably been opened up.

The Real-World University

- Despite the different traditions and ways of training researchers discussed at the start of this paper, the role of research in all economies is now strikingly similar. Research is the driver of the Knowledge Based Economy and the universities are now an important element in wealth creation. Last year, in the ICT industries, there was more global direct foreign investment in R&D than in manufacturing. The Celtic Tiger must have its share of such investment. And, in a sense, for Ireland, R&D is the new manufacturing and universities

⁵ Postdocs are encouraged to read – well before they need to look for a job - Mark Granovetter's *The Strength of Weak Ties* – famous to sociologists – and invaluable to job seekers.

are the new RTCs, but we don't say it openly. A number of changes are taking place. Quality and excellence in research will not only be essential – they will be monitored and heavily rewarded. But the indicators of quality will be much broader than *Nature of Science*. Indicators will probably include economic indicators and “cooperation” indicators. Cooperation with industry will also be heavily rewarded. But not in a crude and obvious way. If the Department does an extra €1 million of research with industry (film industry, health boards, quantum computing industry, whatever.), then we will give them an extra 15% non-tied funding for their own research in the following year. Probably all research will leave the Departments – those out of date bureaucratic shells – and reside in flexible “Interfacing Research Centres” which will have the financial flexibility and authority to deal with industry. And these will be the homes of the doc and postdoc. Media Studies and Culture and Heritage are now economically important and, hence, respectable research areas. However, less pleasantly, Adam Smith's invisible hand will remove or amalgamate the six independent Departments of Italian in the Dublin area.

- **For the postdoc:** There is a full recognition of the postdocs (economic) worth. Along with the necessary professionalisation of research management in the Interfacing Research Centres comes the full professionalisation of the researcher from doctoral employee (not student) through postdoc and onto a professional and pensionable researcher career which may be within the university or the IRCs, or in outside industry. All will be viewed, formally at least, as equally worthy professional research paths – and career moves between such paths will be strongly supported and of importance to postdocs. Researcher training, of necessity, now includes training to be a professional researcher – research management, contracts and contract law, IPR (including Digital Rights Management), career planning, very probably science policy and the business economics of your industry (your need to know where your research fits in), and so on. But this will have already started during your doctoral research. Research identity is now much, much broader extending out into the economy and the role of your research in economic development and its commercialisation. And you may have a major and expected role in undertaking this commercialisation. Employment paths are much better demarcated. Academic careers are still available through the Departments but are now supplemented by research careers in the IRCs or into industry as either researcher or research/knowledge manager or even, with this broader postdoc experience, commercial manager. But the main difference is the career paths into industry. Industry and government now welcomes researchers (even slightly older postdocs) because you have worked with them already and you know their culture. And if you have to, you can wear a suit, write the Agenda for the Board Meeting, and deal with the patent lawyers.

A Common Background

These four scenarios represent tensions, which all Irish universities are having to come to terms with. The challenge becomes - how to develop universities - and research careers - which draw out the best, yet guard against the excesses of these characterisations. Luckily, there were many common points of agreement, starting points, in the symposium. Among the most important which let us start to frame the shape of future research careers:

- World class research standards and an international openness and competitiveness in the Irish system are essential.
- There was a rejection of any research career system which would restrict circulation and lead to stagnation. Weak researchers must move out of research.
- But at the same time, a recognition that young researchers have an absolute right to work in a system which offers them the chance to have a human life – including house and mortgage, kids and nappies, car and insurance – and offers them as good a chance of being able to finance them as anyone of the same age in the private sector.
- More broadly, there was an acknowledgement that the university interacts with society. And while the major axis of interaction for many is “industry” and the importance of universities’ research in economic development, other social dimensions will be important. Indeed, many postdoctoral researchers will want to interact with this wider society in their research and finally will want to use their research skills and knowledge outside the university without be regarded as effluent from a “leaky pipeline”.
- Finally, disciplinary differences and disciplinary evolution have to be recognised. In terms of epistemology, in terms of funding structures, in terms of interfaces with society, in terms of training and careers – disciplines can be very different. This needs to be recognised and any system be made sufficiently flexible to accommodate these differences.

We outline now two analogies which seem to be helpful in applying some of these principles to postdoctoral research:

- The Triple Helix which views research as taking place within a progressively changing relationship between university, government and the wider society, including industry and
- The Tree as an analogy for research training and careers, rather than the “leaky pipeline”.

Disciplinary Differences

Not only do the nature, content and approach to research vary markedly across disciplines, they also change over time.

- Different time horizons: Allowances need to be made in administrative, postdoc and career structures for the difference between research, say, in a laboratory and research by survey in human or animal communities which requires longer or intermittent research periods. Even in different life science labs, the natural rhythm of research differs greatly.
- The “non-return” valve: Similarly, some fields are advancing so rapidly, that time away from research for any reason – research in another field, family or prolonged illness - may present difficulties for the vast majority of researchers. The ground rules and techniques of other disciplines change little over a period of five or ten years.
- Transfer rules: In terms of changing discipline, moves in research careers tend to be one way. It is common for mathematicians to go to physics – but not the other way round. And for physicists to go to chemistry – but not the other way round. And so on.
- Quantisation and continuity. Some research areas consist of major on-going programmes in which docs and postdocs come and go and are simply part of a very large team. In other areas, the C19th model of the individual “gentleman-researcher” still functions adequately.

These “epistemological rules” set a framework against which issues in research careers need to be developed. They have obvious implications for career issues as diverse as gender equality, interdisciplinary careers and working with/in industry. And since this framework will change as research moves on, so there will have to be an additional care as to what is to be seen as a “normal” research career. In all, flexibility seems to best describe the needs of both the research and researcher in developing careers.

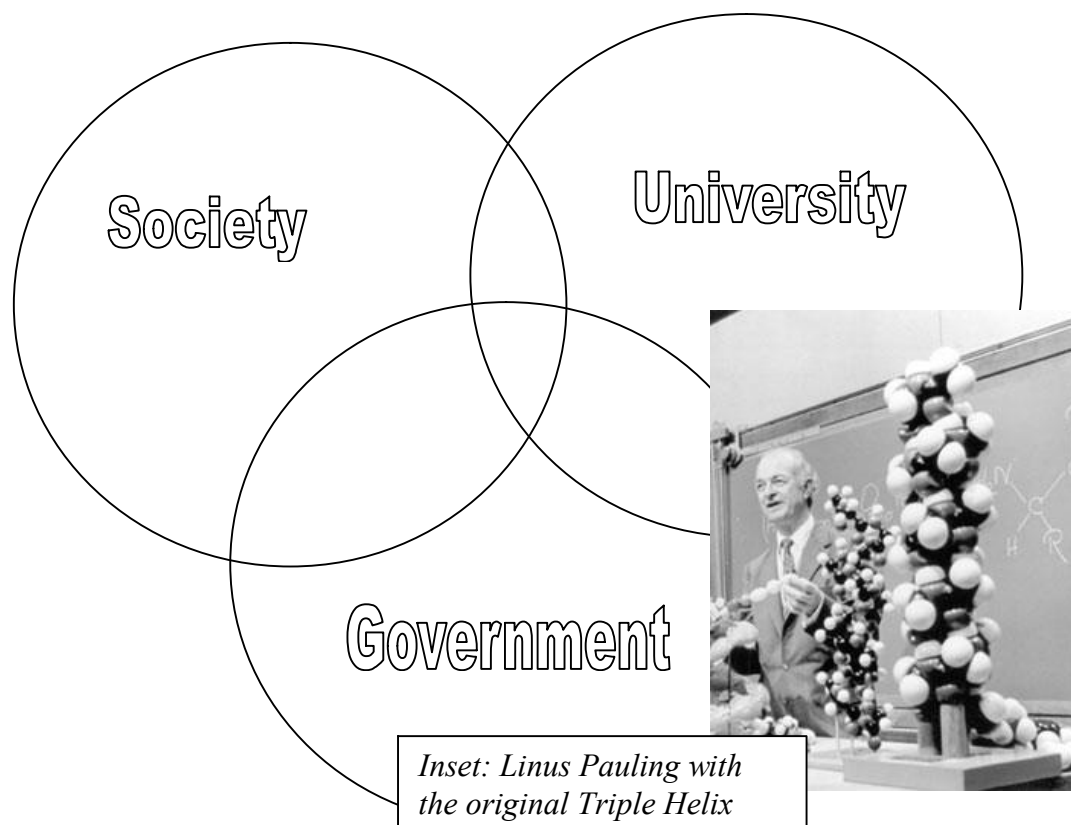
University, Society, Government: The Triple Helix

Despite some difficulties in using the concept, “innovation” is now seen as a central element in Irish social and economic development and particularly in economic growth. Similarly, essential elements in such innovation are research - both economic and social research – and the universities themselves as the promoters and undertakers of much of this research.

Just how universities should fit into this “system of innovation”, this changing world, is, of course, not so well agreed, as we have seen from our review of university scenarios. On the one side, the old language of the “ivory towers” has largely disappeared from Irish universities, however, on the other side, there is strongly voiced need for continued intellectual freedom and a concern over inappropriate and potentially wasteful administrative intrusion.

A useful paradigm, and one which broadens the university role into one wider than the traditional approaches such as University-Industry Cooperation, The Third Mission (i.e. after education/training and research), or Extension Services, is that of the Triple Helix which has been in common use in some universities for well over a decade. The Triple Helix sees the overlapping, interaction and mutual support between university, society (health boards, schools, industry, individuals) and government. While it is useful to work with the overlapping functions of the triple helix, its additional advantage is that the helix element provides a time axis and dynamic to relations between the three groups; that these relations are expected to evolve and change in the future, as the groups themselves change. Hard-line users of this model, of course, sometimes replace “society” by “industry” and concentrate on the here-and-now. But even then, it is still a useful model.

Figure 1 The Triple Helix

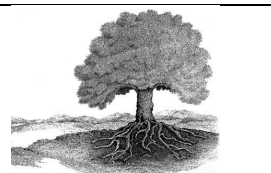


There are naturally profound implications in adopting this model both for the university, which now expects to have some ongoing and probably formally structured relations with society beyond its walls and particularly with industry as well as with government, and for the nature of research careers – the overlap potentially points to linkages with the outside world and that these linkages will last over time and may change. The Triple Helix is a recognition and acceptance of change and that university is a part of the wider society. Now moving on to the symposium’s discussions of research careers.

A Research Careers Paradigm: The Tree

There is now a near unanimous recognition that the traditional “Leaky Pipeline” metaphor for research careers is totally inadequate. While pipelines are still a useful element in normal stock-and-flow manpower calculations, they give neither conceptual insight nor inspiration in understanding the development and dynamics of research careers, and, in fact, mislead rather than help.

The Tree Paradigm, which emphasises an understanding of our world, including science and technology, as deeply rooted in society and the school system, with a trunk of more formalised higher level education and training, after which students branch out into a wide variety of useful, legitimate and valued social science, scientific, engineering and technological careers, with research creating outward and upward growth. Indeed, one could even argue for the tree as a symbol of overall research activity. It is a potent and powerful symbol of wisdom and knowledge in many cultures across the World.

	Growing Apex: Continued Research
	Branches: Careers with Research Base
	Trunk: Training UG/PG/Postdoc
	Roots: In society and all schools

The Postdoctoral Researcher

Defining the Postdoc

Many titles are offered to the postdoc: postdoctoral researcher, postdoctoral research associate, research assistant, postdoctoral fellow, research fellow, etc.). There are also contrasting definitions. Looking at an Australia and two US, and remembering that these are institutional not national definitions:

- The Australians⁶ decided on “a non-tenured, research only academic positions whose holders have a PhD or equivalent qualification” but recognised that this excludes fixed term researchers on academic appointments but without a PhD and fixed term researchers with a PhD, but not classified as a academic appointments and noted that “The lack of any consistent terminology or clear definitions of status or role reflects the marginal position held by many postdoctoral researchers in universities... Contributing to inconsistency of terminology and to conflicting expectations are two different sources (of postdocs) one publicly funded

⁶ Thompson J. et al., (2001) “Postdoctoral Training and Employment Outcomes”, Department of Education, Training and Youth Affairs, Canberra.

fellowships... The other source is the conditions specified in higher education industrial relations awards...”

- In the US “There is no precise definition of "postdoc," but the term generally refers to a person who holds a temporary appointment, usually awarded in academe, industry, or government, for the purpose of gaining additional training in research. Between 30 to 60% of all PhD recipients in science and math complete at least one postdoc (the frequency depends on their particular field of study). Postdocs have the freedom of doing research full time without the complications of academic committees or administrative concerns”
(SRS/Michigan State University)
- The Federation of American Societies of Experimental Biology (2002) developed a definition with the following points:
 - The appointee was recently awarded a PhD or equivalent doctorate in an appropriate field and
 - The appointment is temporary and involves substantial full-time research or scholarship and is viewed as preparatory for full-time academic and or research career.....
 - The appointee works under the supervision of a scholar or a department in a university or similar research institution and is expected to publish the results of his or her research or scholarship during the period of the appointment...

Taking apart these definitions can give us a number of axes along which we can consider the postdoc and the associated career and develop a definition suitable to Irish research development, within the conceptual framework already developed but still sufficiently flexible. There seem to be four basic axes and a point of qualification:

- The postdoc is a non-permanent appointment to undertake substantially full time research or scholarship, but including any necessary training or career development.
- The appointment is viewed as preparatory for a number of possible careers in academia (including research management as well as research and teaching), in industry or in government for which research skills and knowledge are important.
- The appointee is most likely to have recently obtained a PhD (or equivalent: MD, ScD, etc.) or to have acquired equivalent research skills in the private sector or government.
- The postdoc works under the supervision of a scholar, a PI, Head of Research or equivalent. When the postdoc is based in industry or government, it is preferable to also have a formal, university-based advisor.
- Despite the temporary nature of the contract, the postdoc is recognised as a full-time employee, enjoying all associated rights of the employing institution. As with any full-time employee, the fact that they are learning or receive formal training does not make them “trainees”. The postdoc is already a young professional researcher.

We now turn from this initial attempt at a definition as a useful base line, to the actual the complexity of the postdoc’s life and possible career openings.

Tenure-Track Scholar or Short-Term Contract Researcher?

C.P. Snow's Two Cultures in university research might also well apply to the divide between postdocs on independent, high-status funding and those on Departmental / Research Centre/ Industrial funding. Highly competitive postdoctoral scholarships / fellowships from institutions such as the Wellcome, IRCSET, SFI, Marie Curie, and so on, provide a measure of security and independence to postdocs. On the other hand, funding based on the Department, Research Centre or Research Team's own research contracts, often very "soft" money, may pose difficulties for the postdoc. In reality, however, there is a continuum of postdoc situations from one-year – possibly even less - postdoc contracts upwards to substantial, high prestige, tenure-track positions.

This variety of contract positions reflects a large variety in the careers postdocs can reasonably expect to aspire to. In terms of numbers, there is absolutely no way Irish universities can provide any but a small proportion of postdocs with permanent tenured academic posts. And if we are to avoid stagnation in university research in the future, this will and should remain the case. This brings a particular responsibility to university policy, PI/supervisor and even the postdoc to develop a transparent system which explicitly acknowledges *and actively supports* a number of career paths for the postdoc researcher. Career development might take place along three axes for the development of:

- A small core of academic tenure-track positions, overlapping with PI status.
- A larger number of longer-term contract research positions in Research Centres including possible moves to PI position and permanent positions in research or research management.
- A regulated set of fixed-term contracts, from as short as 6 months to 5⁷ years, which may lead on to the longer-term tenure-track or researcher contracts but more likely will be the foundation for research positions – or otherwise - in industry or government, or for self-employment.

Academic Tenure-Track Positions

There are many approaches to tenure-track positions. Discussions at the symposium and a brief review showed a number of types

- The structured integration. Examples of this approach ranged from
 - "University Research Fellows" which might be offered, for example, on open competition across all Schools for 5 years, with normal probationary procedures. There is no teaching in first 2 years, then some in last 3 years. The fellowship is a preparation for a permanent academic position.
 - "Partnership Fellows" in which a National Research Funding Agency undertakes the funding of the first period, say three years, and the university and the Funding agency joint fund the second three years with the expectation that the researcher will then become a permanent member of faculty. A similar approach is also used in integrating postdocs into industrial research positions.
 - "Starter Packs": Tenure track positions, particularly in science and engineering, are most often associated with moves to research independence and becoming a Principle Investigator (PI) as well as

⁷ 5 year "Postdoctoral Research Assistants", without mention of tenure, seem still (May 2005) to be widely available in the UK.

“start-up packs” – the resources necessary for funding independent research – and are, naturally, highly sought after. The content can vary, but will usually include an amount for research materials and equipment along with funding for one or more junior postdocs, PhDs and lab technicians.

- Ordinary Tenure Track Positions. These are simply advertised as “tenure-track” and can range from nine months to 5 years.

Research Track Positions

While the academic track positions need development to ensure high quality personnel entering university employment, the explosive growth of university-located Research Institutes and Centres and more generally contract-based research in universities is causing some concern in terms of developing associated career structures.

In many countries, there are well developed non-university research career paths – the US National Laboratories, the Max Plancks and Fraunhofers in Germany, the CNRS in France. In Ireland, from the late 1980s, there was a conscious – and at the time sensible - move to concentrate all research activities in universities – with the consequent absence of research careers outside academia. It is now obvious that we need to address this problem – probably by developing these absent research career structures within the new Research Institutes and Centres. And at the postdoc level, this means

- tenure track awards aimed at permanent positions as a researcher/research manager within Centres,
- support to the Centres in developing professional administrative and management structures. Currently, the speed of its development in Irish universities has led to significant differences between the highly professional labs and those still struggling with basic project management issues. Here, while turnover of researchers is essential, some greater stability of senior personnel and the bedding in of basic management skills could benefit the Research Centre

How such long-term / permanent employment and professionalisation is brought about for those with the requisite skills probably needs a review of the status of Research Centres. Indeed, the argument is often made that the stability of employment in Research Centres is potentially similar to that in small high tech firms and consultancies.

Research Experience Positions

The majority of postdocs in university will not and cannot expect to obtain academic – or if they were to develop – permanent research posts. Such a system would destroy the vitality of research. Instead, there must be a realisation, by both the university / research centre and the postdoc, that within a certain period the postdoc, should they wish for permanent stable employment, will move onto a career in government or the private sector. Most short-term and non-tenure track postdoc contracts must come to be viewed, from the individual’s point of view, as research experience which will be important in careers, outside academia, requiring research skills and/or knowledge either in continuing research or otherwise.

It is incumbent on the university, in its own interest in obtaining researchers, to actively prepare such postdocs for transfer and integration into positions outside academia.

Mobility of Postdocs

Geographic, sectoral and research field mobility are three major decisions for postdocs.

- *Geographic*: Taking up an initial postdoc position in the same lab or Department as the PhD is usually seen as helpful neither to the researcher nor the institution. The chosen location will have a major impact on future career prospects. Experience in a leading university abroad has become nearly a requirement for Irish academic careers. However, going to a weak or low visibility university will make tenure track careers near impossible, as will the few or weak publications.
- *Research Field*: A certain change in research field is usually seen as sensible broadening of skills and knowledge but is often balanced by concern for slowing the rate of a postdoc's publications.
- *Sectoral*: Moving to research in government or industry for a postdoc research fellowship can depend very much on the industry and research discipline. Fellowships abroad in the pharma and major ICT industry are well developed and well recognised. Particularly in the ICT area there is an easier tradition of moving back and forth between industry and university.

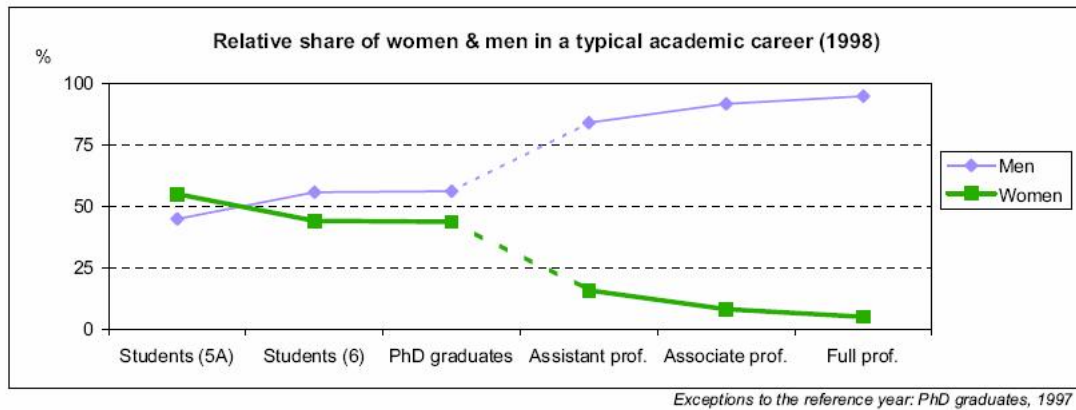
There may be a need for specific programmes to develop these types of geographic, field or sector mobility. Most countries have some form of programme to bring the best of these researchers back to Ireland. However, the symposium recognised the mobility challenges facing Irish postdocs:

- The research system is small – our university system is only about the size of Manchester / Manchester Metropolitan – and
- There is a still limited level of research being undertaken by industry in Ireland.

Gender

The figure below, often referred to as “The Gender Scissors”, shows the relative share of women and men in the typical Irish academic career.

Figure 1 The Irish Gender Scissors



Source: Teresa Rees (2002) “National Policies on Women and Science in Europe”, European Commission.

It points to the major difficulties confronted by females in developing an academic career and particularly highlights the period of “failure” between finishing a PhD and obtaining a permanent (“Associate Professor”) position within academia – the postdoc period.

While the problem has received some recognition in Ireland and SFI has recently instituted its “Career Advancement Award” and “Planning Grant & Institute Development Award”⁸, the roots of this problem lie deep in both university and wider society values and expectations. The Rees Report points to the need for gender mainstreaming – the broad consideration of the gender issue at all levels of university processes and procedures – including legislation, allied to work in gender studies. Gender studies is seen as important in understanding the subtleties and complexities of both direct and indirect institutional discrimination and as the report notes “a more sophisticated awareness of the use of patronage and nepotism in appointments’ procedures, the social construction of scientific excellence, and the exclusionary mechanisms used by scientific elite bodies”. The career difficulties of women in industry show similar, if less marked, patterns and require solutions.



⁸ The SFI Principal Investigator Career Advancement Award - The aim of this award is to provide assistance to academics in getting their research career back on track following maternity, adoptive, carers or parental leave;
The SFI Planning Grant & Institute Development Award, which will provide each research body with the opportunity to conduct an assessment of women’s participation in science and engineering research activities and research management;

Elements of An Irish Postdoc Policy

Professionalisation of the Researcher

The academic profession is well developed with reasonable pay, good career structures, security of employment, pensions, a high level of autonomy and so on. In the British Isles, it paralleled the rise of the universities as teaching institutions in the late C19th and their growth during the C20th.

Research – over and above the gentleman enthusiast - in our universities is relatively new. J.D. Bernal's famous 1939 review⁹ of science is astonishing for the miniscule scale of UK research. Here, significant growth in university research dates only from the 1950s, and, of course, in Ireland since the late 1990s. And most obviously, those undertaking the research in universities are often, perhaps most often, only weakly associated with the structures and benefits of academic professionalisation. There is a need for a “research profession” - closely allied to the academic profession – but capable of developing its own employment and career structures. The symposium recognised that only a very small proportion of researchers will become academics – achieve academic positions.

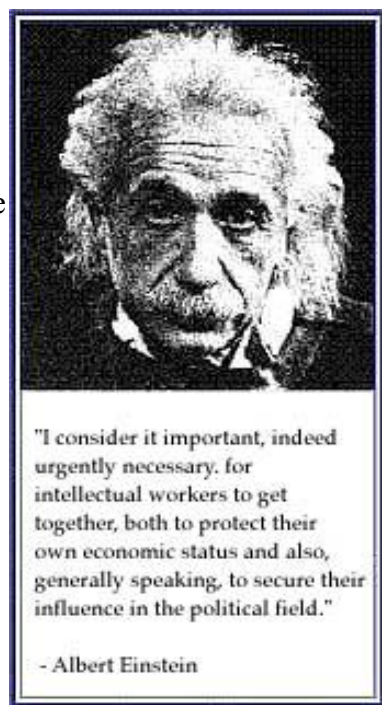
Across the much broader cloth of such “research professionalisation¹⁰”, postdocs play a central role. Most obviously, it is they who do the research and, in comparison to their own, non-research, social cohort, suffer relatively poor career prospects. Professionalisation for postdocs is, crudely, as Einstein indicates, “getting together and getting influence”. Tasks of professionalisation include:

- Reviews of postdoc numbers and working conditions¹¹,
- Developing representative structures both in universities and industry,
- Developing policies on research training, salaries, career structures, etc.

It is slightly strange that a first-year undergraduate is potentially better defined and better represented than the postdoc who may be supervising the lab or giving the tutorial or the lecture.

University Initiatives

One of the strongest messages from the symposium as a whole – not just the postdocs themselves – was a recognition of the key role played by the postdoc in research, in



⁹ Bernal J.D. (1939), “The Social Function of Science” George Routledge, London.

¹⁰ There is a broader need for all parties – government, universities and industry - to commit to the recognition of the “profession of researcher” and building associated professional structures. The way in which groups such as engineers and architects have professionalised themselves over the last century may present a viable model. Such a Research Profession needs to be recognised across 1) disciplinary boundaries (including the humanities and social sciences) and 2) institutional boundaries to include those in industry and government; thus supporting transfer across both type of boundaries.

¹¹ See for example in the US <http://www.nationalpostdoc.org>

the university life and, in time, in the wider economy and society. From a self-interested, an altruistic or a utilitarian starting point, an improvement in postdoc conditions was seen as necessary. Key points included:

- While the postdoc is a temporary position, the person should have access to the normal employment rights enjoyed by permanent academic staff – ranging from pension, maternity and holiday rights to access to the swimming pool and the car park. Formally, the postdoc should be treated as an employee rather than a trainee.
- There should be a formal university postdoc framework policy in each university, with different disciplines then developing any necessary detailed policies particular to their own area.
- Absolute clarity and honesty on the part of the PI/supervisor with the postdoc was stressed. Formally, this should include annual career reviews with discussions of career prospects, risks involved and career alternatives. The limitations on the total period of postdocing implied in new EU regulations might not be as that detrimental to research, providing some flexibility could be achieved.
- Clear training & supervision structures are needed. Particularly in some areas of the sciences, the growth of very large, functionally specialised, research groups has accentuated potential conflict between the interests of the team and those of the individual. Balancing, if not resolving these conflicts need discipline-appropriate policies ranging from regularity of meetings with the PI/supervisor to possible rotation across research areas / techniques to development of the individual's research interests.
- Clear career structures must be developed for the postdoc – into academia, into university-based research, into industry and into government: “a clear set of attractive options” as one senior researcher stated, “with clear transition points, which would let postdocs assess the opportunities and plan their own careers.” Allied to this is a clear rejection of the traditional “leaky-pipeline” model of research careers.
- Continued internationalisation of the Irish university / research system. The symposium emphasised the necessity of internationalisation – not simply because science is international, or Ireland is a small country, but because the

<p style="text-align: center;">Johns Hopkins Medical School</p> <p>Guidelines for Postdoctoral Training Programs</p> <p>At its meeting on April 28, 1999, the Advisory Board approved the following guidelines that provide a more structured environment in which our postdoctoral fellows receive training:</p> <ul style="list-style-type: none"> • An initial appointment period of up to three years with reappointment on an annual basis. Six years would be the total time allowed for appointment as a fellow. • In some circumstances, the six year total time may be exceeded. Guidelines should be in place in each department in order to justify extending the training period. Exceptions would be recommended by the preceptor to the Department Director and reviewed by the Associate Dean for Postdoctoral Programs • A time frame for notification of non-reappointment should be established. This should occur at least six months prior to the end of the current appointment period. • All fellowship programs should have documentation regarding educational goals and objectives. • A postdoctoral training committee should be established in each department. The committee would meet with all fellows at least once a year during the fellowship to provide evaluation, counselling and career assessment. • Fellows should be informed that a postdoctoral fellowship appointment is not tantamount to a faculty appointment at the conclusion of the program. Each chairman is asked to establish procedures in his/her department to facilitate the implementation of the above guidelines.

research in the laboratory benefits from different approaches and research attitudes. The Weizmann felt that a ratio of about 1/3 non-nationals in the lab was healthy.

- Continued effort in clarifying the administrative status of postdocs, both Irish nationals and non-nationals. Issues here range from balancing tax, PRSI and pension options to visas and work permits for the partners and families of non-nationals. These absolutely essential but sometimes desperately slow reforms are the sometimes low-visibility changes which provide the real bedrock of good career structures.

Government Funding Initiatives

The symposium showed deep concern, particularly among scientist and technologists, that sufficient talented people would choose their disciplines as undergraduates and then choose to undertake research. The expected increase in research numbers over the coming decade, as Ireland continues its reorientation towards a “knowledge society”, may be difficult to fulfil, unless solid, attractive and visible research career structures are developed. This will be a challenge to not only to universities and research funding agencies but also to wider government policy and those likely to employ the researchers whether in the private or public sector.

A number of approaches seem important:

From Government Funding Agencies:

- The development of a small number of strong explicitly tenure-track awards leading to academic positions. A proposal by the Chief Scientist to create a major 7-year award was particularly well received.
- The development of research career structures, over and above the traditional academic positions. Researchers, including postdocs, and research management in the Research Centres and Institutions which are often hosted by or allied to universities also require progressive career structures leading to a number of permanent positions for the most talented.
- Research funding structures which recognise and support the growing diversity of research careers. While recognising most State funded research will remain in universities, fellowships which span university / industry / government locations for research need to become much more common – not only to assist in career development or to help integrate and gain synergy from research activities across the different sectors but simply because some disciplines and research topics require it.
- The continuing development of strong interdisciplinary financing structures which support postdocs in moving on to PI or other research positions.
- Supporting the continuing move to Graduate Schools. While this is much more important for doctoral students than postdocs, Graduate Schools can be seen as part of the professionalisation of research and provide the critical mass to provide postdocs with training as well as eventual career opportunities.

Public & Private Sectors Initiatives

The three major arms of Government – health, education and social welfare – have an annually expenditure in the region of €6 to €8 billion each. All have more or less well developed and formalised technical / policy research activities and an expectation that relatively small increases in efficiency or effectiveness will bring large rewards. Such

research / policy locations across Government activities are becoming the career progression routes of many postdocs, including many from the natural sciences.

In this case Government Departments and Agencies on behalf of research / policy functions might seek to develop interfaces with appropriate university departments and

- Host, on site, some of the relevant university research activities – including the postdocs.
- Develop a fellowship system – possibly administered through the Research Councils - for postdoc research in their area of interest.

Both these activities serve to open up and signal to talented individuals the career opportunities available.

In the private sector, strong university to company career structures at the undergraduate level - most obviously through student placement programmes. These are now extending them into postgraduate and research training / experience areas as the R&D investment of major multinational corporations in Ireland increases. It will be important that these companies are encouraged to develop mechanisms – either on their own or in conjunction with the Government – to support manufacturing and service industry orientated doctoral and postdoctoral training and clear progression paths from university research to industry. Such mechanisms might include:

- In company or joint university/company postdoctoral fellowships. Abroad, this has developed most strongly in the pharmaceutical / biotech industries, but might well be developed in industries as diverse as ICT and financial services.
- Joint university / industry research projects or eventually even joint research institutes, in which postdoctoral researchers work closely with the companies involved, eventually acting as the most effective form of technology transfer to the company: the new employee. But again with a formalised expectation that this career progression is a transparent, legitimate and expected part of university-based postdoctoral research in appropriate research areas.

Conclusions

Overall the symposium pointed to a number of key challenges in building attractive research careers for postdocs:

- **Within the University:** Move to treating the postdoc as an employee, rather than a trainee. Ensure there is a formal university postdoc framework policy, which can be detailed out by the different disciplines. Institute annual reviews of the postdoc activities and future career directions. Put in place clear training and supervision structures. Work with government and industry to develop clear career progression mechanisms out of university-based restructures. Continue the internationalisation of Irish research with say, 1/3 of postdocs being non-Irish nationals. Continue work on the essential improvement of the administrative / legal positions of postdocs, their partners and families within the Irish system.
- **Within Government:** Develop a number of postdoc, tenure-track positions aimed at university employment. Develop postdoc, tenure track positions aimed at tenure within the Research Centres/Institutes and aimed both at permanent research and research management careers. Strengthen the postdoc

career paths from university into research and research management in industry and government by developing postdoc positions which span research in university, industry and government. Develop mechanisms which support postdoc research and careers in interdisciplinary areas – the NSF IGERT Programme may be a useful model. Accelerate the development of Graduate Schools to provide the critical mass for training and possible career moves.

- **Within the Public & Private Sectors:** Host internships and postdocs to act as a screening device for employing good researchers. Develop your own internal fellowship system and joint research with an appropriate university. Such developments will also create good career paths for the postdocs.

More generally,

- Move away from the imagery of the “leaky pipeline”. It is useful for traditional “stock and flow” calculations, but gives a totally inappropriate image of the modern research career and smacks of the erstwhile arrogance of the Ivory Tower.
- Recognise the usefulness of considering research development, and postdoc career development in particular, as a joint university / society / government effort to achieve the best for all parties – and not least the postdoctoral researcher.

And finally, there is a need to seek to professionalise the research career – as distinct from, but closely allied to, the well established academic career - at all levels. And in the case of the postdocs to establish and financially support a National Postdoctoral Association which can organise and give voice to their needs and priorities.