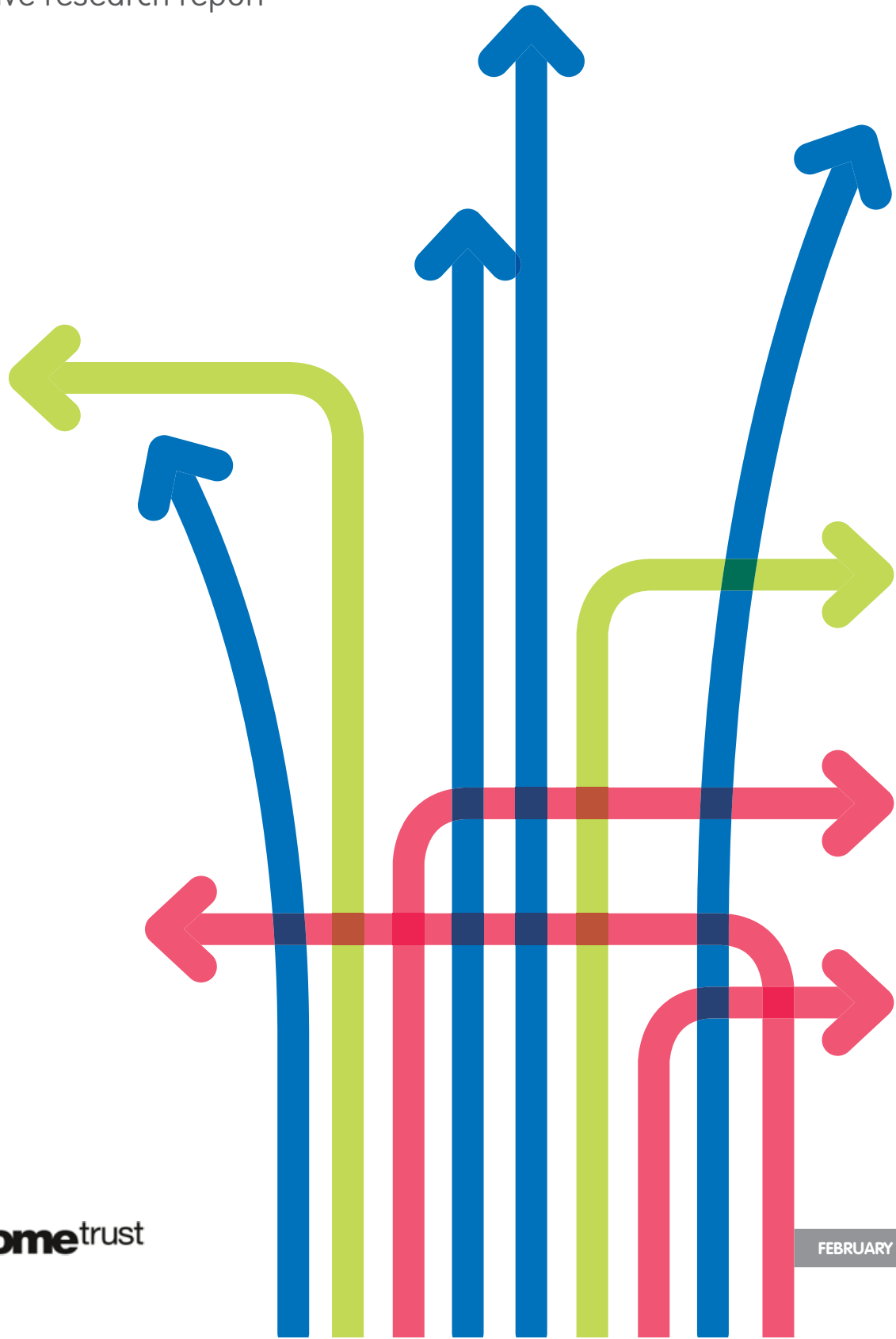


Risks and Rewards

How PhD Students Choose Their Careers:
Qualitative research report



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1.

Executive Summary

1.1 About the study

This qualitative study, conducted in Autumn 2012, looks at the career decisions and priorities of a group of PhD students.

The sample included:

- Individuals who had studied for a science PhD (as recipients of an award through one of the the Wellcome Trust's Four-Year PhD Programmes).
- 28 men and 31 women (59 in total), interviewed individually by telephone.
- A further former 30 PhD students in two online forums (15 mixed gender, 15 female only).
- Individuals who had started their PhD award and study in years 2004 – 2007.
- British and non-British students.
- Participants now based in the UK, and participants based abroad.
- Some who had children (a small minority, 9 from depth interviews, mix of male and female) and most who did not.

The report explores:

- What motivated these individuals to study for and complete a PhD?
- What are their career aspirations and plans?
- How do these plans develop and evolve during their early post-PhD years?
- What influences the career choices?

Our primary aim was to find out what draws an individual who has studied for a PhD to an academic science career, or to a career outside academia.

A secondary aim was to explore whether men and women who have studied for a PhD think and talk about their career aspirations differently; and whether their experiences and choices are different.

The research was commissioned after the Wellcome Trust's Basic Science Career Tracker revealed that the proportion of PhD students remaining in academia declines over time; and that higher proportions of women than men leave academia during those early post-doctoral years. The research was designed to shed light on these issues through qualitative enquiry, drawing on in-depth discussions.

A high flying, ambitious group of interviewees

The study found that group as a whole were keen to be in control of their careers, and very articulate about their career decisions and the choices facing them. We report what they said, and the conclusions we have drawn through analysis about their values and beliefs.

1.2 Key findings from the study

The majority of those interviewed in this study were motivated to start a PhD by their passion for science. A small proportion of those interviewed specifically began a PhD because they wished to pursue an academic research career and a few said they started a PhD to facilitate a career outside of science. Most study participants actually described having a lack of awareness at the start of their PhD, of the range of potential careers options open to them once they completed their training.

Not surprisingly, a good PhD experience created a greater propensity to pursue a career in academic research.

The first academic position after a PhD was thought to bring a number of rewards, including the opportunity to excel in science and continue to work in an area of great individual interest. However, pursuit of a career in academia at this early career stage was also described as risky.

Success, particularly in the early post-doctoral years is perceived to be far from certain due to a number of challenges (described by both men and women), specifically:

- Funding:** one of the main challenges for new academics is the prospect of securing funding for research and finding a permanent position – and particularly in a time of austerity
- Pressure to publish:** the pressure to publish high quality and high impact research papers as a key author is ever present for academic researchers, and the ability to do this can be affected by factors outside of 'your' control (e.g. success of research and attainment of results, collaboration/support of colleagues). This pressure to publish well is thought to become more acute as academics progress in their career.
- Long working hours culture:** whilst participants did describe 'flexibility' in the working day as an academic researcher, this was tensioned against the perception that to be successful, researchers must work long hours to sustain the high workload and be very determined
- Pressure to move:** there is some perception that to be a successful academic researcher you must move institution and even country to broaden your profile and research experience. Those with specific personal circumstances and local ties, view this perceived 'compulsory mobility' as a potential deterrent to their pursuit of an academic research career
- Lack of stability:** careers outside academia can appear to offer greater stability, and, over an individual's life course, look increasingly appealing. In particular as life aspirations change over time, a number want to settle down and potentially start a family, so choose a career path that is perceived to be less uncertain.

Some are comfortable with the 'risks' associated with building a career in academic science; however for others, when any of the risks outweigh the potential rewards of an academic

career, things reach a tipping (decision) point. And at this time a number appear to exit academia, being drawn to careers that do not appear to involve the same level of risk.

Most of those exiting academia were those who 'just loved science' to start with – rather than those setting out with a plan to pursue an academic career. And women in the study seemed to reach a tipping point sooner than the men. Furthermore, most of the women in this group who left academia did so straight after their PhD; suggesting that their experience during the PhD, and/or their perception of what post-doctoral academic work might be like, influenced their decision. Though the numbers were small, participants with children in this study did not appear to have particularly different aspirations or behaviours compared to those without children.

In addition to the challenges outlined above, a number of the women in the study raised concerns around:

- The tension between competitiveness (and self-promotion) and meritocracy. While the women in our study were undoubtedly high achievers, many felt that the competitiveness of science (e.g. to secure a grant and post), and especially at the early career stages, results in less weight being given to integrity and meritocracy, making academia an unattractive long-term career option for those who are less naturally competitive.
- The absence of female role models for aspiring researchers, making it hard to visualise what a successful academic career could look like.
- The lack of mentoring and career support from supervisors and colleagues.

Of the participants choosing to leave academic research, the vast majority reported that they were doing fulfilling and enjoyable work where they could use their science skills and training. However, some of these same participants also reported that they would have liked to stay in academia – and slightly more women than men fell into this category.

1.3 Implications and Recommendations

While the study revealed that this group of individuals were a highly motivated and career-focused cohort, there is probably more that funders and stakeholders in provision of PhD training can do, to reduce the number leaving academia in the early post-doctoral years.

Some potentially excellent scientists from a career in academia may be lost, when they would have preferred to stay. And if individuals at this early stage in their career can be helped to better negotiate and manage the perceived 'risks' and 'rewards', the loss to academia may be reduced.

Based on the findings we suggest a series of potential interventions for funders, institutions and academia more broadly that may address the myths or misperceptions associated with the pursuit of a career in academia, thus helping to balance perceptions of 'risk vs reward' and motivate some bright women and men to continue a career in academia. These include:

More career advice and support during the PhD, including:

- Help with planning careers and making grant applications.
- Expansion and enhancement of networking opportunities.
- Encourage mentoring from other scientists and researchers.
- Expansion of the opportunities to secure bridging funding at a critical time for early career researchers, for example to assist with writing up a PhD and applying for a post.

Develop new and innovative approaches to careers involving academia.

- There may be more opportunities to support research collaborations and dual posts between industry and academia. Other types of post that require complementary skills to those of a Principal Investigator, such as project management, team-leading and technical skills could be supported.

Some changes to academic culture and working practices would be helpful

- A need to challenge a prevailing opinion (evident in this study); that to be Principal Investigator is the main, or even only, career aspiration for newly qualified post-doctoral researchers. Much of the perceived risk of pursuing a research career in academia is associated with the pressure to secure funding for such a post.
- Could funders consider having more longer term funding awards targeted at early career scientists to allow researchers to become established?
- Could institutions do more to involve early career academics in the 'corporate world' of the university, to broaden their experience of the sector – beyond their employment on a specific project?
- There is a perception that it is a 'requirement' for a researcher to move institutions (and country?) in their early career to raise their profile, strengthen their track record, broaden their experience and successfully apply for a grant. More research is needed on whether moving posts or institution, if pursuing a career in academic research, is actually of long term value to researchers. As science becomes more international, virtual technologies are helping to forge collaborations without the requirement for face-to-face contact.

- Funders and institutions should do more to increase awareness and raise the profile of those who have come to successful science careers through a variety of different routes and backgrounds. Women could benefit from seeing more female role models following careers in academic research, particularly if accompanied by information on their background and how they have overcome any challenges.
- Institutions need to do more to ensure that there is good communication and dialogue about the working benefits that do exist within academia (which are often more comprehensive than those that exist in other sectors), such as maternity/paternity leave provision and the options for flexible working within academic research. Could academia learn from family-friendly innovations and systems in other sectors? For example, challenging the notion that long hours equate to productivity.
- Funders and institutions should consider how to challenge the perception that working in industry is secure and stable but involves intellectual constraint, while working in academia brings intellectual freedom but insecurity and instability.

The vast majority of those we spoke to had enjoyed doing a PhD, and were now enjoying their subsequent careers. Most felt they were using their scientific knowledge built upon during their PhD training and science skills, whether they remained in academia or not.

2.

Introduction

2.1 Background to the research

The Wellcome Trust promotes the progression and retention of the brightest minds in academic science by offering award schemes and funding initiatives that are designed to build capacity within biomedical science, developing the careers of researchers and supporting the retention of highly-skilled researchers in biomedical science.

The Trust's Basic Science Career Tracker (BSCT) survey was launched in 2009 and aims to establish:

- The career paths of award holders;
- The proportion remaining in academic research; and
- The barriers and drivers behind career choices, including what drives successful careers in academic research.

There have been three waves at the time of writing.

Since 2009, the BSCT has helped the Trust to build up a valuable picture of choices and attitudes regarding careers, particularly at PhD and immediate post-PhD level. Already there are findings around:

- **Career destination and reasons for leaving academia:**
Most remain in a science related field, if not academia itself. Those leaving academia cite uncertain job prospects, lack of job security, and lack of funding opportunities.
- **Relatively low levels of retention of women in academia:**
The proportion of PhD students overall remaining in academia declines over time, but this is particularly marked amongst women.
- **A trend for moving overseas to work in academia:**
Awardees increasingly pursue their careers abroad. Looking at the proportion of the 2003/04 cohort remaining in the UK, this dropped from nearly nine in ten in wave one of the BSCT (2009) to just half in wave 3 (2011). There is a widely held belief that moving abroad is vital for career progression.

The BSCT, however, gives only quantitative information, and raises a number of questions about the motivations of students and how best to support them.

The Wellcome Trust therefore commissioned further in-depth analysis of the factors influencing career choices of awardees. The research involved *qualitative in-depth interviews and online discussion forums ('online forums')*.

This report presents the findings of the research.

2.2 Aims and Objectives

Our aims were:

- To find out what draws PhD students to a career in academic science, or to a career outside academia.
- To discover why women may tend to leave academia sooner than men, by exploring whether men and women think and talk about their career aspirations differently, and exploring whether their experiences and choices are different.

To this end we considered a number of questions and subsequent policy implications for the Wellcome Trust.

- What are the drivers and barriers to career choice, including remaining in academia?
- How do demographic factors like gender and family affect decisions?
- What does a PhD's career journey look like, and what are the key decision points?
- What could the Wellcome Trust do to retain interested individuals in academia?

Some of these questions have previously been considered by the Wellcome Trust. However the aim of this in-depth qualitative work was to shed some new light on them.

Why are women more likely than men to leave academia?

One of the emerging findings from the BSCT data is that the proportion of PhD awardees remaining in science declines over time (at least in the years immediately after the end of the PhD) – although the Wellcome Trust remains relatively successful in retaining awardees in academia. In the 2003/04 PhD cohort, which has now been surveyed three times, 60% are currently in academia compared with three quarters (76%) after the first wave.

The BSCT has found that women are more likely than men to leave academia during these early post-doctoral years. Looking again at the 2003/04 cohort, during the first wave two thirds of women were still working in academia (67%), compared with over nine in ten men (93%). This already considerable gap had widened further by wave three, when less than half of the women in this cohort (46%) were still in academia, compared with 87% of men.

Possible hypotheses for this gender imbalance in retention, prior to the qualitative research, included: perceptions of the working environment; the perceived peripatetic lifestyle of academia; competition for funding (identified in wave 3 of the BSCT as a growing challenge); and instability of tenure and lack of longer term posts.

The Wellcome Trust appears to do better at retaining women in academia than some institutions in other areas of science.

For example, the UK Resource Centre for Women in SET and the Royal Society of Chemistry found that whilst women are more likely than men to say that they want a career in research (either academic or in industry) at the outset of the PhD (72% vs. 61%), they are much less likely to express this intention at the end of their studies (only 37% of women compared with 59% of men). And regarding academic research in particular, at the end of their studies, women are much less likely than men to say they intend to pursue this as a career (12% vs. 21%). The report cites the perceived competitive, solitary nature of academic research as one of the key barriers.

Retention and progression of women is by no means an issue unique to academia: women remain proportionally under-represented at senior levels in all significant areas of public life, including politics and industry.

2.3 Who did we speak to, and how?

Who we spoke to

The Wellcome Trust provided a unique sample of awardees who had already expressed a strong interest in being involved in further research.

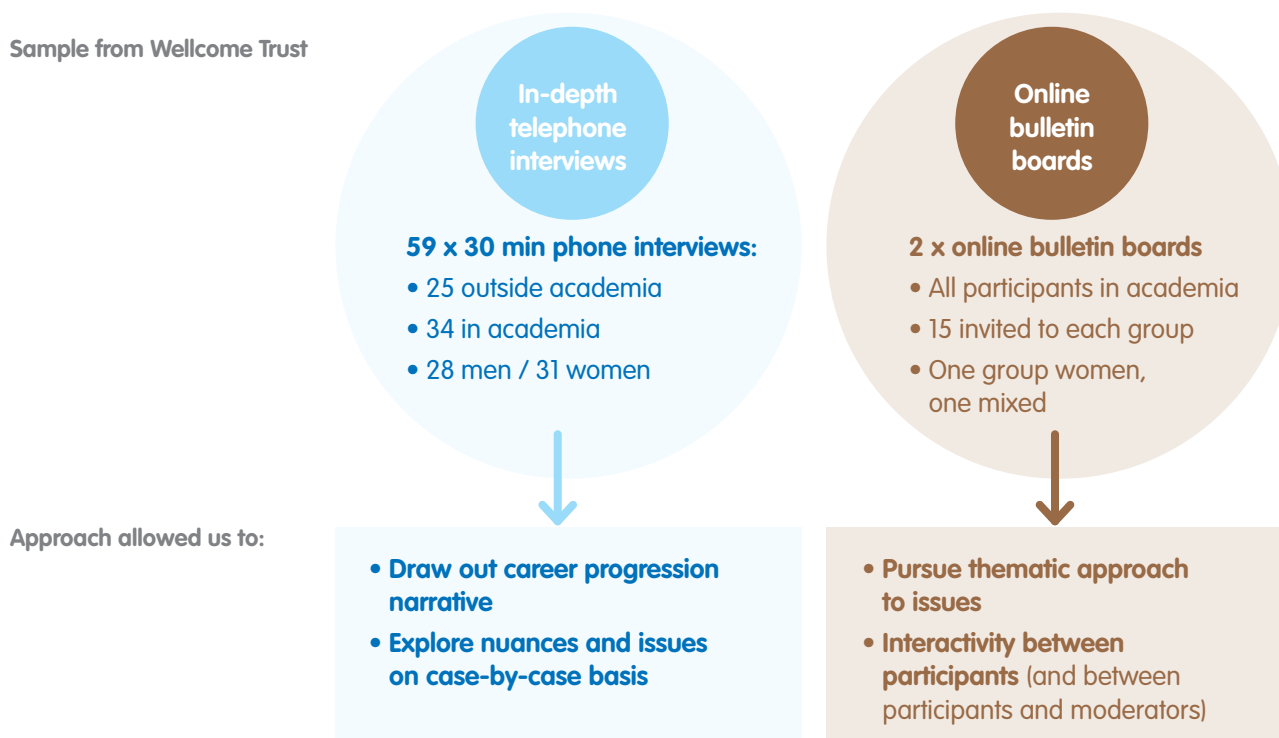
The sample was subdivided as follows:

- **Gender:** Men and women who had studied a science PhD as part of the Wellcome Trust's award scheme.
- **Inside and outside academia:** A mix of people still in academia and working outside academia.
- **Cohort:** Those who had started their PhD in 2004, 2005, 2006 and 2007
- **Nationality:** A mixture of British and non-British awardees
- **Current location:** Either UK or abroad

The awardees interviewed who worked outside academia were in a variety of roles. These are discussed in more detail later in the report.

METHODOLOGY: QUALITATIVE DISCUSSIONS

Sample from Wellcome Trust



¹UK Resource Centre for Women in SET, The Chemistry PhD: the impact on women's retention. The Guardian (24th May 2012) also reported on this issue, so it is very much a current consideration for the sector and for society as a whole.

²The purpose of qualitative research is to explore issues in detailed and open-ended way not possible in quantitative surveys. When reading this report it should be remembered that qualitative research does not aim to be representative of the wider population. Any breakdown of the numbers of awardees interviewed in terms of particular characteristics or experiences is purely indicative and cannot be interpreted as statistically robust or more widely representative of views.

How we spoke to them

This was a qualitative study consisting of in-depth telephone interviews and online forums with awardees.

Why we chose this sample breakdown

The sample for this research was designed to expose any differences between the views of different groups:

- men who are still in academia
- women who are still in academia
- men who have left academia
- women who have left academia.

Our sample for the research comprised a relatively equal number from each of these groups. This is called 'purposive' sampling and is the best practice approach to qualitative research. It meant that we had enough individual interviews within each group to look at common themes between interviews, and to compare the views of each group with each other.

We did not aim to replicate groups exactly in proportion to the overall numbers as they exist in the real world. In our study the men who have left academia are 'over-sampled', as there are proportionately fewer of them in real life than in the study. However we needed to speak to enough people in each different group to identify common themes and ideas within groups and to be able confidently to compare the views, attitudes and experiences of the different groups with each other.

If we had aimed to be representative we would have risked interviewing too few men to bring out the full range of their opinions, and more women than would be useful.

How we discussed the issues

The data generated by the depth interviews enabled us to draw out a narrative of career progression, and explore nuances and issues on a case-by-case basis. Though interviewers followed a guide, we allowed interviewees the freedom to tell their story in their own way. Each interview lasted at least 30 minutes and in general participants were thoughtful and forthcoming with their ideas and opinions.

The online forums pursued a more thematic approach to the issues. We identified several question areas which would prompt discussion (based on initial hypotheses and the findings coming out of the depth interviews) and put these up as new threads each day. Participants responded to our questions as they were put up on the boards, either posting a response themselves directly, or replying to others and discussing things among themselves. At any time participants could talk about any of the live issues.

The design of the boards allowed for interactivity between the moderators and participants, whereby moderators were able

to direct the flow of the debate and create new topic threads as and when required.

The boards were 'live' for 10 days. One forum was mixed gender, the other women only, to draw out any themes which were mentioned specifically by women and allow women to discuss these with one another.

Anonymous verbatim comments made by awardees during the telephone interviews and online forums have been included throughout this report, attributed by gender and whether they are working inside or outside academia. These should not be interpreted as defining the views of all participants but have been selected to provide insight into a particular issue or topic and the way issues were typically framed and described.

About the interviewees: Wellcome Trust awardees are ambitious high-flyers

Those who obtain funding and awards through the Wellcome Trust tend to be the best and brightest of aspiring young scientists. As we expected, they were articulate and ambitious. The research revealed that they were very keen to be in control of their careers and not to feel forced or influenced into making unfavourable decisions by external factors in the academic science career pathway.

Allowing awardees a chance to author their own account of their careers so far – the pressures, problems and choices they have had to make – offers a fresh and illuminating perspective on the BSCT findings. The fact that awardees are thoughtful about their careers made the qualitative research particularly fruitful.

2.4 Publication of the results

Any press or publication of the findings of this study requires the advance approval of the Wellcome Trust and Ipsos MORI. Such approval will only be refused on the grounds of inaccuracy or misinterpretation of the findings.

Acknowledgements

Ipsos MORI would like to thank Halina Suwalowska, Liz Allen, Abigail Taylor, Emlyn Samuel and Shewly Choudhury at the Wellcome Trust for their help and cooperation on this project. We would also like to thank all of the Wellcome Trust PhD awardees who participated.

3.

Aspirations and what happens next

KEY INSIGHTS

- Students do not necessarily plan their careers from the start of the PhD, and career help and advice should take this into account.
- Most in this study enjoyed completing a PhD, and were now enjoying their careers. Most felt they were using the knowledge gained from the PhD and science skills, whether they remained in academia or not.
- Most started their PhD because they loved science and wanted to do some more of it. Some did a PhD to enable a scientific career. A small minority wanted a career specifically outside science.
- **Some still in academia:** Many of those who described doing a PhD to enable an academic career were still in academia at the time of interview (both men and women).
- **Some have left:** While most participants had ended up doing fulfilling and enjoyable work where they could use their science skills, this study revealed that some who have left academia would have liked to stay.
- Some of those who have left said they loved science when they started, and maybe would have liked an academic science career. The research suggests a passion for the subject is a good motivator, but not sufficient alone to keep people in the early stages of their post-PhD career in academia .
- More **women** than men take this route, and most of the women who leave academia do so directly after their PhD, suggesting that experience during the PhD, or their perception of what post-doctoral academic work will be like, plays a part.

3.1 Aspirations

Thinking back to before they started their PhD, participants recalled that they had had few clear ideas about potential careers at that time. There was little evidence of career planning at this early stage, except amongst a few particularly driven individuals.

To research science had been the primary intention amongst most awardees across both genders. These participants were passionate about science and how the world works:

'I wanted to pursue science in its purest form ... discoveries and thinking about problems, and I really, really loved it' *Female, Outside, Depth*

'After experiencing science in action (e.g. seeking to solve an unanswered question, as opposed to cramming previously discovered facts), I caught the bug in a major

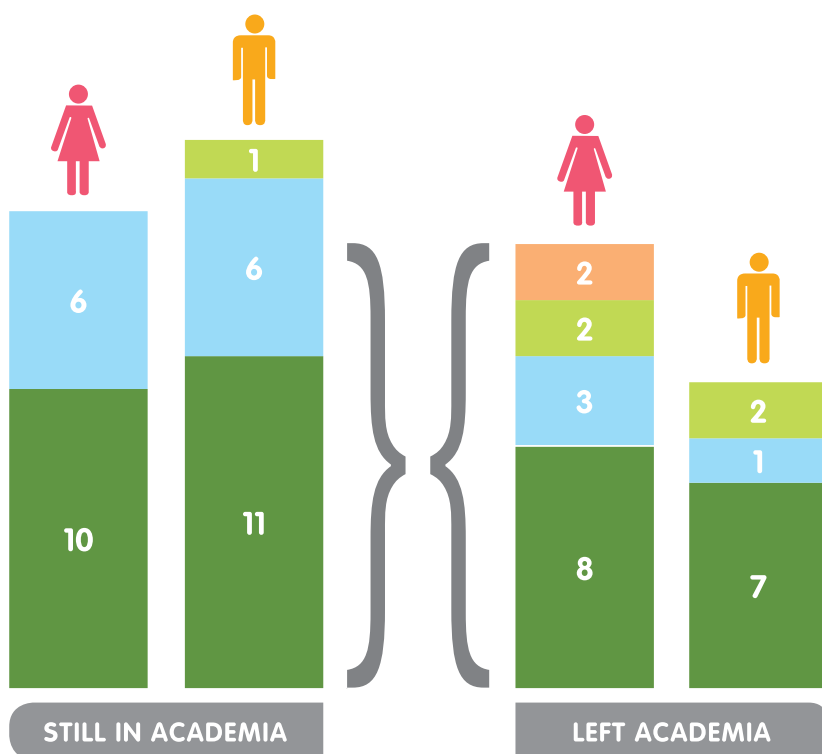
way. It engaged my curiosity and gave a taste of the thrill of problem solving' *Male, Inside, Online Forum*

Two of those we spoke to said that they had simply wanted to remain at university after their first degree. This was also a secondary consideration for many more.

A slightly smaller group – men and women equally – had wanted specifically to go into academia. Others had aimed at other areas of science such as becoming a government scientist, or working in healthcare while some had wanted to go into science-related industry or NGOs. These people had seen a PhD as a means of achieving their career aims.

'At that point you don't really know; you want to be a scientist but you don't know in what form. I just knew I wanted to research and I wanted to do it at a good university, and of course if you don't do a PhD it's very hard to get anywhere in science.' *Female, Inside, Depth*

“WHY DID YOU DO THE PHD?”



- Both women and men aimed for ‘career in academia’.
- Most who start with that objective have stayed, so far – though a few more women have left.
- More women than men who ‘just love science’ left.
- Hardly any men who wanted ‘a career in academia’ left.

- “I just loved science”
- “I wanted a career **outside** academia”
- “I wanted a career **in** academia”
- “I wanted to stay at university longer”

Our 59 depth interviewees: not statistically reliable but reflects stories we heard in the interviews

3.2 What happened?

We can compare the initial motivations of students with the destinations they have reached so far.

Who stays? Most of those who had started their PhD to get a career in academia were still there at the time of the research, both men and women. In our study, all those who stayed in academia beyond the PhD went on to a postdoctoral position, (with the exception of one individual moving straight to a PI position).

Who leaves? The research identifies some of both genders who might have liked to stay in academia, and yet have left.

Many of those who had already left said that they felt disappointed to have left academia, but saw no alternative. Most said they did not see themselves returning.

“I’d love to go back into academia, but I am living to my means, and the benefit package wouldn’t work out”.

Male, Outside, Depth

Men and women in our study were equally passionate about science, equally committed, and equally driven to have a successful career. And those who had left academia for other jobs remained passionate about science and about using their scientific skills.

Of those who initially would have liked a career in academia, (even if it was not the primary motivation for doing the PhD), higher proportions of this group have left – women in particular. Similarly, many who were motivated initially by love or passion for science had left academia by the time of interview – especially women.

This mirrors the story emerging from the BSCT; by wave 3 of the Wellcome Trust’s tracker, nearly nine in ten men are still in academia three years after their PhD, while more than half the women have left.

Most of the women in our sample who had left had done so directly after the PhD. These people have not experienced life as a post-doctoral academic. The research suggests that experiences they have during their PhD, and perhaps the perception of what life will be like in future if they stay in academia, affects their decision. We look at this in detail in Chapter 5 where we discuss ‘risks and rewards’ of staying in, or leaving, academia.

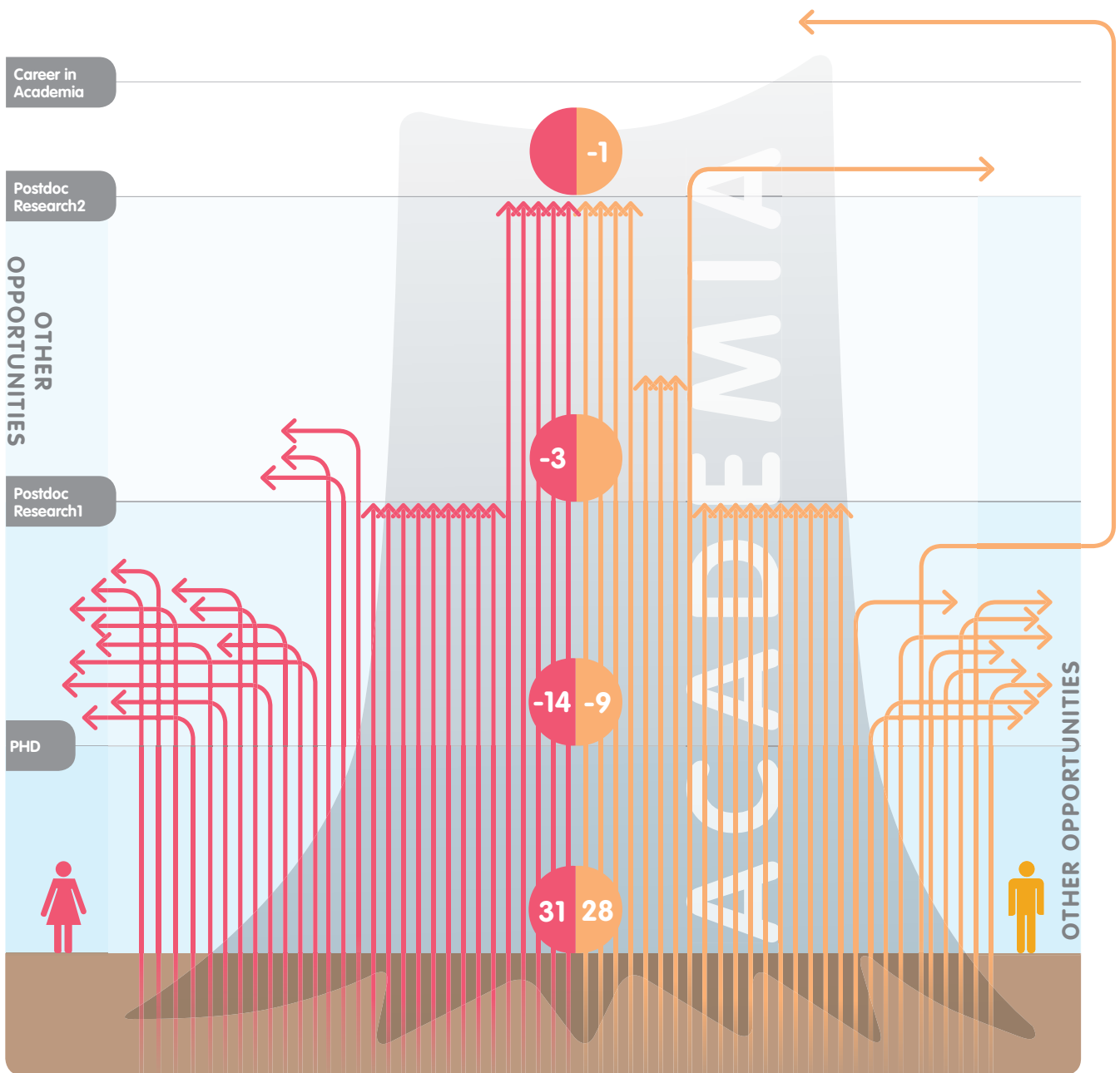
It is worth noting that the decision process for women (and others who had left academia) was not specifically related to having children. Indeed, those with children did not have particularly different aspirations, behaviours or outcomes compared to those without. Rather, the concern, which perhaps had more of an impact on women (discussed in

more detail in Chapter 5) was around the prospect of fitting an academic career together with aspirations for having a relationship and a family.

We find evidence that non-British awardees are more likely to stay in academia than their British peers. Out of the 59 awardees, there were 24 non-British, 8 of whom left, and 16 of whom stayed. Among the 25 British awardees we spoke to

16 left and 9 stayed. Non-British awardees were not, however noticeably more set on academia that British awardees, but there may have been other factors present.

The diagram below shows the points at which the male and female participants in our study tended to leave academia for other options.



● MALE ● FEMALE Each arrow represents an interviewee

4.

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What happens during the PhD and how does it affect career plans?

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KEY INSIGHTS

Having a positive experience of completing the PhD makes it more likely that the student will embark on an academic career afterwards. If PhD students receive more help to make the experience of the PhD more positive overall, it may be more likely that more of them stay in academia.

Towards the end of the PhD, time is very pressured.

- Most apply for lots of jobs at the same time: the most proactive are networking hard within academia towards the end of the PhD.
- Most take advice from people they already know (who potentially don't know the full range of careers on offer).
- Some feel they do not have enough time to prepare for publication as well as complete their PhD.

There may be interventions which can help them make more informed career choices, for instance:

- During the PhD, getting some positive examples of the life in academia, plus networking and career guidance, and advice on best practice when applying for funding.
- The interviewees highlighted a particularly difficult 'pinch point' for those doing a PhD in the UK: the point of writing up and applying for new funding. Some interviewees suggested bridging funding would help at this critical point.

4.1 The elements of a good PhD experience

A positive PhD experience tended to set up a 'positive spiral' where the student becomes keen to stay in academia. A more negative set of experiences cumulatively leads to dissatisfaction with academic life. There are opportunities to influence and support the student along the way, potentially leading to a more positive outcome for the journey through the PhD.

For most, working on successful projects, which attract wider interest from the academic community and allowed them to publish, could make a difference to how they enjoyed their PhD and their chances of getting a job afterwards.

'Different people had much different attitudes to what they did depending on their results. Somebody in the lab and he was really lucky with his project and he got all the results and he never has any real barriers or real struggles. Whereas I had months where on paper it looked like I hadn't achieved very much.' Female, *Outside Academia, Depth*

A supportive supervisor was another key factor. Typically students praised their supervisors for allowing them independence, but also being available for support. Dual supervision between one more senior and one less senior person seemed to work well.

Some awardees had issues with their supervisors being very distant, and in some cases blamed the wider culture of academia for this. For example, one student had a supervisor who, although scientifically brilliant, would see her just once every three months. This could be seen as symptomatic of the time pressures facing academics, but also of academia lacking explicit protocols for management and teambuilding.

Students appreciated a vibrant and dynamic working environment. They described their labs as sociable, interactive, co-operative, innovative and fun. The Wellcome Trust experience enhanced this as the students could work in a range of different labs.

'Some days I was working on my own experiments, or planning them, others I was collaborating with other people, going to a lot of conferences, and playing with ideas – it was

a very creative environment. It was a good balance, not just 8 hours of experiments everyday: that's the job of a technician'.
Male, Inside, Depth

In addition, personal factors play a part. The PhD is felt to be a challenging four years and so participants who had the highest level of interest and focus on the work felt that this helped them to succeed – sometimes described as an 'obsession', 'passion' or 'calling'.

'I was 100% committed to the research'
Male, Inside Academia, Depth

Some of this is inherent to the person; but it could be fostered by support and mentoring. Also, a realistic attitude to academic life seemed to create positive but realistic expectations. Experience at undergraduate level, and good experiences during the PhD, could develop this.

'Before [starting the PhD] I had been ignorant of what the day to day working in this environment would be like – it was positive because you were autonomous, you weren't told what to do and you just had to get on with it, but you saw academia warts and all – the process of building up an empire and how publication is everything'.
Female, Outside, Depth

Personal enthusiasm and optimism and a belief in the value of the research project are also important, and many participants told us that this had helped them network more effectively and be positive and impressive when doing so.

4.2 The next step can be a challenge

As the PhD comes to a close, the students are aware there are many decisions to be made and feel under pressure. There may be interventions which can help them, either at this stage, or earlier in the process, to make more informed career choices.

Apply for many different jobs at the same time

Awardees recalled how overworked they felt at the end of their PhD, and some felt they had simply followed the path of least resistance when making choices about their future.

'It was not necessarily a means to an end – because in science you're more interested in what the next step ahead is rather than far into the future – but of course the overall goal is to continue doing science. But it is generally difficult to get jobs in academic research, and the further into the path you get the more difficult it gets, and it is impossible to predict. So after my PhD I wasn't thinking beyond postdoc.'
Female, Inside, Depth

'At the end of my PhD it was more about not finding myself without a job than really thinking about getting the right postdoc.'
Male, Inside, Online Forum

Early career guidance, built in during the PhD, before the stage where the next step becomes critical, may help them make more coherent plans.

Take advice from those they already know

Participants had taken advice from immediate supervisors, colleagues from earlier award cohorts, more senior researchers in the lab, and friends at other institutions.

'I almost went to the US, then I took up the Cambridge offer, because I knew the supervisor and the research opportunities were better and more relevant, so thought overall it'd be better for my career.'
Female, Inside, Depth

'I was invited to give a seminar, met the lab leader, who liked me, offered me a postdoc contract and a stipend.'
Male, Inside, Depth

While this means that many awardees are making connections and in some cases getting the academic positions they want, it is clear that opportunities depend partly on knowing the right person. This could mean that not all awardees are getting access to the full range of career opportunities available in science.

The most proactive are visiting labs, seeking out specific scientists and networking, as well as taking advantage of networking events (for instance Wellcome Trust events).

Before starting to visit labs I wasn't sure whether I really wanted to do a postdoc, but once I experienced the enthusiasm and the wealth of opportunities and projects out there, I was convinced that I wanted to give it a go. I would recommend just visiting interesting labs before the end of the PhD to anyone. It beats just applying to job adverts and shows the PIs that you are truly interested in their lab.'
Female, Inside, Online Forum

Those who knew most about the life of an academic, or had the best networks, seemed to be most positive about staying in academia. Therefore giving more networking opportunities may help PhD students become more proactive, gain access to more opportunities, and hence be more likely to get the job they want in academia.

A push out of academia: Growing awareness of competition from abroad

Awardees were conscious, when applying for academic positions, that some of their competitors from abroad had more publications, putting them ahead.

'In the UK, PhDs are short, so you're competing against people who have done PhDs twice as long as you, and so will have more publications than you. In terms of a career, a PhD isn't enough, you need publications. That point isn't emphasised enough when you start.'
Female, Inside, Depth

'There is no transition period that allows you to think in length about what to do. There is no easy solution, though; I don't think we can expect someone to keep on paying us just because we need time to think. I feel it is an ongoing process during the PhD as well. Thinking of the next step was always in the back of my mind, but the time to think in detail was not there ... You're amongst the lucky ones if PhD and postdoc connect beautifully.' *Male, Inside, Online Forum*

For those less committed to academic research, the pressure to compete seemed daunting, and the time pressures to apply for more jobs felt overwhelming. At this point, some then left academia.

Additionally, others began to feel pressures such as pressure to move around, go abroad or pressure to publish which also created a sense that continuing in academia would not be worth the risk and difficulty. This thought process is described in detail in Chapter 5.

A pull towards other sectors

Friends and contacts could sometimes suggest new opportunities which are taken up spontaneously, because they come at the right time. In particular, well-paid jobs in the corporate or industrial world could sound very appealing at the difficult stage of the PhD where funds are low, and additional funding seems far off.

'My friends were saying don't you know how much you could be getting in the City?' *Male, Outside, Depth*

PhDs could be given more help to network with a wider range of people so that they have more choice of opportunities; especially in terms of finding opportunities to pursue science outside academia as well as inside.

Help at the pinch point?

The interviewees felt there is not enough time to write up, apply for academic jobs, and produce enough papers to rival students from abroad who have enjoyed longer funded courses. This, they said, could be a key point where interventions might help PhDs remain in academia. Some interviewees simply asked for more **funding** to help with this; there may be scope for **other solutions** also, to help UK PhDs compete better and get more academic jobs.

³Some examples of individual decision processes, names have been changed.

4.3 People and their decisions: why choose a PhD ?



Sam – “PhD got me into industry”

Before starting at PhD level, Sam had done an industrial placement. This experience led him to want to have a career in industry as he enjoyed working as part of a team, and found that he was interested in the business side of scientific research.

Sam knew that he needed a PhD to progress in industry and so applied to the Wellcome Trust. The PhD was hard work, with long hours, working weekends, and with a steep learning curve. He saw it as a ‘necessary evil’ for getting on, and felt it made him a much better scientist. He found that his PhD supervisor was a good scientist but lacked social skills, so he remained disengaged from the idea of an academic career.

‘A lot of the PIs and supervisors I worked with were not necessarily there because they were great bosses, but because they were great scientists, and so it has a tendency to crush a lot of people.’

Sam is now very happy doing science in the context of industry.

Ruth – “I loved science and feel proud to be a part of it.”

Ruth was fascinated with science and with the process of conducting rigorous experiments. When her undergraduate degree finished she applied to the Wellcome Trust and was awarded funding.

‘The day you go into the Wellcome Trust in London, it’s like going to the Temple of Science – we [the awardees] felt like we were a group who were part of something and felt chuffed’

Ruth worked with a very supportive postdoc who was very good at spotting problems in her approach, and making suggestions. Over the course of the PhD, Ruth managed to build up enough good data to form a publication. She visited events and conferences and met others in the scientific community. At one of the conferences she met a principal investigator whose research interests overlapped with her own and they had an involved conversation about possible interesting experiments. Ruth has since contacted them and it looks as though they may have postdoc opportunities which she is keen to take in order to continue with what she sees as ‘her research’.



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Risk versus reward:
is it worth it?

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KEY INSIGHTS

- The post-PhD stage (usually a postdoc position for our participants) brings new rewards, but staying in academia is thought to bring with it some risk.
- Some feel equipped to live with the risks associated with a career path in academia.
- For others, the risks and pressures become more acute over time. When perceived risks outweigh perceived rewards, things reach a tipping (decision) point, and they exit the sector, mostly drawn to careers where they can continue to use the skills from their PhDs or early academic posts in new ways.
- While our participants were happy with their choices, the implication of this study is that some potentially excellent scientists may be lost from academia, those who would have liked an academic career path. If individuals can be helped to manage perceived risks at the early career stage, this loss may be reduced.

What are the risks and why do they grow over time?

- Over time it is likely that post-docs need to secure funding for research as a PI. Applying for funding, especially in a recession where funding sources may be diminished while competition increases, is challenging and uncertain. For the individual, the negative consequences of not getting funding grow more serious.
- Success is felt to require long hours of effort and determination. New responsibilities within the academic institution can create a workload which feels unsustainable.
- There is some perception that to be a successful academic, in addition to the long hours, requires you to move institution and even country to broaden your experience. This can be viewed negatively by a number of potential early career academics .

- Publication of research results is felt to be a crucial enabler of a future academic career. However, like securing funding, attaining a publication as a key author is not certain and is seen to be affected by things outside 'your' control. While many early post-doctoral researchers accept this uncertainty, as time goes on, the pressure to publish – and publish well – becomes more acute.
- And all the while, there is a draw from other sectors which, given some of the riskier aspects of pursuing a career in academia, can look increasingly appealing to highly qualified, scientifically trained individuals. Other sectors are mostly felt to offer greater stability, support, and a wider range of careers.
- As life aspirations change over time, many want to settle down or start a family, so want to choose a less uncertain career path.

The women in the study seemed to reach the tipping point sooner, despite being equally committed to careers in academic science.

They were particularly concerned about:

- Insecurity of post and long working hours making life hard for families.
- Perceived need to move, which was of greater concern for women than men.
- While the women in our study were very high achievers, many felt that the culture of academia was unattractive as a place to stay for many years.
- Some said the culture also caused them to lose faith in the integrity and meritocracy of academia.
- Not enough female role models for aspiring female scientists, making it hard to visualise success.
- Lack of mentoring and career support.

5.1 Many stay in academia, but some leave

Throughout the research, it became clear that each individual creates their own conception of the risks and rewards of staying in academia. The point at which risks outweigh the rewards is highly subjective, but all our interviewees felt that there were risks associated with an academic career, and that these increase during the first few years of academic work post-doctorate.

Some of these, in academia at the time of interview, felt equipped to live with risk and continue to work towards the goal of being a research leader. They remained as focused and determined as ever on a career in academia. They were mostly thinking strategically about how to minimise the risks, obtain secure funding, and progress as quickly as possible.

However others, though still in academia at the time of the research, said that they could see themselves leaving if risks began to outweigh rewards.

Leaving to make a difference but also to avoid insecurity of academia

Within our sample, 28 men and 31 women had completed the Wellcome Trust-funded PhD. By the time we had spoken to them 15 women had left academia, and 10 of the men had done so (it is worth remembering that this is a higher proportion of male leavers than we find in the wider population, but speaking to this group in slightly greater numbers gives us a better qualitative understanding of the point of view of men who leave academia).

The women who left told us that they wanted careers where they could use their scientific knowledge, but also where they felt had more impact on 'real world' problems. The men were more likely to cite the instability and insecurity of academia as a reason for leaving – though they also said they wanted to address 'real world' problems.

'I was missing the insight of why my research was really valuable – then I realised I wanted to be helping people with their lives, and medicine gave the relevancy that I lacked'.

Male, Outside, Depth

Those outside academia were working in a wide range of areas. The vast majority were enjoying their work and felt they had made good choices. The areas included:

- **Industry:** Patent law, Venture Capital, Transfer, Biotech, Pharma, Management Consultancy, IT, Insurance.
- **Public Sector:** NGO, NHS, Education, Medicine, Healthcare, Science policy.
- **SciComm:** Television, Exhibitions.

5.2 Post PhD brings new rewards, but academia appears more risky over time

After the PhD, those in new academic jobs enjoy many rewards:

- Making a difference, a feeling of contributing to scientific knowledge.
- Stimulating lifestyle and company of like-minded colleagues.
- Long hours and dedication are enjoyable under these circumstances.
- Career feels as though it is 'on the up' and there is potential for success.
- Some start to taste the fruits of their hard work, with publications and successful completion of projects.

However, participants also told us they felt new pressures. The key point is that these pressures are not static, but increase over the first few years of postdoctoral work, contributing to a sense that the life of an academic is risky. Staying in academia involved dealing with these risks, which gets more and more difficult, until for most it feels no longer 'worth it'.

Both those who left academia, and those who stayed, told us they were satisfied with their career decisions. However, the implication of this study is that some potentially excellent scientists may be lost from a career in academia; those that would actually have liked to follow an academic career path. If individuals can be helped to manage perceived risks at the early career stage, this loss may be reduced.

More competitive, fewer jobs

One of the main challenges for new academics is the need to secure funding for research. Often newly post-doctoral graduates take up positions on a research grant led by a more senior Principal Investigator (PI). However, over time, and to sustain a successful career as a research academic, it is likely that the post-docs themselves will need to secure funding for research as a PI. There is growing awareness that career planning gets more competitive. There are fewer jobs (academia has a 'bottleneck' structure with few senior jobs) and more competition from abroad. This makes it perfectly possible that a relatively experienced person might be left without a job at all.

In addition, a climate of recession means that potentially future funding sources may diminish, while competition increases.

So, after three or four years of successful post-graduate work, the risk that funding may not be obtained next time is still just as present as it was in the beginning. It is not until

later in the career that the rewards of seniority (security, and higher income) are felt to 'kick in'. Failing to get funding straight after the PhD is disappointing. But after a few years of post-doctoral work, the chance of getting funding is still low and the consequences of not getting funding are much more serious than at the start. So the risks of continuing feel greater.

'A lot of people end up finishing their third post-doc, are not able to get into a science position and then have to get a takeover job like teaching, or leave science completely.'
Male, Inside, Depth

'Lots of people get quite demoralised because getting funding can be very, very difficult.' *Female, Inside, Depth*

Several awardees felt that the set path for staying in academia beyond PhD is restrictive: they felt they only had the option to do several postdocs before either managing to establish themselves as a principal investigator (PI) or in a teaching position, or having to leave academia altogether. Many participants argued that there should be other permanent roles in order to retain talent within academia and make funding applications less cut-throat.

'There isn't very much in addition to the PhD qualities that one gains from a postdoc, which would be useful for non-academic jobs. Instead, what a postdoc gains is an extremely high level of expertise and experience in his particular research area, and thus it would be very valuable to keep postdocs in academia... postdoc needs to become a PERMANENT career option.' *Female, Inside, Online Forum*

More work to do within the university, but little support on offer

Working in academia is perceived to demand long hours of effort and determination. New responsibilities, such as teaching or lab work, create time pressure. Institutions have varying levels of support for their junior staff. The longer this goes on, the more tired the participants felt. Some thought that they would not be able to sustain working like this in the long term.

'After a while in my project it did not feel I was doing what I signed up for. I could not carry out the right experiments, many hours were taken by continuously supervising new arrivals, results were coming slowly, boss bullying me. These, together with fixed term contracts, relatively low pay, high competition meant that it was not working for me.'
Male, Inside, Online Forum

'Universities have pulled out of supporting postdocs doing teaching. Supposing your grant has run out, the university just says 'Bye! Next!', there's no sense of support!'
Female, Outside, Depth

Negative perceptions about the culture of academia

Whether these are myths or reality, those in academia after their PhD tend to hold some clear and rather negative views

about the academic culture. Again, over time, these views contribute to an increasing perception that an academic career has many risks and few rewards.

- Once you get out of academia, you can't get back in again.
- If you're going to succeed, it has to be your vocation – you'll do long hours, for low pay, and put up with it.
- You have to move around every two years, across institutions and even countries, even if you don't see the benefit to science of doing so.
- The best researchers don't necessarily get funding, but the most confident and loudest might do (women in particular feel this, see section 4.3 below).

A sense that success may not be under your control

All told us that publication, at almost any cost, is a crucial enabler of academic success.

'Everything is geared towards publications at no matter what cost – and there are lots of sacrifices required at lots of levels. Everything in the world is geared towards publication. It's not "this is really exciting science," but "this journal won't like this story" – there's not enough focus on the science.'
Female, Outside, Depth

'[Pressure] to publish leads to a LOT of stress (poor quality of life), ridiculous working hours for postdocs (most work 50h or more per week, despite only being paid for ~40h), and promotes incentive for scientists to make exaggerated claims / even sometimes to commit fraud.'
Female, Inside, Online Forum

'I guess the stuff I didn't anticipate revolved around publications and so I didn't necessarily expect there to be so much publication pressure during the PhD.'
Female, Outside, Depth

However, while publication is dependent on hard work and effort it is also felt to be dependent on 'luck' – the chance of success in an experiment, or whether the lab is working on something of great interest to the sector. This can feel a highly risky aspect to a career in academia.

'I pursued an academic career: I knew I could work really hard but actually not succeed just 'cause of bad luck.'
Female, Inside, Depth

'I thought [academic science] is not for me because I feel like this is a bit out of my control. There's a big element of luck to it if your project works. If you happen to pick the right one it will be great. But then if you don't then it's almost the luck of the draw and I felt that was a bit too random for my liking.'
Female, Outside, Depths

Some felt they could beat this system by being especially dedicated and working hard to try and control for the random elements of the process. Those who are currently planning to stay in academia talked at length about how they would strategically manage these 'luck' elements. However for

others, even those who enjoyed academic life, this perception that their career was driven by some factors out of their control contributed to dissatisfaction with academia. While many early post-doctoral researchers accept this uncertainty, as time goes on, the pressure to publish – and publish well – becomes more acute.

A pull from outside: other sectors start to feel appealing

As mentioned in Chapter 4, there is often a draw from other sectors, and this can intensify after a few years of post-doctoral work, and appeal to highly qualified, scientifically trained individuals. Friends in industry describe the management support, mentoring and performance feedback they get, and this can seem appealing to those in academia as they get more experience of the lack of support within their universities.

Many start their academic careers believing that academia allows intellectual freedom, while working in industry, for example, is compromised and constrained. However, as they become aware of more options for working outside academia, some change their minds.

Personal factors have a part to play as well. Some awardees found that they prefer to work more with others or to do more project management than research. Some found that their interests changed, to funding strategy or science policy rather than research, for example; or they wanted a different pace of work, so opportunities outside academia felt more appealing. There was a perception that these different kinds of work would not be available within academia.

'In TV and journalism, you might do a show on the moon landing, then the next few months you may do one about how fossils get made, it's just more interesting to do it on that level, on that timescale.' *Female, Outside, Depth*

'I don't want to sound big-headed, I'm just being honest: I'm good enough to be able to stay in academia if I want to, so I could go about getting different postdocs and different sort of jobs like that. It's more about the work environment and the amount of satisfaction you can get from the work. I look forward to a more professional environment. I look forward to people saying well done. I look forward to much shorter-term goals and achievements.' *Male, Outside, Depth*

Life aspirations change over time and so the pressures feel more high risk

For most we spoke to, the risks mentioned above become more serious over time because academic life seems to get more risky just as individuals start looking for a more secure, less risky lifestyle. Insecurity of post, the need to move around, and the long working hours made it hard to start families or build work-life balance. Moving around was felt to be

particularly stressful and a challenge to a couple where both are academics:

'Generally the problem is no long term contracts, combined with people needing to stay in a very narrow academic area, where the jobs in this area are very geographically distributed. There is virtually no chance of finding two jobs in the same city for two academics in a couple. Now add to this the insistence that researchers move from institution to institution. Academia selects a very special subsection: those who are obsessed and who have zero responsibilities.'

Male, Outside, Depth

'You can't keep your children in school – science must come first. You're not allowed to care about anything other than science.' *Male, Outside, Depth*

'You pretty much can't advance if you haven't been somewhere else. Or my experience is you look at anyone who's got there and they've been somewhere else and research is very much an international thing.'

Female, Outside, Depth

Some question whether moving around produces the best science.

'Moving around can be good: it can expand your horizons, and ensure that you don't get stuck in a rut, but at the same time you do get genuinely outstanding professors who have never left the institution at which they did their PhD.'

Male, Outside, Depth

Most, however, feel it is part of the essential culture of academic life, but while science might benefit, individual scientists might lose out.

'I'm sure it will select for some of the best people as it selects for those who are willing to sacrifice everything for a career.' *Female, Outside, Depth*

The way that moving around is framed by funders could make a difference to early career scientists. Whether the Wellcome Trust, for example, requires candidates for awards to 'make the case for staying in one institution', or to 'make the case for moving to another', may affect scientists' perceptions of the culture.

In addition, most interviewees noted that academia has a long hours culture which can be all-consuming. While it is very positive for individual, keen scientists, it may not fit with family life.

'You have to churn out data at such a high capacity – sometimes doing 12-14 hour days with no breaks, and there were days when I was doing dissections when I wouldn't go to the toilet all day because that was 2-3 dissections that I would be missing out on. So you risk your own health just to get to publication quicker ... There are always people working in the buildings – you even go into the lab after a night out... There were unofficial guidelines that were printed out and handed to you which encourage you not to take any holidays,

and if you arrived at 9.30am that was treated as a half-day holiday, same with a 4.30pm leave.' *Female, Outside, Depth*

'You will work long hours, you will work on the weekends, the science comes first. It's so vocational; the people who are doing the best work and publishing the best stuff are totally in love with their jobs. But I don't think it's set up for a family.'

Male, Outside academia, Depth

5.3 Women reach a 'tipping point' sooner

When we showed participants the results from the Wellcome Trust tracker (that more women than men leave academia), participants tended to say that they were not aware of it - but they were not surprised by it. Women leaving is not just a problem of science or of academia. Women earn less and occupy less senior positions than men within the corporate, legal and academic worlds. The 'glass ceiling' debate is not new. So, it is not surprising that women are also under-represented in academic science. But our study suggests there are some reasons why women leave academic science specifically. Some aspects of academic culture seemed to act as a deterrent to both men and women, but were seen by both genders to disadvantage women more.

Insecurity of post plus long unsociable hours: seen by both genders to disadvantage women more. Women bear children, take maternity leave and tend to be primary carers. As discussed elsewhere, there was a prevalent perception that once you leave academic research, getting back in can be difficult.

'It's alright if you're a guy, but it's even worse for a woman – speaking from my wife's point of view, she's a scientist as well, it's just so fiercely competitive, the world of academic science, and it's all built on reputation. And unfortunately, if you take time off for maternity leave or to raise children, you're not there to have a reputation, so you suffer.'

Male, Outside academia, Depth

'I think the main issues for women in academia are linked to having children, the career break you have to take for that, and the problems surrounding child care and the devotion of time to your career versus your family.'

Female, Inside academia, Online forum

Timing of having a family. Waiting to have a baby until the career is established was seen as a challenge to career success, as was having a child early (e.g. during the PhD). Many awardees were unaware that the Wellcome Trust four-year programme included provision for maternity leave; but even those who knew about it felt that the challenge was more complex than simply having access to leave.

'Having children early could make it much easier to pursue an academic career slightly later in life for women. Studying for a PhD and trying to get on the academic career ladder doesn't mix with getting pregnant and taking maternity leave.'

Female, Outside academia, Depth

'It is unnerving, for example, in my lab there's a lady in her forties who has children, but she's waiting to hear about whether she's going to get more funding. That does put me off it a lot: I don't want to be living off one three year contract to the next. You have to try so hard to be one of the lucky few with a permanent contract.'

Female, Inside academia, Depth

Need to move was seen as a greater concern by women than men. This was not only about having a family. Women overall tended to wish for a more relaxed approach to work as they progressed through their careers. Words like security, calm, lack of stress and predictability came up in women's discussions more than in men's, suggesting that these aspects of work are more highly valued by women.

'I'd like to stay in [my town] and have some job security, and I don't see why that should be seen as a negative.'

Female, Outside Academia, Depth

There were also some specific aspects of the academic culture only mentioned by women, which also acted as a deterrent for them to remain.

'Macho and competitive' environment. Some female awardees were critical of the academic environment where they felt everyone had to take a competitive stance and avoid 'showing weakness.' This was felt to favour men rather than women, though the women in the study stressed that it was not because women are unable to rise to a challenge. In fact, many mentioned that Wellcome Trust female awardees would be likely to be particularly driven and well-adapted to a competitive environment. Rather, women said they found it wearing and boring, and it was a game that they did not want to play over the long term.

'It's a very harsh environment to be part of, but I wanted a challenge. It chews up people and spits them out – it's a culture of sink or swim but the uni doesn't like people who can't swim so it makes them sink. It's an uphill struggle.'

Female, Outside academia, Depth

'Progressing in academia requires you to be quite ballsy and cut-throat, and that's not every woman's cup of tea.'

Female, Outside academia, Depth

'Boys are really confident – they just decide "I'm going to be group leader", that's it.'

Female, Inside, Depth

Better connected and confident candidates are perceived to do best. Some women said this caused them to lose faith in the integrity and meritocracy of academia. They felt pressure to 'shout about' their work, network hard, and display bravado in funding applications. This did not suit them, plus made them feel that the best candidate would not always get the funding.

'I've spent my career in immunology which is really cliquey. The big guys, they all know each other and they won't let anyone else in, basically. I don't think it's a departmental thing. I think it's an international thing and it's really a thing by the journals ... it's not always the best things that are getting published.' *Female, Outside, Depth*

'My impression before my PhD was that if you did solid science, this was then acknowledged by the scientific community, graciously accepted and published. But actually it depends what lab you work in, who's your PI – their reputation and their publication history. It's very political. Now I'm on the other end of publications and know that it utterly depends on who writes it and where.' *Female, Outside, Depth*

'I have been increasingly seeing people who seem to do well, it's less about how hard they work, how rigorous they are. It's more about achieving certain things or how they come off, how people think about them rather than what's interesting. That's basically why I've been put off: it is basically a little bit corrupt and bankrupt in that way.' *Female, Outside, Depth*

Few female role models. There was a perceived lack of genuine female role models. Awardees did see women at senior levels, but described them as having either a great career, or a great family life. This choice did not appeal to female interviewees.

'There were a couple of women [in the department] but their careers weren't particularly successful and they seemed to find it hard to balance work and home life.'

Female, Outside academia, Depth


'I've certainly seen successful women in my field, although I don't know how successful they are in their marriages.'

Female, Inside academia, Depth

Lack of mentoring and career support. Both men and women in the study said that it was hard for early career academics to plan their careers and that universities did not prioritise supporting or mentoring staff. Only women, however, said that this was significant enough to make them consider leaving.

What are the differences between men and women?

Equally driven and keen, but...



Women

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More put off by perceived compromises


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Think about planning children earlier

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Value 'settling down' and expect stress to reduce

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Men

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Accepting of the culture of academic life

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Happy to 'struggle' to succeed for longer & put in long hours

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Strategic approach to career / networking

.....

5.4 People and their decisions: Why stay? Why leave?



Miranda – “The pressure to move put me off”

Miranda hugely enjoyed her PhD and found it very rewarding. When it came to the end of the PhD, she wanted to stay at her current university, working with her supervisor on the same issues and exploring similar subject avenues. However, after the PhD finished very few positions came up; she was unemployed and running out of money. Miranda started a PGCE to be a teacher. She has plans to re-enter academia at her old university with the help of her supervisor, and sees secondary teaching as her fallback option. Miranda wanted to stay in her university with ‘her work,’ but this did not look feasible.

‘It’s really daft because we’ve spent three years training doing something we really enjoy, and then funders just want you to walk away from it ... They want you to be an ‘independent researcher’, but actually you’ve been independently researching your area for three years, you’ve found what you want to do, and they won’t give you any money for it. You want to build on it and become an expert, but they weren’t interested in that.’



Lena – “I couldn’t make a difference to the world in academia”

During her PhD in infectious diseases Lena became frustrated with what she saw as the lack of connection between basic bioscience research and real-world medical application.

‘I was working on a virus that causes a disease in humans and I asked all the postdocs [...] what the symptoms were... There was zero interest in the patient, but there was a great emphasis on what protein A does and protein B in our lab.’

In the end Lena came to feel that, if one wanted to make a difference to the world, academia was not the place to be. Lena now works in public service, where she has received training and numerous promotions.



Marcus – “You have to be dedicated and move, for science”

Marcus has considerable ability and dedication to his subject. During his rotation year on the Wellcome Trust programme he made a significant scientific discovery which formed the basis of his PhD. This allowed him to write a paper, published in an eminent journal.

He and his supervisor had a close relationship and his supervisor recommended him to an elite university in America. Having no partner or children, he felt free to move. Marcus is now on a five-year postdoc where things are going very well. He works very long hours, but enjoys the academic lifestyle and all that goes with it. Ultimately he doesn’t see too many problems with science and feels that people putting in the “ridiculous” hours and dedicating their whole lives to it is ultimately “all the better for science.”

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Conclusions and thinking points

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6.1 What support is needed?

We contend that both men and women could benefit from interventions to improve their perceptions of the risks versus the rewards of an academic career. Interventions in the following areas might help those who would like to stay.

There are a number of things that research funders, institutions and the academic sector could consider, including the following.

MORE CAREER ADVICE AND SUPPORT DURING THE PHD

- Help with *planning careers* and making grants applications to aid the transition to next stage.

'There wasn't much explanation built into the PhD regarding where funding comes from, how to apply for grants, career paths, or dealing with the admin side of things.'

Male, Inside academia, Depth

- Continue and enhance current *networking* opportunities. Access to *information* about different sorts of careers within and outside academia, provided early in the PhD.

'Once you've left your university for two years you're not eligible for careers support so maybe the Wellcome Trust could offer some sort of careers advisory service to former Wellcome Trust award holders.'

Female, Outside academia, Depths

- For those who are struggling during the PhD, a system of *mentoring* with other scientists and researchers in the field would be welcomed, and could help give them a wider perspective.

Participants also asked for expanded opportunities to apply for *bridging funding*, to help time-pressured PhD students consider funding applications at the same time as writing up a PhD and publishing other papers. This, they felt, would help them compete more effectively with international students. This may not be the most realistic request but should be considered as it illustrates a particularly key barrier to PhD students remaining in academia.

DEVELOPING NEW INNOVATIVE APPROACHES TO CAREERS IN, OR WITH, ACADEMIA

Careers available are to some extent dictated by the needs of academia. However participants identified the bottleneck of too many academics seeking PI roles as one reason why people leave academia, and suggested funding for a wider range of roles. This could include:

- Considering the opportunities for research posts which involve academic research, but are not solely based in academia. This might include jointly-funded research posts in institutions, or industry sponsorship of research posts.

Awardees could contribute their expertise to the sponsoring organisations, for example through secondments. There could be opportunity for communicating better, and valuing more, academic posts which are not based solely in academia.

- A range of flexible technical scientist roles. Scrutinise the PI role and see if this can be broken down and split into more than one role, for example one focusing on project management, the other on laboratory work.

'I'm a research facilitator [outside academia], managing lab assistants, and I really like that role. Generally I think it would be good for group leaders [in academia] to have people in this kind of role: it would take a lot of pressure off the group leader, and allows me to do something I'm good at... group leaders are freed up from their administrative and management duties to concentrate on the actual science. They don't have to focus so much on the day-to-day running of projects.' *Female, Outside, Depth*

'After the first post-doc most people leave academia and only a few become PIs. Wouldn't it make sense to keep these highly qualified post-docs in academia for longer? Maybe more permanent post-doc/senior scientist positions should be created.' *Female, Inside, Online Forum*

- Allow scientists to take up part-time or temporary research-related roles, such as project management and managing a research budget, at different times in their careers to allow for more family-friendly work and regular hours. PhD experience – knowing how academia works and how to communicate with academics – would be invaluable for such roles.

CHANGE TO ACADEMIC CULTURE AND WORKING PRACTICES

Changes to working practices

- Remove funding criteria which require PhDs to *relocate* and consider research into the extent to which moving around benefits the scientist or the science outputs.
- Institutions to learn from family-friendly innovations and *systems in other sectors* that enable people with children to pursue careers, for example challenging the notion that long hours equate to productivity.
- Potential for *fewer academic funding awards, but for longer time periods*.
- More investment in staff and *career progression*, in line with what is common in other industries, so that PhDs can realistically plan their careers.
- Institutions should find ways of incorporating new academics more into the 'corporate world' of the university, potentially through guaranteed teaching posts over time.

- Effective '*line management*' could be valued more in academia. This may involve training for senior scientists as well as juniors, plus incentives in the university system so that coaching, support and mentoring can be increased and valued.

Changes to academic culture

In this study, most participants were reluctant to critique academic culture. Many said that the way things work now is the system which produces the 'best science', and if it does not suit individuals, that is regrettable, but cannot be altered. However the following areas were identified as areas of culture which currently act as a deterrent to staying in academia and could possibly be changed.

- Create awareness and raise the profile of a range of *role models* who have come to successful science careers through a variety of different routes and backgrounds. Challenge the prevailing opinion, evident in this study, that the Principal Investigator is the main and only career option for newly qualified post-doctoral researchers.
- Women could also benefit from seeing more female role models following careers in academic research. This would be particularly valuable if accompanied by information on their backgrounds and how they have overcome any challenges.
- Ensure that there is good communication and dialogue about working benefits that do exist within academia (often more comprehensive than those that exist in other sectors), such as maternity leave provision and the options for working more flexibly within academic research.
- More information and research is needed on whether moving posts or institution, if pursuing a career in academic research, is actually of long term value to researchers. As science becomes more international, virtual technologies are helping to forge collaborations without the requirement for face-to-face contact.
- There is a perception that it is a 'requirement' for a researcher to have moved posts to successfully apply for a certain grant; if this is a myth, then funders need to better communicate this.
- Challenge the ingrained perception that *working in industry equates to intellectual constraint* while academia means intellectual freedom. One participant told us that new biotech companies offer legitimate opportunities to publish, but that academics do not necessarily know about. Knowing more about the world of industry may help early career scientists weigh up all the opportunities open to them to remain in science.

There is also scope for funders to **conduct research to provide an evidence base for future activities designed to motivate and retain good scientists. Suggested areas include:**

- Drivers of motivation among non-British students.
- The value of moving posts, institutions, and country – what does the sector really think?
- Career decision-making for clinicians, a study similar to the current study but investigating the views of those in clinical science.