ROYAL SOCIETY OF CHEMISTRY

Investing in our science skills base

A briefing on chemistry PhD training in the UK

Registered charity number: 207890

Summary

According to our survey, between September 2011 and September 2015

- The number of chemistry PhD students starting their training has increased by 3%, but there are variations in growth across different regions of the UK,
- The proportion of chemistry PhD students funded by UK Research Councils fell by 8%.
- The proportion of chemistry PhD students from the UK, from the rest of EU and from outside the EU remained broadly the same.
- The main funding sources for these groups of students varied. For UK students, the UK research councils were the largest single funder. For students from the rest of the EU, the main funding source was university funding and for students outside the EU, the main funding source was overseas governments and organisations.
- The Engineering & Physical Sciences Research Council (EPSRC) is the single largest funder of chemistry PhD students in the UK.

Introduction

The UK's science and innovation sector is world leading, ranked second in the world for the strength of its science[1] and third for its innovation.[2] It creates growth and high-productivity jobs across the UK, delivering new technologies, attracting inward investment and helping to solve global challenges.

To fulfil its potential, our science and innovation sector will need a healthy supply of science and technology professionals, from expert technicians to researchers and entrepreneurs. *Skills* is a key pillar in the Industrial Strategy Green Paper[3] published by the UK Government in January 2017 and maintaining access to the global pool of talented science professionals must also be a priority in negotiations for the UK exiting the EU.[4]

In 2016 the Confederation of British Industry surveyed 500 companies with employees based in the UK and found that demand for highly trained science, engineering and high-tech professionals was expected to increase by 90% in the next 3-5 years.[5] This demand was expected to increase by 63% for the UK manufacturing sector, where chemistry plays a vital role. In 2015 17% of chemistry PhD graduates went to work manufacturing.[1] The average lifetime earnings premium for a PhD qualification over a Master's degree qualification is 9% and for chemistry this premium is 12%.[6]

In the Spring 2017 budget the UK Government announced a £90 million investment to fund 1000 new PhD places, around 85% of which will be for STEM subjects.[7] In addition to a high level of science and technical skills, PhD training develops key competencies for the workplace including independent and critical thinking, problem solving, team-working and project management skills. Understanding the supply of skilled workers in the UK, including STEM PhD provision, will be crucial in realising government's ambitious plans for growth across our regions at the same time as negotiating our departure from the EU.

To understand this from a chemistry perspective, we surveyed 37 UK chemistry departments about their provision of PhD training over a four year period. For each year we asked about the PhD students who had started their training that academic year, beginning in September 2011.

1. How many chemistry PhD students are there in the UK and where are they being trained?

The universities in our survey hosted 4133 chemistry PhD students who started their training between September 2011 and September 2014. This is equivalent to 86%[8] of chemistry PhD students beginning their training across all UK universities during this period.

- The total number of PhD students starting their training in the universities in our survey has grown by an average of 3% between September 2011 and September 2015. For chemistry across all UK universities, this figure is 2%.[9]

A key strand of government policy is increasing regional productivity and growth. To deliver the government's vision for '*better productivity [and] ... more economic growth not just in the South East of England but across the whole country*[10] we will need skilled science and technology professionals, including STEM PhD professionals, all around the country.

Universities are important drivers of regional economic prosperity in a direct way as employers and because they attract students who spend in local economies. Moreover, collaborations with local businesses enable growth by opening new avenues of research and innovation, working with companies to develop and commercialise new products and enabling local businesses to meet their skills and technology requirements.

While the total number of PhD students starting their training has on average grown annually, data from the Higher Education Statistics Agency (HESA) shows that there are regional variations from an overall growth of 28% in the East Midlands to an overall decrease of 10% in the South East (Table 1).

Table 1: Regional variations in compound average annual growth rate of first year chemistry PhD student numberst Source data: Higher Education Statistics Agency (HESA), **http://www.hesa.ac.uk**

	Academic Year		
Region*	**Number of students starting in 2011/12**	**Number of students starting in 2014/15**	**Compound annual growth rate 2011/12 2014/15†**
East	95	95	0%
East Midlands	50	105	28%
London	130	165	8%
North East	45	50	4%
North West	115	110	-1%
Northern Ireland	20	30	14%
Scotland	180	200	4%
South East	165	120	-10%
South West	85	85	0%
Wales	50	40	-7%
West Midlands	90	80	-4%
Yorkshire	110	135	7%

2. How is PhD student training funded?

In the UK PhD student training is funded in a variety of ways, including by UK Research Councils, overseas governments, industry, charities, universities and individual students. Funding can cover living costs and/or tuition fees. PhD tuition fees are £4-5k per year depending on the subject for students from the UK and other EU countries. For students from outside the EU PhD tuition fees vary according to the institution providing the training.

We found that between 2011/12 and 2014/15:

- 35% (1147) of chemistry PhD students were funded by UK Research Councils. The number of students funded by Research Councils decreased by 8% (Figure 1).
- Further analysis of the data shows that the Engineering and Physical Sciences Research Council (EPSRC) is the single largest funder of chemistry PhD students in the UK (Figure 2).
- 25% (1034) of chemistry PhD students were funded through universities. This might draw on a broad variety of sources including HEFCE Research Degree Programme funding, scholarships, donations and trusts. The number of students funded through universities increased by 27%.

The departments in our survey told us whether their Research Council chemistry PhD students were funded through Centres for Doctoral Training (CDTs), Doctoral Training Partnerships (DTPs) or CASE/industrial-CASE studentships (Figure 3). Between 2011/12 and 2014/15, we found:

- 51% of Research Council students were funded by DTPs and 26% were funded by CDTs. These represent 16% and 8% of all chemistry PhD students in our survey, respectively.
- A 35% increase in the number of PhD students funded through CDTs and a 12% decrease in the number of students funded through DTPs.

Figure 1: Sources of funding for first year chemistry PhD students **(see note 1 & 2)**

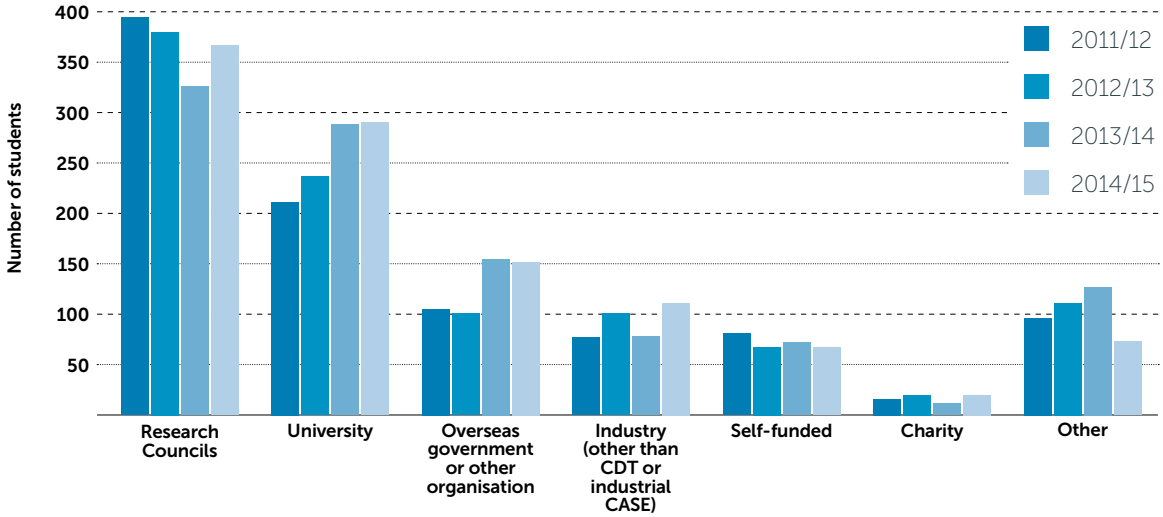
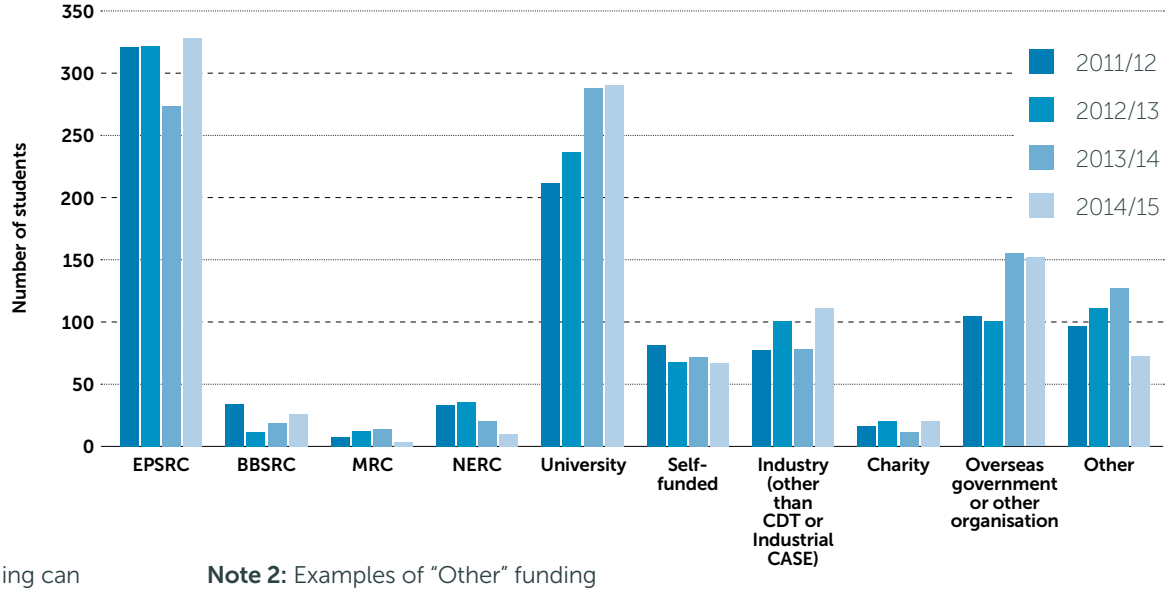


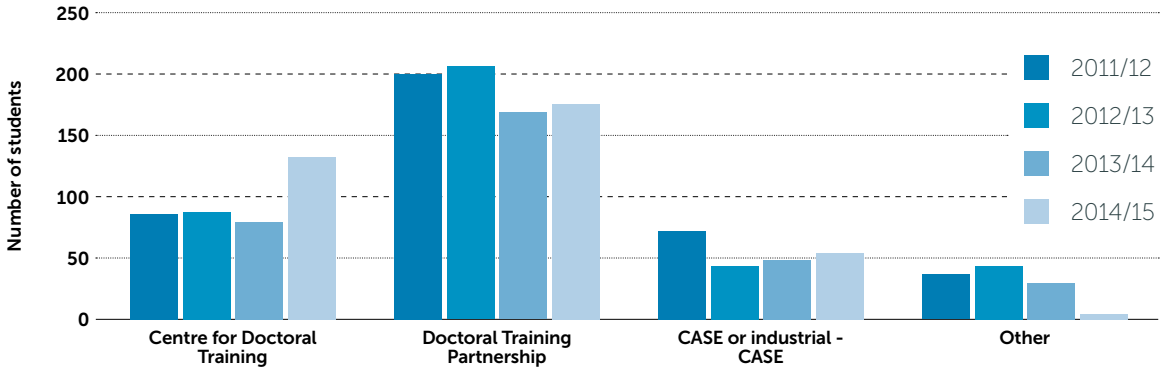
Figure 2: Sources of funding for first year chemistry PhD students with detailed breakdown of research council funding students **(see note 1 & 2)**



Note 1: University funding can include international student fees, HEFCE Research Degree Programme funding, endowments, donations and trusts.

Note 2: Examples of "Other" funding sources included endowments, the UK Home Office, Department of Justice, National Health Service and the Royal College of Surgeons.

Figure 3: 'Funding mechanisms for the first year chemistry PhD students, funded by Research Councils, in our survey from 2011/12 to 2014/15'



The funding mechanism for the majority of students recorded under "other" was not specified, but in 2011/12 included a small number of EPSRC project student-ships begun prior to their being stopped in 2011.

3. Where PhD students are from

For the UK to remain a world-leader in science and innovation we must continue to attract skilled and talented people to work in our universities and businesses from the UK and elsewhere. This includes enabling scientists to train, work and collaborate globally. The UK has a strong scientific reputation that makes it an attractive training destination for those wishing to pursue a career in science. A recent literature review on the mobility of the global research workforce found that the number of international students that were part of UK research degree programmes tripled between 1994/5 and 2012/13.[13] UK universities have an international workforce that actively collaborates with others across the world and contributes to the UK's knowledge economy. For chemistry in 2014/15:[14]

- 22% of university staff were non-UK EU citizens and 13% were from outside the EU;
- 15% of PhD students were non-UK EU citizens and 24% were from outside the EU;
- Chemistry in UK universities received £54.5m or 23% of its funding from EU government bodies.

In March 2017 the UK government gave notice of its intention to leave the European Union. Ensuring the UK is "one of the best places in the world for science and innovation" is one of government's twelve objectives in the negotiations for exiting the EU.[15] To achieve this, the UK needs immigration arrangements that continue to attract the brightest and best PhD students from around the world, as well as from across the UK. By attracting students, this will draw future global science talent to the UK, as well as developing the longer-term international links, relationships and collaborations that place the UK at the forefront of the global scientific community.

Our PhD training survey found that while the total number of students beginning their PhD training increased, the relative proportions of students from the rest of the EU and non-EU countries stayed broadly the same (Figure 2). A similar trend is observed when looking at chemistry students beginning their training during the same period across chemistry at all UK universities.[16]

However from our survey there are differences in the sources for funding for PhD student training for students from the UK, non-UK EU and outside the EU (Figure 3):

- Research Councils were the largest funder of UK students (52%)
- Universities were the single largest funder of non-UK EU students (37%)
- Overseas governments and organisations were the single largest funder of non-EU students (49%).

Figure 4: Number and nationality of chemistry PhD students in our survey

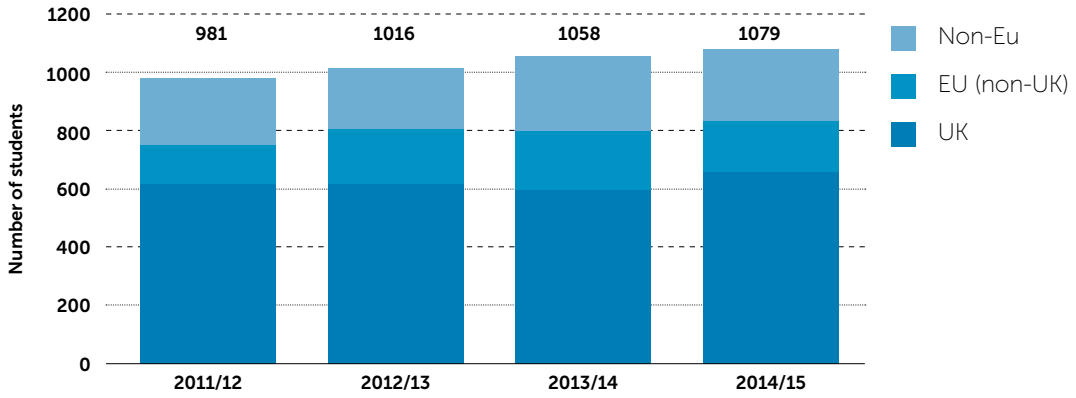
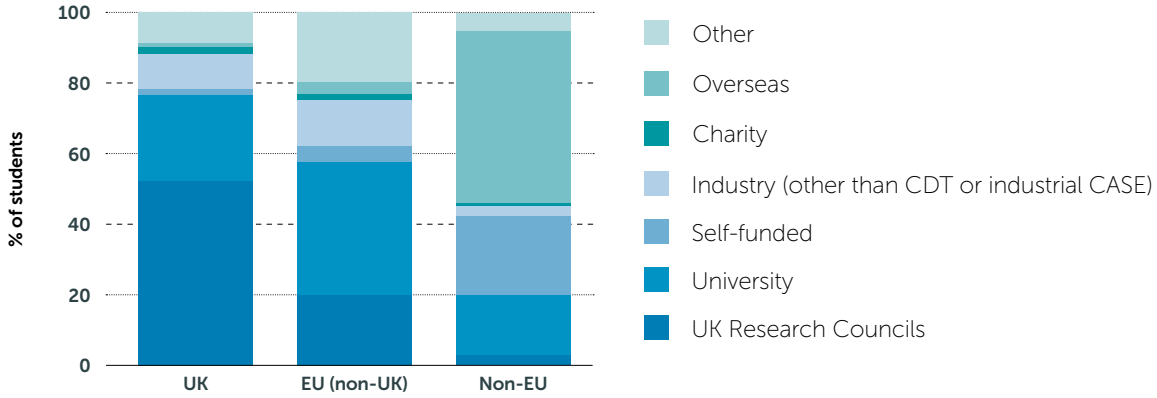


Figure 5: Sources of funding for UK and international chemistry PhD students starting between September 2011 and September 2014 **(See Note 1& 2)**



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6 http://www.rsc.org/news-events/features/2015/oct/pay-and-reward-survey-2015/
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