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Strategies for Scientists in Higher Education

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Abstract

Scientists have had a role in higher education since the very first institutes of higher education. While this role has evolved considerably in the last century, the period that has seen the most significant changes has been the last four decades. The rapid expansion of the higher education sector and the massification of education through the commitment of the state to free education has seen the role of scientists in higher education in Ireland swell to incorporate new responsibilities and expectations. In this paper a brief history of the role of scientists in higher education and the recent changes to that role are presented. Although these changes are focused on the role of Irish scientists, similar changes can be identified across Europe. A new strategy for supporting scientists in higher education is proposed — a research-informed masters programme in science education that provides the necessary skills and experience for early career scientists in higher education to cope with the demands of their positions.

Keywords: *Science Education; Irish Science; Course Development.*

1. The Early Role of Scientists in Higher Education

Scientists and institutes of higher education have been inextricably linked since the very first institutes of higher education. While the term "scientist" has only existed since it was coined by William Whewell in the nineteenth century (Yeo, 2003), science has existed in education in some form since the rise of natural philosophy in the sixth century in ancient Greece. It initially entailed investigation into the "natural world that concentrated on questions of material causation" (Lindberg, 1992). These early scientists found their natural home in the Platonic Academy and eventually in mediaeval universities. Pedersen (1997) points out that "in medieval terms, the schools and universities... at that time [were] the only real workshops of science and learning". In Ireland, the first university was the University of Dublin, Trinity College, founded in 1592 by Queen Elizabeth, and together with Oxford, Cambridge, St Andrews, Glasgow, Aberdeen, and Edinburgh made up the seven ancient universities of Britain and Ireland. The first gathering of scientists in higher education in Ireland came in 1683 when a group of natural philosophers founded the Dublin Philosophical Society at Trinity College (Wilde & Lloyd, 1844). These scientists began a relationship between science and higher education that would culminate in eighteenth and nineteenth century Ireland producing some of the most distinguished scientists of the time, such as mathematician William Rowan Hamilton (1805-1865), geologist/physicist John Joly (1857-1933) and physicist George Francis Fitzgerald (1851-1901). Around the same time, the Leviathan telescope at Birr Castle was established as the largest telescope in the world from 1845-1917 (Yearley, 1995). This period in Irish science is one of the most significant: "the years between 1780 and 1880 can only be hailed as a golden age for Irish science... Ireland's leading figures in science were men enjoying the highest of international scientific reputations" (Davies, 1985). The nineteenth century brought challenges for scientists in higher education in Ireland. The ongoing political and religious tensions eventually saw the establishment of new universities. The Catholic Church, with its power over Irish education growing through its primary and post-primary school influence, demanded institutes of higher education that were not deemed a threat to the faith, as it "would not allow the education of Catholic students in overtly secular institutions as this could lead to the erosion of Catholic faith and morals, due largely to their exposure to the works of suspect philosophers, historians and scientists" (O'Riordan, 1897).

2. Recent Challenges & Developments

Across Europe in the twentieth century scientists found more opportunities in higher education thanks to the rapid expansion of the sector. Ireland benefited from significant investment from the state that facilitated a period of growth and expansion: "the Irish state made a long-term commitment to investment in education from the 1960s, largely absent in

the first generation of independent statehood, which was sustained over the following two generations" (Loxley, Seery, & Walsh, 2014). After this expansion of higher education, the next meaningful development to the role of scientists in higher education was the influence of the European Union and the injection of research funding. This was mirrored by commitment from the Irish state to research and innovation which helped drive the economic boom in the 1990s. The Programme for Research in Third-Level Institutions funded €1.2 billion for basic research from 1998 onwards. In the early 2000s, the global financial crisis brought on a recession which caused a sea-change in Irish state investment and huge cuts to basic research. Although foreign investment saw total spending on research and development grow during this time (See Figure 1, from Butler (2015)), the lack of research funding for crucial areas such as astrophysics, particle physics and mathematics presented a challenge to scientists, especially early-career researchers in institutes of higher education.

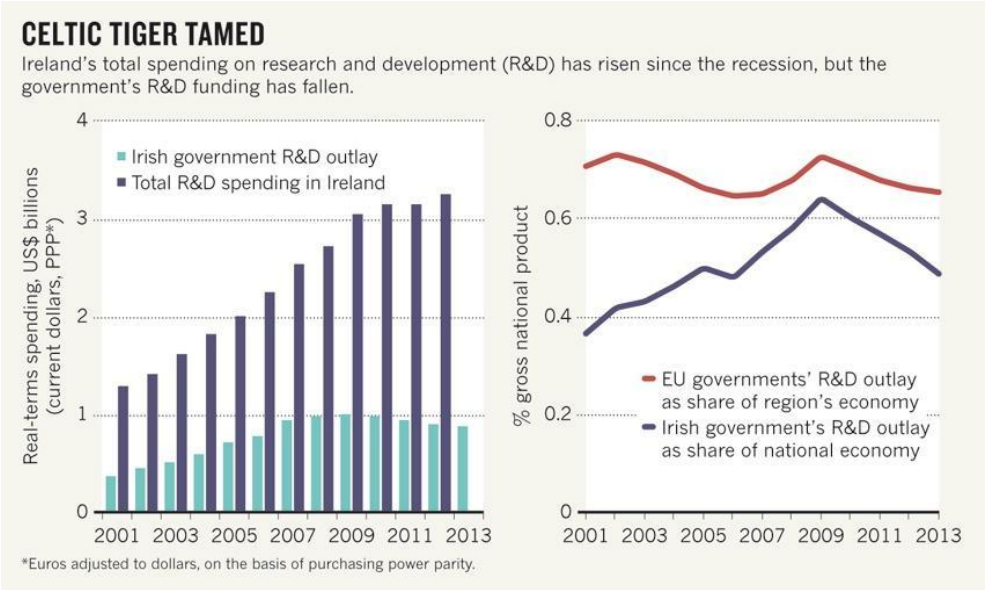

Figure 1. Source: Butler (2015). Original data: OECD/World Bank.

3. A New Strategy

To get a sense of how these developments have impacted on early-career researchers, a research project is underway to collate the myriad challenges that currently face scientists during the early stages of their working lives. Work on this project is in its infancy, but already it is clear that as a consequence of the dearth of funding for basic research, growing demands are being placed on Irish scientists to perform more core duties in increasingly competitive environments. Gathering input from Irish scientists across institutes of higher education has shown that these duties now include: securing research funding, publishing frequently and diversely, disseminating research, informing policymakers, seeking out commercialisation opportunities, teaching, tutoring, mentoring, supervising, assessing students, developing new courses, understanding and utilising social media and mass media, embracing public engagement and involving the public in decision-making processes. Many of these duties can be traced back to the objectives of the European Commision and the tenets of "responsible research and innovation" (Owen, Macnaghten, & Stilgoe, 2012). In a bid to ensure scientists are more equipped to carry out some of these duties and succeed in their discipline, a new research-informed masters course has been developed at Trinity College Dublin that provides education and skills to cope with these new challenges. The course takes the form of an M.Ed in Science Education and is designed around four core modules: "Science in Society", "Communicating Science", "Learning Theories" and "Frontier Research and Current Debates" with the overarching aim being to give participants a critical understanding of the role of science in society. While incorporating traditional components of science pedagogy and curriculum, it also draws upon growing fields of science education, including informal learning and public engagement (Roche, 2015). There is an emphasis on developing skills that are becoming crucial to scientists in higher education in Ireland such as an understanding of science governance, publishing, funding, policy and ethics in order to enhance career opportunities. It will also actively engage in, and be informed by, science education research. A key component of the M.Ed is the partnership with Science Gallery Dublin — a world-leading public engagement space that will bring expertise and practical experience to the course for all the scientists. Figure 2 shows an example of the type of public engagement experience that Science Gallery Dublin can bring to an M.Ed in order to support scientists in higher education.

Figure 2. The image on the left is from an exhibition called "RISK LAB" which invited members of the public to consider the underlying probabilities associated with risk-taking behaviour, such as gambling. The participants shown are visitors to the exhibition that are engaging in a game of poker while wearing biosensors that are displaying their physiological responses to the stresses of taking risks. The image on the right is from an exhibition called "FAT" which explored the relationship and stigma surrounding fat and diet. The mediators in these images are Science Gallery employees in the mold of traditional "explainers" with the crucial difference that they do not solely explain the exhibit in the traditional "deficit model" of science communication (Trench, 2008) but instead engage in conversations and facilitate a discussion around the topics emerging from the exhibition. Source: Science Gallery Dublin, Trinity College.

4. Conclusion

Trinity College Dublin embraces novel strategies for coping with challenges in higher education, such as recently offering a postgraduate certificate in 21st Century Teaching & Learning in association with Google Ireland (Roche, 2014) in order to address the need for stronger computer science skills among post-primary teachers. The M.Ed in Science Education is the latest effort to help cope with challenges to science in Ireland, in particular to support scientists in higher education struggling to meet the demands imposed upon them due to a lack of national funding in basic research. The M.Ed in Science Education is a strategy we feel will not only empower scientists to adapt to their changing role in higher education but also ensure that they are central to any future developments in scientific policy.

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