Evaluation of BBSRC's David Phillips fellowship scheme

This document represents the views and conclusions of a Review Panel of experts

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Abbreviations

BBSRC	Biotechnology and Biological Sciences Research Council
BIS	Department for Business, Innovation and Skills
BSC	Bioscience Skills and Careers Strategy Panel
CASE	Collaborative Awards in Science and Engineering
C1	Cohort 1
C2	Cohort 2
C3	Cohort 3
Co-I	Co-Investigator
Defra	Department for Environment, Food and Rural Affairs
EMBO	European Molecular Biology Organization
EPSRC	Engineering and Physical Sciences Research Council
EU	European Union
IF	Impact Factor
IP	Intellectual Property
MRC	Medical Research Council
NERC	Natural Environment Research Council
NI	New Investigator
PI	Principal Investigator
RSE	Royal Society of Edinburgh
TAC	Training Awards Committee

Executive Summary

This document sets out the views of a specialist Review Panel convened to provide an independent evaluation of BBSRC's fellowship support for early-career scientists, with a particular emphasis on the David Phillips fellowship scheme. The objectives were to: assess the extent to which the scheme has supported outstanding early-career scientists; assess the quality of fellows' research and the outcomes arising from it; consider whether fellowship support has enabled early-career scientists to establish themselves in academia; comment on the level of support provided to fellows by BBSRC and host institutions; and to identify ways to build on successes and address identified gaps and issues.

The Panel's analysis was based on questionnaire responses from 81 former and current early-career fellows, and on the final reports from 62 completed David Phillips fellowships. The fellowships had start dates between 1996 and 2008.

Throughout the text, the term 'fellow' is used to refer to both current and former fellows.

Key conclusions

1. The David Phillips fellowship scheme supports excellent early-career scientists

The calibre of individual early-career scientists supported by the David Phillips fellowship scheme is very high. The majority of fellows are very accomplished researchers, a notable number are outstanding, and several are exceptionally talented. Fellows' achievements, both during and after the fellowship, are impressive. Fellows are conducting high-quality, creative and innovative research, they are establishing sustainable research programmes, and they are achieving excellent career development outcomes.

2. The research conducted by David Phillips fellows is of a very high quality

The overall standard of fellows' research is very high and some is of an exceptional quality. The research has led to exciting discoveries and is making important contributions to scientific fields from across the BBSRC remit. The outputs and outcomes arising from the research are very good and include a large number of publications in high impact and prestigious journals, further funding to develop the research programme, and the establishment of new academic partnership links. The high quality of fellows' research contributes to the strong international standing of UK bioscience.

3. The David Phillips fellowship scheme enables early-career researchers to establish themselves in academia

The career development outcomes of fellows are very good. Nearly all former fellows secured permanent positions; the majority remained in academia and a few secured leadership positions in industry. Fellows have been awarded a substantial amount of further funding from BBSRC and a wide range of other organisations, which has enabled them to develop their research programmes and establish their own research groups. Fellows are also contributing to the wider academic community through, for example, membership of funding committees, journal editorial boards, strategy panels and other professional bodies.

4. Fellows' research has delivered economic and societal impacts

Delivering economic and societal impacts from research is not the primary objective of the David Phillips scheme. Nevertheless, there is evidence that fellows' high-quality research has delivered wider impacts, or has potential to do so in the future. A large number of fellows established formal partnership links with industry or other stakeholders as a result of their fellowship. A notable proportion secured intellectual property rights and three established spin-out companies. These are impressive achievements, especially considering the relatively early stage of many fellows' careers. Fellows' research is delivering wider benefits to the public good including contributions to human health, food security, industrial biotechnology, animal health and welfare, the environment and combating climate change, and other areas of government policy. Overall, it is encouraging that fellows are developing a culture within their research teams which recognises the importance of realising the wider benefits from their research.

5. The balance and coverage of the fellowship awards are good

The David Phillips fellowship scheme supports excellent science from across the BBSRC remit, with a very strong emphasis on basic research. A key strength of the scheme is that it is focused on supporting the most talented researchers with the best ideas from any area of the BBSRC remit. Fellows' creative, investigator-driven science has led to exciting discoveries, which have underpinned future developments, sometimes in unexpected ways. David Phillips fellows are making substantial contributions to addressing BBSRC's strategic priorities, without the need for the scheme to be formally aligned to priority areas. It was pleasing that the David Phillips fellowship scheme has established a suitable niche within the wider landscape of early-career fellowships. BBSRC was the most appropriate funder for the fellowship awards, all of which fell clearly within its remit.

6. The non-financial support provided to fellows by BBSRC is very valuable

BBSRC now provides a range of additional non-financial support to its fellows, which includes a mentoring programme, a biennial BBSRC Fellows' Conference, feedback on annual reports, and a mid-term progress review. This dedicated support is one of the strengths of the fellowship and is indicative of the importance BBSRC places on its investment in its fellows. High-quality mentoring is very important in enabling fellows to

establish themselves in academia, and BBSRC's mentoring provision is effective. The Fellow's Conference is a particular highlight of the fellowship scheme. It provides for inspiring and stimulating discussion, excellent networking opportunities and a forum for fellows to discuss career development issues. BBSRC could build on its success by organising an additional event, exclusive to early-career fellows, in between the biennial conferences.

7. The David Phillips fellowship scheme has evolved over its lifetime to address the concerns of fellows and emerging issues relating to career development

Since its inception, the fellowship has developed from being viewed as a senior postdoctoral position to a vehicle for establishing an independent scientific career. The most important changes include a substantial increase in the level of the research support grant, changes to eligibility criteria and fellowship conditions to ensure the scheme takes accounts of career breaks and is family-friendly, the provision of training in scientific leadership and laboratory management, improved mentoring and the introduction of the Fellows' Conference. These changes are very positive and illustrate the care BBSRC is taking to ensure the scheme remains fit for purpose. The prestige of the scheme among the research community has increased over its lifetime and is now very high, reflecting the level of support, both financial and non-financial, BBSRC provides to its fellows.

8. The quality of support and mentoring provided by host institutions is variable

Some fellows receive excellent support and mentoring from their host institution, whereas others report a lack of support. This is concerning as poor mentoring from host institutions was a key contributory factor for the few fellowships which were less successful than anticipated. BBSRC should explore ways to ensure departments make clear and explicit statements about the support they will be offering to their fellows; visits from BBSRC mentors early in the fellowship are useful in this context. In addition, fellowship applicants should consider more carefully the range of support provided by the proposed host institution when choosing where to base their fellowship.

9. Fellows are concerned about issues associated with securing a permanent academic post

Obtaining a permanent academic post is one of the most challenging aspects of the fellowship. One in four fellows changed host institution during their fellowship, primarily because of a lack of career development opportunities. Although it is positive that fellows are able to negotiate positions with better prospects at other institutions, the moves are disruptive and adversely affect fellows' productivity. It is unreasonable to expect institutions to guarantee fellows a permanent position at the outset of their fellowship. However, BBSRC should encourage institutions to formalise the procedures for fellows' career development and make these clear to them. It is also essential that fellowship applicants are aware of the implications of their choice of host institution on career development. Some prestigious institutions provide an excellent research environment, but offer limited prospects to obtain a permanent post; other institutions

may offer greater opportunities for career development, but provide more modest resources and facilities for research.

10. Issues with tenure prevent fellows from applying for research grants and studentships towards the end of their fellowship

To be eligible for BBSRC research funding, a researcher must have a contract which extends for the full duration of the proposed grant. Unless fellows have secured a permanent position or have their salary underwritten by their host institution beyond the end of the fellowship, they are unable to apply for research grants in the final years of their fellowship. This is a concern, as it delays the pursuit of exciting research directions and damages fellows' momentum. It also creates additional stress for fellows who see their marketability decrease as their fellowship nears its end. BBSRC should explore possible ways to address this issue, taking care to avoid creating perverse incentives which would discourage an institution from itself making a commitment to support its fellows.

11. The current level of financial support provided by BBSRC's early-career fellowship awards is good

The research support grant is of sufficient value to allow fellows to conduct a competitive research project and it takes into account additional costs associated with specific research areas. It is a notable improvement from the early years of the David Phillips fellowship scheme, when the research support grant was very limited and fellows were forced to spend a lot of time writing grant applications rather than conducting research. The five year duration of the fellowship is also essential, providing sufficient time for researchers to establish an academic career. BBSRC should prioritise support for new fellows, ensuring that the current level of support and the number of awards can be maintained in the future.

12. The application and administration processes are fair and effective

Overall, the application and assessment processes are good. The eligibility criteria ensure the scheme is targeted on individuals with suitable experience, and the assessment criteria ensure it supports high-quality early-career scientists within the BBSRC remit. Nevertheless, some further improvements to the application process are possible, for example, improving feedback to applicants, increasing transparency of the process, and ensuring that the timing of interviews and decisions are coordinated with other major early-career fellowship funders. The Panel endorsed the proposed introduction of outline applications which could provide a number of benefits: reducing the burden on uncompetitive candidates; enabling applicants to address issues with their proposal and clarify the support from their host institution; and achieving a better gender balance in applications. The administration of the scheme is effective. Fellows and fellowship applicants view BBSRC staff as helpful and sympathetic: they adopt a flexible approach to the administration of the fellowship award which benefits fellows and enables them to take advantage of opportunities as they arise.

13. Early-career fellowships are an essential part of BBSRC's funding portfolio and they must continue to be supported in the future

The David Phillips fellowship scheme is extremely successful. It supports outstanding researchers, enabling them to conduct very high-quality research and establish independent academic careers. The scheme allows BBSRC to be adventurous with its support for future talent. It represents an excellent investment in the next generation of research leaders and provides good value for money. BBSRC has ensured the scheme has actively evolved over its lifetime to address emerging issues, and it is important that this continues. The future research climate is unlikely to be as favourable as it has been in the recent past; fellows will face additional challenges such as lower responsive mode success rates, reductions in university funding and the number of academic posts, and increased competition from overseas. As resources become more limited, BBSRC should endeavour to protect its fellows from the worst effects of these changes. Support for early-career scientists is vital for the long-term viability of the UK research community and, in turn, the UK's ability to use science to deliver solutions to major global challenges.

1. Introduction

1.1 BBSRC

1. The Biotechnology and Biological Sciences Research Council (BBSRC) is one of seven Research Councils sponsored through the Department for Business, Innovation and Skills (BIS) of the UK government. Its principal aim is to foster a world-class biological science community in the UK. The mission of the BBSRC is to fund internationally competitive research, to provide training in the biosciences, to encourage opportunities for knowledge exchange and economic impact, and to engage the public and other stakeholders in dialogue on issues of scientific interest.

2. BBSRC supports research and training in a number of ways, including research grants, studentships, fellowships and strategic grants to BBSRC-supported institutes. In the 2009-10 financial year, BBSRC invested £53.7M in training awards and fellowships.

1.2 Evaluation context

3. BBSRC is committed to the effective evaluation of the research and training it funds, as part of its strategy for evidence-based decision making. Evaluation plays a central role in:
   - enabling BBSRC to account to government, the public, the scientific community and other stakeholders for the funds it allocates
   - justifying BSBRC funding allocation and contributing to the evidence that all Councils are required to submit to BIS
   - informing internal funding decisions, providing evidence of progress and achievement, and facilitating the development of a strategic overview for future funding decisions
   - helping BBSRC to improve its policy and practice, through informal policy decisions and the design of new schemes, programmes and processes; and through identifying good practice, lessons learned and ways to improve processes

4. Formal evaluation of research is currently conducted at a number of levels in BBSRC:

Project:	• evaluation of final reports from grants
Scheme:	• evaluation of major research investments, for example, through responsive mode or research initiatives (time-limited research funding in strategically significant areas) • evaluation of funding schemes (e.g. international Partnering Awards, Research Industry Clubs, fellowship schemes)
Institution:	• Institute Assessment conducted every five years at the BBSRC-supported Research Institutes

5. BBSRC's Evaluation Framework[1] outlines the Council's approach to evaluation and the methodology used.

[1] www.bbsrc.ac.uk/researchevaluation

1.3 The David Phillips fellowship scheme

6. BBSRC introduced the David Phillips fellowship scheme in 1996[2]. The aim of the scheme is to support outstanding scientists in the early stage of their research careers to establish themselves as independent researchers. In awarding the fellowships, BBSRC seeks to identify scientists who could be expected to be among the leaders of their generation of bioscientists. Applicants should be able to demonstrate that the fellowship will be of benefit to them, their science and BBSRC.

7. David Phillips fellowships are awarded for a period of five years. They include a personal salary and a significant research support grant. There are normally up to ten David Phillips fellowships available each year. The fellowship awards are made within any area of science within the BBSRC remit.

8. David Phillips fellowships are intended to enable successful candidates to embark upon a period of independent research and scholarship at an important stage in their research career. In assessing applications, there is a strong emphasis on the scientific potential of the candidates. In addition, the proposed scientific programme should be sound, and of a novelty and timeliness that will add to the understanding of the biosciences.

9. Applications for David Phillips fellowships are assessed by BBSRC's Training Awards Committee (TAC), formerly known as the Studentships and Fellowships Panel (SFP) or the Committee for Studentships and Fellowships (CSF). An outline of the fellowship application process is shown on page 13.

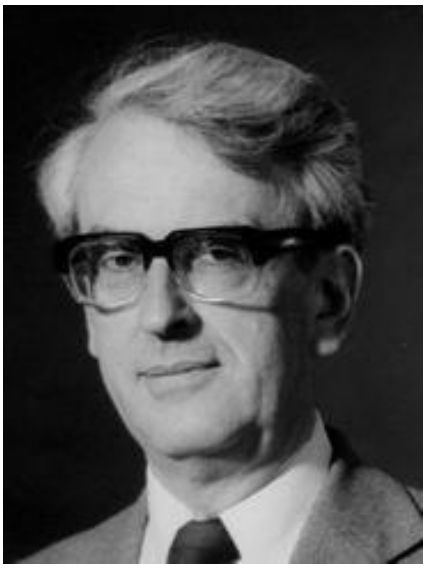
10. In 2006, BBSRC introduced the Institute Career Path fellowship scheme. These fellowships were designed to support innovative early-career scientists in strategically important areas targeted by BBSRC. The scheme was based on the existing David Phillips fellowship and aimed to enhance the quality of science in BBSRC-supported institutes in a targeted way. There were normally up to two Institute Career Path fellowships available each year.

11. The Institute Career Path fellowship scheme has been discontinued, with the last funding call in 2010. The operation of the Institute Career Path fellowship scheme is outside the scope of the present review.

[2] BBSRC Technology Foresight Junior Research fellowships awarded as part of the 1995 competition were subsequently rebranded as David Phillips fellowships.

Biographical note about Sir David Phillips

Sir David Phillips (1924-1999)



David Phillips (later Sir David Phillips, Lord Phillips of Ellesmere) was a distinguished structural biologist who later in his career held the post of chairman of the Advisory Board for the Research Councils for ten years in the 1980s and 1990s.

David Phillips gained a first degree in Physics and after war service returned to Cardiff for postgraduate studies in crystallography. After postdoctoral research in Canada, he joined a team headed by Bragg, Perutz and Kendrew who were investigating the three-dimensional structures of large molecules such as proteins. He was involved in the determination of the first 3-D structure of a protein molecule, myoglobin, in 1958. Phillips led the group which determined the complete structure of lysozyme in 1965, a structure characterised by a deep cleft on one surface which suggested how lysozyme might interact with other molecules. With the other members of the group and with C. A. Vernon, he was able to propose a mechanism for the enzyme's catalytic activity which has since been shown to be essentially correct. The work was immediately recognised to be of very great importance. Phillips was elected a Fellow of the Royal Society, and was awarded many honorary degrees and a number of medals, including the Royal Medal of the Royal Society in 1975.

After his appointment as Professor of Molecular Biophysics at Oxford, Phillips led the way in the elucidation of the structures of enzymes, antibodies, viruses and other macromolecular complexes. He served as a vice-president of the Royal Society (1972-73), and as its biological secretary (1976-83). He was then appointed chairman of the Advisory Board for the Research Councils, the body responsible for advising the Government on the disposition of funding for research councils and universities, a post he held for ten years.

BBSRC was pleased to name its early-career Fellowship after Sir David Phillips in recognition of his contributions to the understanding of the structure and function of biomolecules and of his achievements as a scientific adviser to the Government during the period which spanned the planning which led to the establishment of BBSRC as a separate Research Council.

Assessment criteria and timeline for the 2009 David Phillips fellowship application process

Assessment criteria

Candidate
- research achievements to date
- number and quality of publications
- overall comments on the suitability of the candidate, including personal achievements

Proposed Research Programme
- relevance to BBSRC's mission
- economic and societal impact
- scientific quality of the proposed research
- choice of host institution
- scientific independence

Timeline

Nov	Application deadline
Dec	Initial sift of applications by TAC members; based on potential of candidate rather than quality of proposed research programme
	Applications from non-competitive candidates rejected
	Approximately 50% of applications are sent for peer-review; this includes an assessment of the scientific quality of the proposed research
Mar	TAC reviews applications and associated referees' comments
	15-20 candidates are shortlisted for interview
Apr	Fellowship candidates are interviewed by a sub-group of TAC
May	Funding decision announced

1.4 Evaluation methodology

12. The aim of the evaluation was to obtain an independent assessment of BBSRC's fellowship support for early-career scientists, with a focus on the David Phillips fellowship scheme. Specifically, the objectives were to:
    - comment on the extent to which the fellowships have supported outstanding early-career researchers
    - assess the effectiveness of the fellowships in enabling early-career researchers to establish themselves in academia
    - assess the quality and international standing of the research conducted by fellows
    - identify the major outcomes and achievements of the fellowships, including any economic and societal impacts
    - assess the balance and coverage of the fellowship awards
    - comment on the application and assessment procedures of the fellowship scheme
    - identify ways to build on successes and ways to address identified gaps and issues

13. Information was gathered from a number of sources:

    - **Former fellows**: A questionnaire was sent to all former fellows who held a David Phillips fellowship. The survey covered topics including the success of the fellowship, research outputs and outcomes, further funding, career development, and views on the fellowship application and administration processes. 42 out of 58 questionniares were returned (72% response rate).

- **Current fellows**: A questionnaire was sent to all current holders of a David Phillips fellowship or an Institute Career Path fellowship. The questionnaire was very similar to that sent to former fellows. 39 out of 44 questionnaires were returned (89% response rate).
- **Fellowship applicants**: A questionnaire was sent to all researchers who attended an interview for a David Phillips fellowship or an Institute Career Path fellowship, but who were not subsequently awarded a BBSRC fellowship (i.e. were either not offered a fellowship or did not accept the offer of a fellowship). The unfunded applications were from the 2006, 2007 and 2008 fellowship calls. 17 out of 29 questionnaires were returned (59% response rate).
- **BBSRC data**: Relevant data were collated from fellowship application forms, fellows' final reports and the BBSRC grants database.

14. The questionnaires are reproduced at Appendix 2. The survey responses were received between March and May 2009.

15. Host institutions were not approached as part of this evaluation. As such, some of the challenges faced by institutions in providing support for their fellows may not have been fully captured.

16. The evidence collected for the evaluation was reviewed by a Panel of independent experts who are familiar with career-development issues in the biological sciences and who between them have expertise across the BBSRC remit. The Panel included an industry representative.

1.5 Data analysis

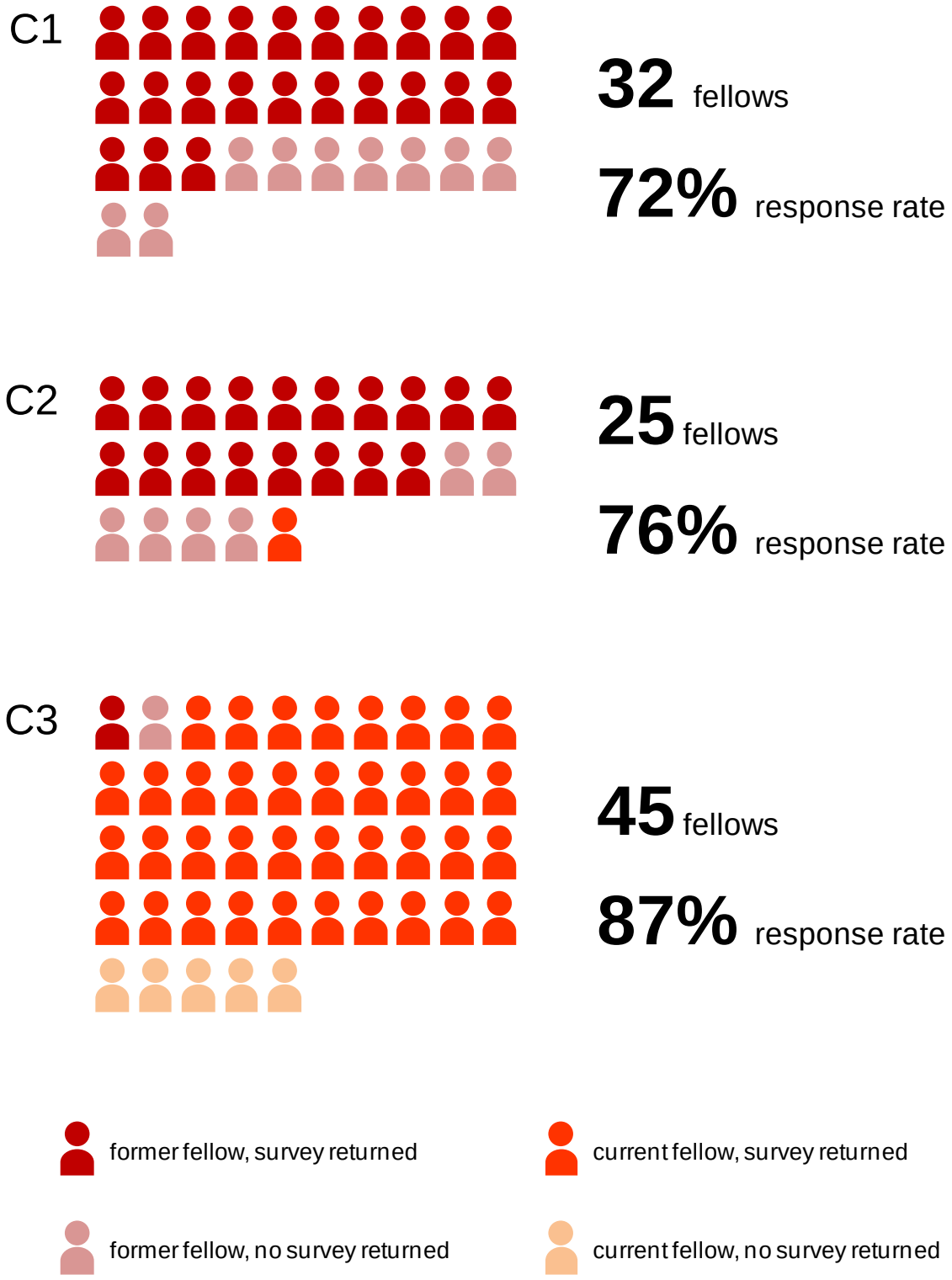
17. For the analysis of the data, fellows were placed into three cohorts:

    - **Cohort 1 (C1)**: David Phillips fellows who applied in the 1995 to 1998 calls. The research support grant associated with these fellowships was fixed at £15K per annum. These fellowships are all complete.
    - **Cohort 2 (C2)**: David Phillips fellows who applied in the 1999 to 2003 calls. These fellows received a more significant research support grant (e.g. up to £200K over five years for the 2000 call). Almost all of these fellowships were complete at the time of the survey (one was still current as the fellow had taken a career break).
    - **Cohort 3 (C3)**: David Phillips fellows and Institute Career Path fellows who applied in the 2004 to 2007 calls. The majority of these fellowships were current at the time of the survey (two were classified as complete as the fellows had resigned their fellowships).

18. For conciseness, 'fellow' is used as a collective term through the text to describe both former and current holder of David Phillips fellowships or Institute Career Path fellowships.

19. The Panel's analysis was primarily based on the outputs and achievements reported by former fellows. As these were all David Phillips fellows, the findings and conclusions within this report refer to the David Phillips fellowship scheme only. To determine the effectiveness of the Institute Career Path fellowship scheme, BBSRC would need to conduct a separate evaluation after several intakes of these fellows had completed their fellowship.

Number of fellows in each cohort and their status (former or current) at the time the evaluation surveys were conducted



2. The calibre of fellows and the standard of their research

Summary

- The David Phillips fellowship scheme has supported excellent early-career scientists
- The research conducted by David Phillips fellows was of a very high quality
- The number and quality of publications arising from the research was very good
- The development of intellectual property and establishment of spin-out companies was high compared with the wider BBSRC research portfolio
- Fellowship performance was adversely affected by a number of issues, including staffing difficulties, experimental, methodological or technical issues, a lack of resources, and uncertainty about employment or tenure
- The number of fellowships which failed to meet their research objectives or did not result in good career development outcomes was very low

2.1 Calibre of fellows

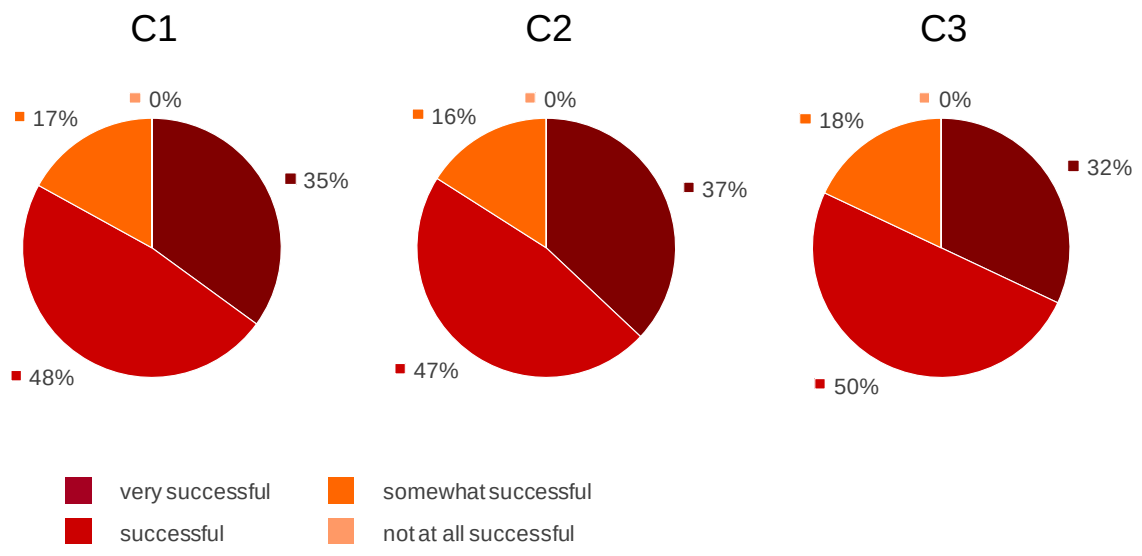
20. The David Phillips fellowship scheme was very successful in meeting its objective to support outstanding early-career researchers. The majority of fellows were very accomplished researchers, a notable number were outstanding, and several were exceptionally talented. The high calibre of fellows was demonstrated by their impressive achievements both during and after the fellowship. Fellows conducted high-quality, creative and innovative research, they established sustainable research programmes, and they achieved excellent career progression outcomes.

2.2 Standard of research

21. The standard of the research conducted during the fellowship was very good. The research led to exciting discoveries and made important contributions to scientific fields from across the BBSRC remit. Some of the research was of an exceptional quality.

22. Fellows produce a final report at the end of their fellowship. These reports are formally assessed although, unlike those of responsive mode grants, they are not graded. An overview of fellowship performance was therefore obtained from fellows' self assessments. 84% of C1/C2 fellows stated that their fellowship had been successful (48%) or very successful (36%) in meeting its research objectives.

Fellows' self-assessment of the success of their fellowship



Self-assessments were based on the response to the question: "In your opinion, how successful was your fellowship in meeting its research objectives?" In previous evaluations of responsive mode research, grantholders' self assessments were very similar to the final report grades awarded by Research Committees.

2.3 Research outputs and achievements

23. The high standard of fellows' research was reflected in the quality, quantity and range of outputs produced. These included a large number of papers in high impact and prestigious journals, the development of intellectual property, the establishment of spin-out companies, further funding to develop the research programme, and the establishment of new academic partnership links.

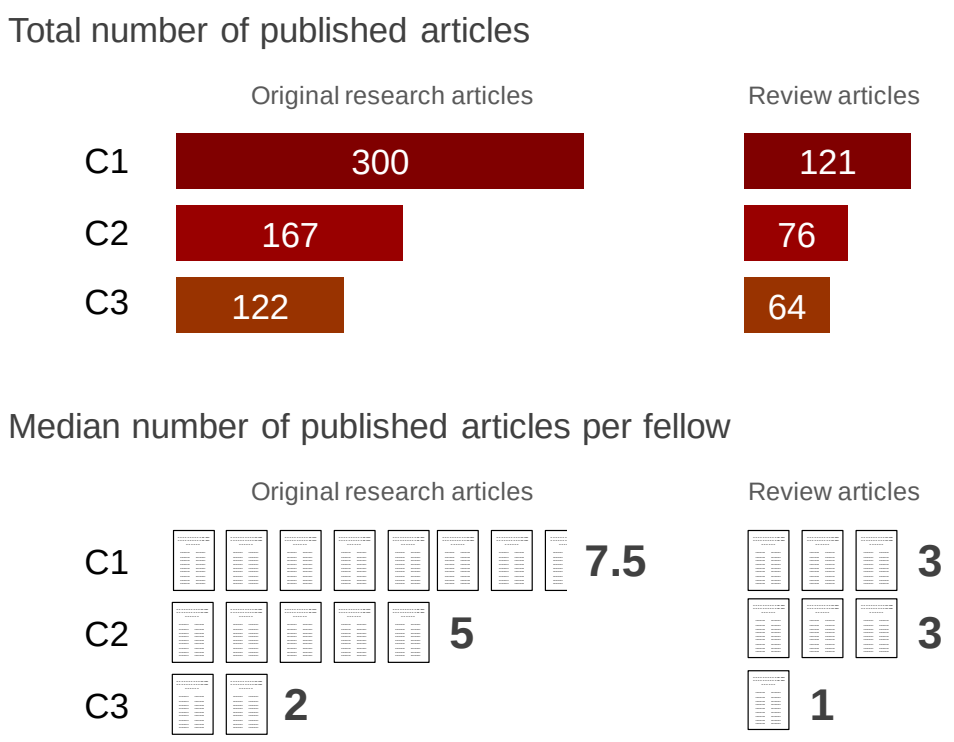
24. The data on research outputs presented in this report are focused on the combined data for the C1 and C2 cohorts (referred to as C1/C2 throughout the text). Data on research outputs from C1/C2 fellows were collected from final reports and questionnaire responses from 57 fellowships. The figures are likely to underestimate the total outputs, because while they include data from the final reports of 56 fellowships, they only include survey responses from the 42 fellows who returned the questionnaire. Data from the C3 cohort are also presented, although it should be noted that the C3 fellowships were still current when the evaluation surveys were conducted.

2.4 Publications

25. The published outputs arising from the fellowships were impressive in terms of quality and quantity. Fellows published in an appropriate mixture of high-profile and specialist journals. This was particularly noteworthy considering that fellows were making the transition from postdoctoral researcher to independent scientist and establishing their own research programmes (which might be expected to interrupt publication output).

26. A total of 467 original research articles are known to have been published and reported so far from the C1/C2 fellowships. The median number of original research articles per completed fellowship was six, rising to eight when review articles are also included. This compares very well with the median number of four peer-reviewed papers (original research and review articles) per completed grant in previous evaluations of the responsive mode research portfolio. 95% of C1/C2 fellows had published an original research article.

Fellows' publication output



27. In general, the quality of journals in which fellows' research articles appeared was very good. A large proportion of fellows published papers in high-ranking, multi-disciplinary journals or prestigious journals in specific scientific fields. Although journal impact factors (IF) should not be used as an indicator of the quality of individual research articles, it was nevertheless very encouraging that 16% of C1/C2 fellows had published an original research article in *Nature* or *Science*. More broadly, 35% had published in a journal with an IF of ten or more, 54% had published in a journal with an IF of eight or more, and 84% had published in a journal with an IF of five or more. A relatively small proportion of research articles were published in lower profile journals.

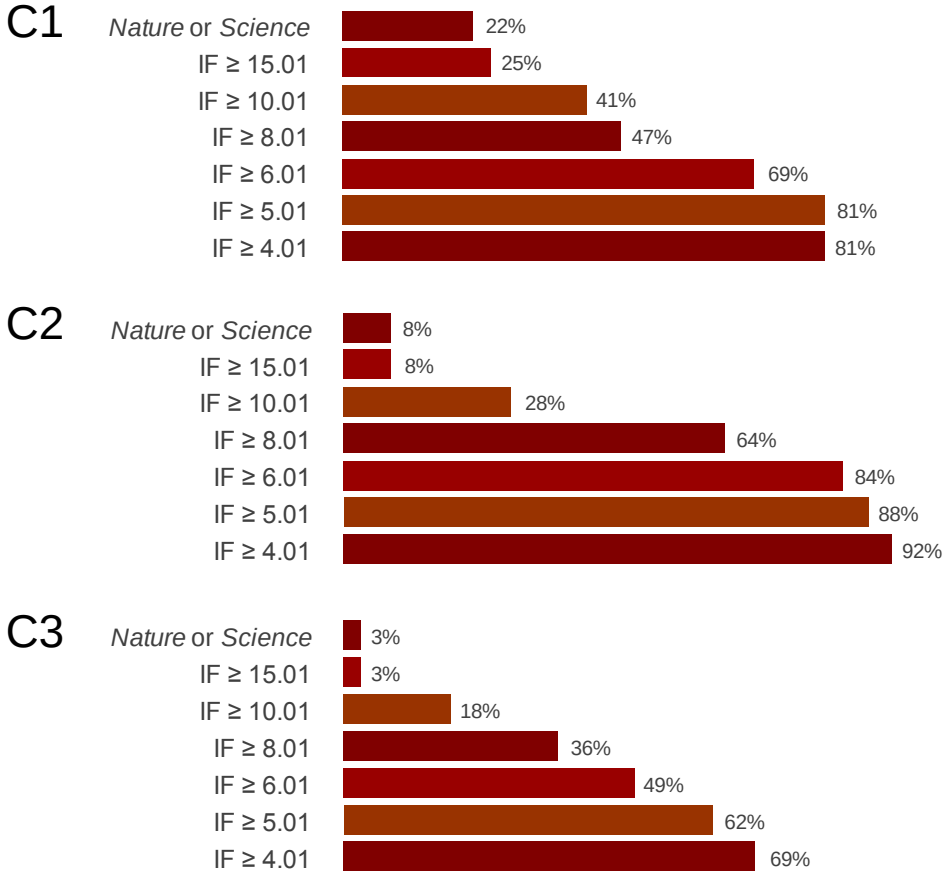
A C1 fellow at the University of York investigated the symbiosis between plant roots and fungi. Her work focussed on arbuscular mycorrhizal (AM) fungi, which confer a number of benefits to the plant including increased resistance to pathogens and enhanced capture of nutrients such as phosphorous. AM fungi were thought to have no role in nitrogen capture, but her research demonstrated that AM fungi are able to enhance the decomposition of complex organic materials in the soil and increase nitrogen uptake by the plant. The work has implications for food security as, in the future, crops will need to grown with less input from inorganic fertilisers. The results were published in a paper in the high impact journal *Nature* which has been cited over 170 times.

A C1 fellow at the University of Exeter (initially the University of St Andrews) conducted research into the evolution of male dimorphisms and female mate choice. The fellowship contributed to seven original research articles. One paper described how local population density drives the strategy male earwigs use for securing a mate and was published in the high-impact journal *Nature*.

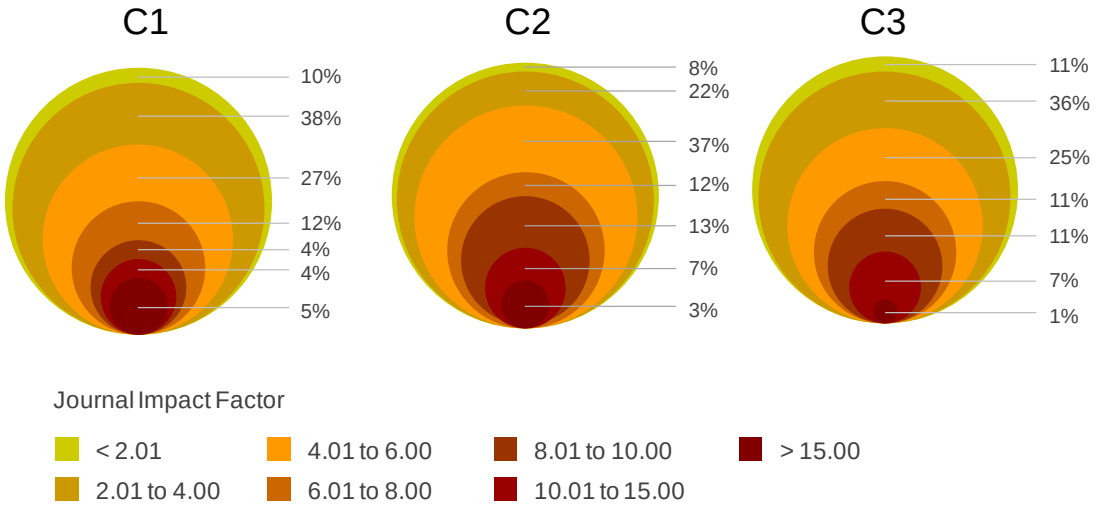
A C3 fellow at the University of Cambridge (initially the Babraham Institute) investigated how baby mice adapt to malnutrition in the womb either because the mother is undernourished or because of defects in key imprinting genes that control the function of the placenta. His research discovered that the undernourished baby sends signals to the placenta, which in turn responds to meet the baby's needs for growth. Foetal and placental signals involved in this process were identified. The work contributed to two articles in the prestigious journal *Proceedings of the National Academy of Sciences of the USA*, which together have been cited over 180 times. The research has wider implications for human health, as adaptations which occur in the womb may lead to life-long alterations in the function and structure of the body.

A C1 fellow based at the University of Edinburgh studied the evolution of reproductive strategies in many different types of organisms, including birds, mammals, insects, plants, protozoa and bacteria. His work in evolutionary biology led to important advances in basic scientific knowledge, but it also helped to addressed more applied questions: using sex ratios to estimate the population structure of medically important parasites; how learning can influence the effectiveness of pest management strategies; and how different farming practices select on the behaviour of root symbionts. The fellow's publication record was very impressive, with the fellowship contributing to 44 original research articles. Five papers were published in the high impact journals *Nature* and *Science*, and three of these have been cited over 100 times each.

Proportion of fellows who published an original research article in a high impact factor journal



Distribution of original research articles by journal impact factor



Publication data is based on information in fellows' final reports and updates provided in survey responses. Fellows were asked to provide details on the publications arising from their fellowship, rather than all the publications arising from their wider research programme. The analysis should be treated with caution as it places less emphasis on prestigious journals in specific fields which have more specialised readerships and therefore lower impact factors. In particular, strategic and applied research is less likely to be published in high impact, multidisciplinary journals such as *Nature* and *Science*.

28. 76% of C1/C2 fellows had published a review article or book chapter. This was a relatively high proportion which prompted a slight concern that fellows may be writing review articles solely to improve their publication numbers. In practice, however, the majority of review articles were of high quality and were published in prestigious journals with wide readerships.

29. 71% of C1/C2 fellows reported at least one publication with an international co-author, and 19% reported at least one publication with an industrial co-author. This was good and indicated that fellows were successfully establishing research collaborations with overseas academics and industry.

30. The number of fellowships that did not result in an original research article being published was very low. Three C1/C2 fellows (5%) had not published an original research article as a result of their fellowship. Two of these fellows ended their fellowship early after less than a year, and the other did not return a questionnaire to update their final report. Fewer fellowships failed to produce an original research article than was the case with responsive mode grants within the wider BBSRC research portfolio; in previous evaluations of responsive mode research, 12% of grants resulted in no peer-reviewed publication.

31. The publication outputs of C1 fellows were higher than those of C2 fellows, even though the C2 cohort receiving a more substantial research support grant. This is probably because it takes a substantial amount of time to realise all the outputs from the fellowship research programme, and many of the C2 fellows had only recently completed their fellowship. Moreover, with limited specific project support, C1 fellows may have attributed all of their research outputs to the fellowship salary support.

2.5 New products, processes, resources, tools and technologies

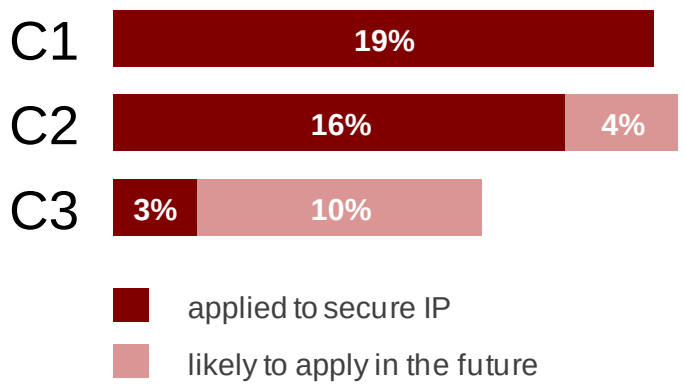
32. 48% of C1/C2 fellows reported that the research supported by their fellowship had resulted in a novel product, process, resources, tool or technology. These varied widely, but included assays, compounds, databases, datasets, genetic stocks, libraries, methods, molecular markers, reagents, software and transgenic lines. The reported users of the outputs were primarily other academic bioscience researchers. Other users included biomedical researchers, clinicians, farmers, industry (agricultural, biotechnology, medical, pharmaceutical), neurologists, physical scientists and plant breeders. It was pleasing that fellows were developing such tools and resources, and were sharing them with the wider research community and other stakeholders.

2.6 New intellectual property and spin-out companies

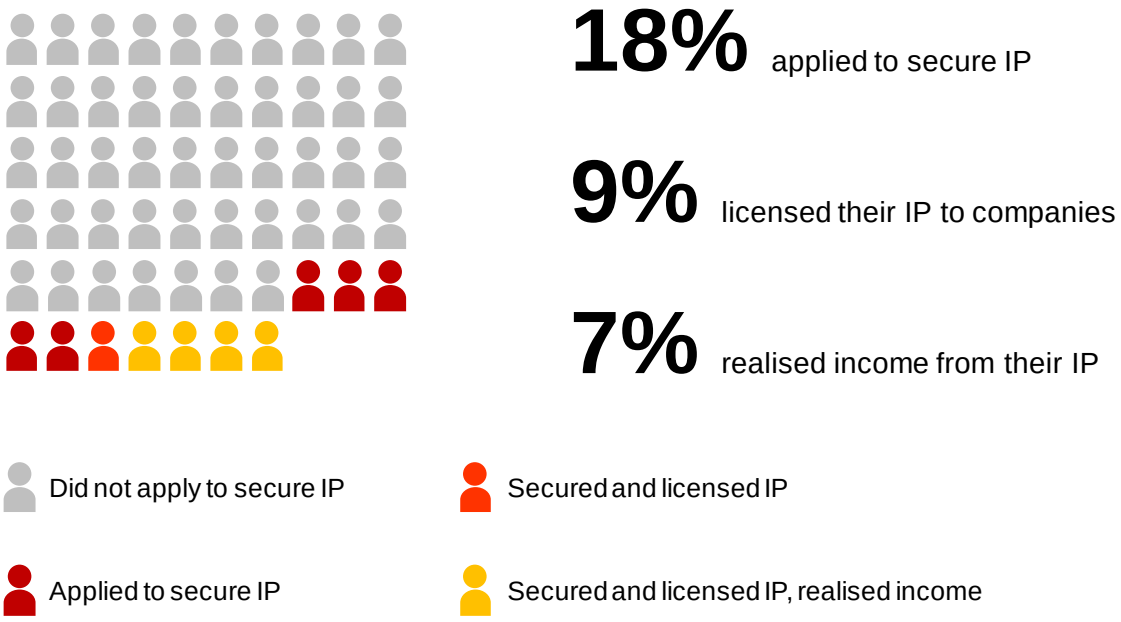
33. 18% of C1/C2 fellows had applied to secure patents or other intellectual property (IP) rights as a result of their fellowship. This was a very positive output of the research, especially considering the relatively early stage of fellows' careers and the focus on basic research within the fellowship portfolio (see Chapter 6). The proportion of fellows developing IP rights was notably higher than within the wider BBSRC research portfolio; for example, in previous evaluations of responsive mode research, 10% of grantholders applied to secure IP rights.

34. Five C1/C2 fellows (9%) had licensed their IP to companies, and four (7%) had realised an income from it. In addition, two C3 fellows had licensed their IP to companies and one had realised an income. This was particularly impressive, demonstrating that fellows' IP was useful to others. Academic researchers sometimes seek to secure IP at too early a stage, when the IP will have limited commercial value; it was pleasing that this was not the case for the majority of fellows (their success in licensing IP to companies indicated that they were developing IP in an appropriate manner).

Proportion of fellows who applied to secure IP as a result of their fellowship



Number of C1/C2 fellows who licensed their IP to companies



35. Six C1/C2 fellows (11%) received further funding for technology transfer or commercialisation activities. Funding was received from the BBSRC Follow-on Fund, BBSRC / Royal Society of Edinburgh Enterprise fellowships, Scottish Enterprise and the Wellcome Trust.

36. Three C1/C2 (5%) fellows used the research supported by their fellowship to contribute to the formation of a spin-out company. This was a remarkable achievement for individuals who were at a relatively early-stage in their career.

> A C1 fellow at the University of Strathclyde conducted research on DNA analysis using Surface-Enhanced Resonance Raman Scattering (SERRS), a vibrational technique that provides molecularly specific information at ultra-low concentration levels. The fellow produced a portfolio of patents from the work and sought to commercialise his findings. In July 2007, over five years after the fellowship ended, he co-founded the spin-out company D3 Technologies Ltd. The company was subsequently acquired by the Renishaw group, who agreed to invest approximately £5M over a five year period. The company is now known as Renishaw Diagnostics and is focused on developing and commercialising in vitro diagnostic and clinical research products to detect human infectious diseases.
>
> The research of a C2 fellow at the University of Manchester (initially the University of Oxford) led to the development of a unique technology which could be used to determine the 3D shape of small drug-like molecules. The fellow pursued a commercialisation strategy, aided by a BBSRC / RSE Enterprise fellowship and two BBSRC Follow-on Fund awards. In July 2007, the fellow established a spin-out company, Conformetrix Ltd. The company is exploiting its proprietary analytical tools to understand how bioactive ligands work and is using this information to develop new drugs. In 2008, Conformetrix Ltd received the BioNoW Biomedical Start Up Company of the Year award.
>
> A C1 fellow at the University of Glasgow (initially the University of Edinburgh) developed novel technologies for producing protein-coated microcrystals (PCMCs). She recognised the potential applications of her findings in biocatalysis and drug-delivery, and developed a commercialisation plan with the help of a BBSRC / RSE Enterprise Fellowship. Her fellowship contributed to the production of five patents and, in 2001, she co-founded the spin-out company Xstalbio Ltd. The company is focused on advanced mechanisms of drug delivery, specialising in the formulation of therapeutic proteins, peptides, DNA and vaccines. A key benefit of the PCMC technology is that the crystals are stable at relatively high temperatures and humidity, making them ideal for the supply of drugs and vaccines in countries where it is not possible to maintain a reliable cold-chain.

37. Overall, the proportion of fellows who developed IP or established spin-out companies from their research was very good. Fellows were astute enough to recognise the broader potential of their research, and they made efforts to realise it. The level of commercialisation activity among fellows was relatively high. BBSRC should be cautious about trying to increase it any further as this may encourage fellows to conduct commercialisation activities when it would be inappropriate for them to do so.

38. Training in commercial and entrepreneurial awareness is an important aspect of early-career scientists' broader development. BBSRC's requirements for commercial awareness training should remain flexible; some fellows receive very good in-house training from their host institutions, whereas others may benefit from external courses. It is important that all fellows have access to and take advantage of such training. There are opportunities for funding organisations to work more closely together in providing commercial and entrepreneurial awareness training. For example, the Royal Society organises an 'Innovation and the Business of Science' course business which David Phillips fellows are funded to attend. The BBSRC Fellows' conference (see Chapter 6) also plays an important role in raising awareness of commercialisation issues, offering a forum for fellows to talk with others who are involved in developing and exploiting IP.

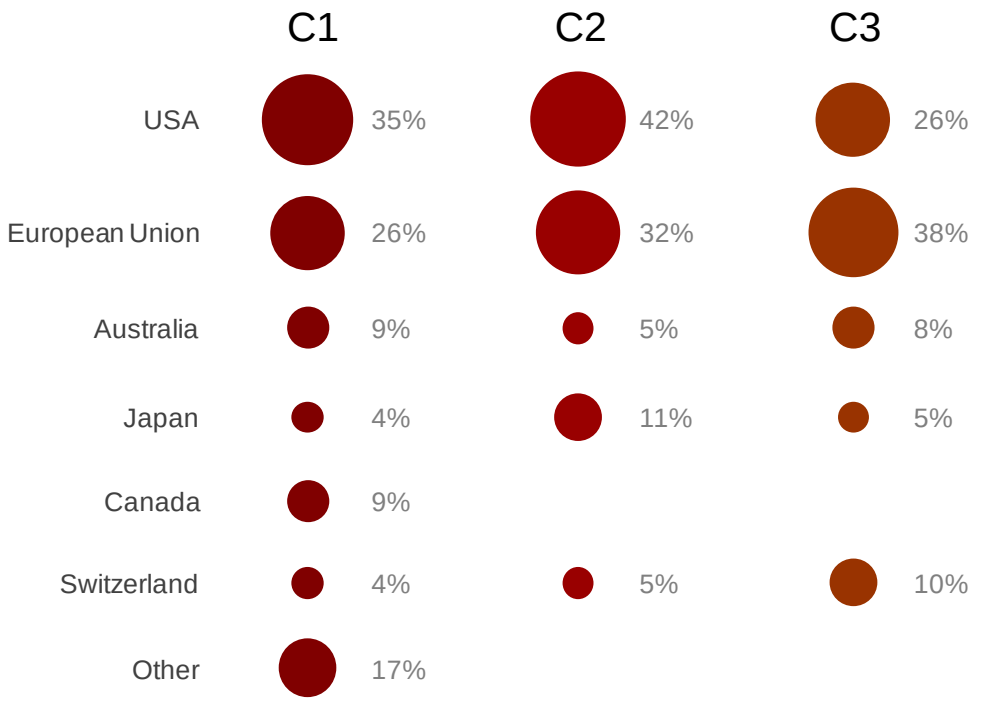
2.7 New and improved academic partnership links

39. The proportion of fellows who established partnership links with other academic researchers was good. 73% of C1/C2 fellows established new or improved partnership links with academics in the UK or overseas as a result of their fellowship; 59% established or developed a formal research collaboration (e.g. joint publication, joint grant proposal).

40. 62% of C1/C2 fellows established new or improved academic partnership links with overseas academics; 50% established or developed a formal research collaboration with overseas academics. The majority of partnership links were with researchers in the USA or the European Union.

A C1 fellow at the University of Nottingham conducted research into sexual reproduction in fungi. During the fellowship, he developed formal research collaborations with researchers in Australia, New Zealand and the USA, which resulted in several joint publications. He has continued to develop international partnership links and, together with colleagues at the University of Nottingham, subsequently established a collaboration with the DOE Joint Genome Institute (JGI) in the USA. The JGI is providing $3M of in-kind support to a Nottingham-coordinated programme which aims to sequence the genome of the lichen forming fungus *Xanthoria parientia*. This will be the first lichen fungus to have its genome sequenced. The project may eventually benefit diverse areas, such as climate change studies or the production of secondary metabolites (e.g. antibiotics).

Proportion of fellows who developed academic partnership links with overseas researchers



The European Union includes: Austria, Czech Republic, Denmark, Germany, Finland, France, Ireland, Italy, Netherlands, Spain and Sweden; excludes the UK. Other includes: India, Israel, New Zealand and Norway (each of which were reported by a single fellow).

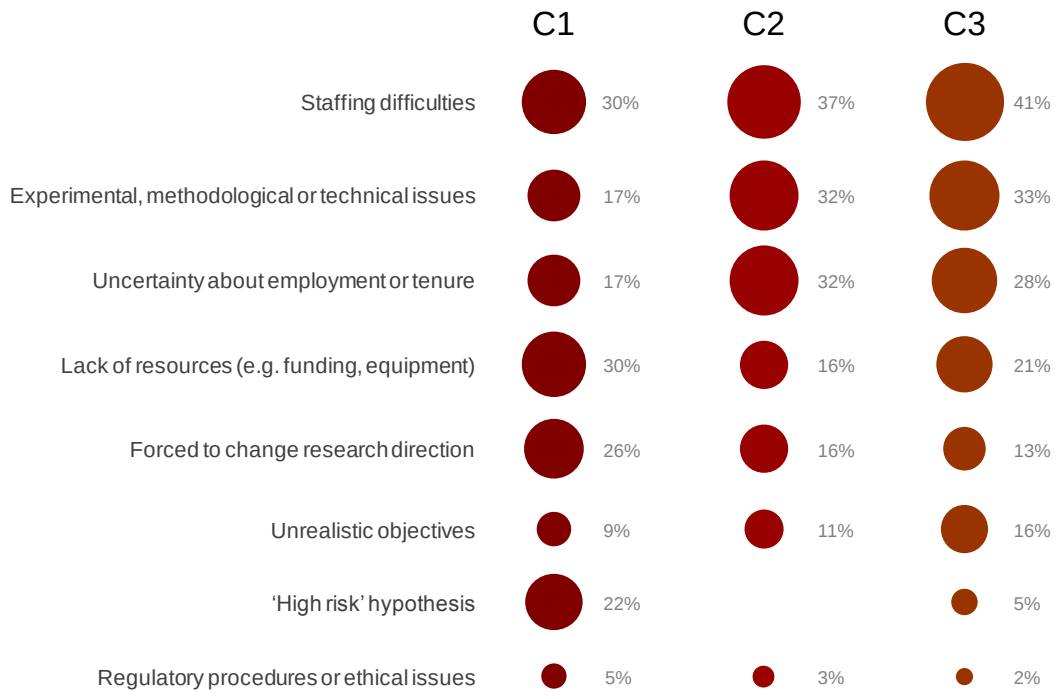
2.8 Further funding to develop the research

41. Fellows obtained substantial amounts of further funding to develop their research programmes, indicating that the fellowship scheme was supporting individuals who were conducting competitive, high-quality research. This is discussed further in Chapter 4.

2.9 Issues affecting the completion of fellowship research projects

42. 86% of C1/C2 fellows faced difficulties which affected their ability to meet their research objectives. These included staffing difficulties, experimental, methodological or technical issues, a lack of resources, uncertainty about employment or tenure, or being forced to change research direction. Although it is unsurprising that early-career independent researchers experience some issues of this kind, it was pleasing that the majority were able to overcome any problems. However, for a small number this was not the case.

Issues which affected fellows' ability to meet their research objectives



Staffing difficulties include: unable to recruit someone with the necessary qualifications and experience; staff temporarily stopped work during the grant (e.g. illness, career break); staff left during the grant so I had to recruit.

43. Recruitment and retention of staff caused significant problems. This is to be expected as the most talented and ambitious postdoctoral researchers will be attracted to work in more prestigious, established research groups, where they perceive they will have a better opportunity to further their own career. However, in some cases, staffing

difficulties were probably a result of fellows recruiting staff at too early a stage in the award.

44. Ten C1 fellows commented that the lack of a substantial research support grant and, in particular, funding for support staff (e.g. a technician or postdoctoral researcher) affected their ability to meet their research objectives. They were forced to spend a lot of time writing grant applications rather than conducting research. BBSRC subsequently addressed this issue by substantially increasing the size of the research support grant.

45. Five fellows in total commented that they did not request sufficient support in their original application and, subsequently, this led to difficulties. With hindsight, or with better advice from their host institution or BBSRC at the outset, they would have adjusted their application. These issues were primarily related to funding requests for research staff. For example, two C3 fellows did not request funding for any support staff in their application. Another fellow requested funding for a technician, but noted that a postdoctoral researcher with sufficient experience would have been more appropriate for the research project.

46. A large proportion of fellows were affected by uncertainty regarding their employment or tenure. These uncertainties affected the long-term planning of research activities, led to difficulties with securing research grant and studentship funding, and disrupted fellows' momentum, especially if they had to change host institution during the fellowship. These issues are discussed in greater depth later (see Chapters 4 and 5).

2.10 Less successful fellowships

47. A few fellowships failed to meet their research objectives or did not result in the fellow establishing an independent research career. Although this was disappointing, the overall number of unsuccessful fellowships was remarkably low. Indeed, some failure should be expected from a scheme which supports adventurous and innovative research. Moreover, early-career fellowships are inherently more risky than responsive mode grant funding, as they are specifically designed to support researchers with limited track records. It is unlikely that the less successful fellowships could have been identified at the application stage, and it is vital that BBSRC continues to take risks on early-career scientists.

48. The lack of support or mentoring from the host institution was a contributory factor in those few fellowships which were less successful than anticipated. This was particularly the case for fellowships funded early on during the lifetime of the David Phillips fellowship scheme, when some host institutions and fellows treated the award as a senior postdoctoral position rather than a vehicle for career development. In the majority of cases, greater guidance and intervention from the host institution could have mitigated many of the issues which affected the performance of the less successful fellowships.

3. Research outcomes and impacts

Summary

- Fellows' research has delivered or has potential to deliver economic and societal impacts
- A large number of fellows established formal partnership links with industry or other non-academic stakeholders
- Fellows research has potential to deliver wide ranging benefits to the public good
- Fellows' research contributed to the high international standing of UK bioscience
- Fellows' research addressed BBSRC's wider strategic priorities
- The fellowship scheme is delivering good quality outcomes and impacts without the need to formally align the scheme to priority areas

3.1 Economic and societal impacts

49. Economic and societal impacts are those ultimate impacts that relate to the overall objectives of BBSRC as an organisation and would generally be expected to arise in the longer-term. Examples of economic and societal impacts that should arise from BBSRC research funding include:
    - research findings are used for the public good (e.g. food security, industrial biotechnology, human health, medical research, government policy)
    - research contributes to the increased competitiveness of the UK economy (e.g. provision of skills and expertise, or contributions to new or improved products and processes)
    - income to the research community and 'UK plc' (e.g. from new technologies, intellectual property, spin-out companies)
    - the UK maintaining its high standing in biological sciences
    - BBSRC maintaining its role as a key funder of biological sciences
    - public confidence in biological science research is maintained

50. These impacts relate to how effectively BBSRC is functioning and delivering the outcomes expected of publicly funded research. However, precise measurement and attribution of these impacts are difficult.

51. Delivering impact from excellent research is an important priority for BBSRC. However, it was not a primary objective of the David Phillips fellowship scheme over the evaluation period. Nevertheless, it has been useful to examine the potential impact of fellows' research, especially given the expectation that fellows may be among the leaders of their generation of bioscientists.

3.2 Non-academic partnership links

52. 52% of C1/C2 fellows established new or improved partnership links with non-academics in the UK or overseas as a result of their fellowship, which included 43% who established or developed a formal collaboration (e.g. joint publication, joint grant

proposal, funding from an industrial partner, licensing of IP). Thirty non-academic partners were reported, primarily from industry. 17% of C1/C2 fellows received funding of over £10K from industry (e.g. collaborative research grants, CASE studentships). 19% of C1/C2 fellows published at least one paper with an industrial co-author.

53. The establishment of a large number of non-academic partnership links was a notable achievement, especially as the David Phillips fellowship scheme supports researchers from across the whole BBSRC remit. Many fellows worked in scientific areas where there were relatively few UK companies in the corresponding industrial sector, and some fellows' research would not necessarily be expected to attract industrial interest.

Non-academic partners reported by fellows

UK industry

AstraZeneca, Avecia, Axis Shield, Cairn Research Ltd, ChoiceBiotech, DNA Research International, DuPont, e2v, GlaxoSmithKline, Ionscope Ltd, Magstim Ltd, Oxonica, Pfizer, Philips Research, Piramed, Schering Healthcare Ltd, Syngenta, UCB, Unilever, Vastox, Wyeth, Zeneca

Overseas industry

BASF, Bayer Crop Science, Cytokinetics, Intellikine, Pfizer, Syngenta

Other organisations

Central Science Laboratory, Ifakara Health Institute, Tanzanian Ministry of Health, Tanzanian Ministry of Livestock

3.3 Contributions to the public good

54. The research supported by BBSRC contributes to the public good in a number of ways. For example, it:
    - trains scientists in basic scientific research; many go on to work in industry and other sectors
    - supports a bedrock of fundamental scientific knowledge that underpins future research, commercial and other applications, and helps shape government policy
    - contributes to public engagement with science and supports science of public interest
    - helps to maintain a vibrant higher education section that contributes to local and national economies (e.g. through foreign students' fees), and to local communities

55. 69% of C1/C2 fellows stated that their research has the potential to make contributions to the public good. For example, fellows' research may ultimately benefit: human health; animal health and welfare; the replacement, refinement and reduction of animals in experiments; food security; the environment and combating climate change; and government policy and meeting government priorities.

Areas where fellows indicated that their research has potential to make contributions to the wider public good

Human health

ageing, animal models for disease, best practice in use of antibiotics and biocides, clinical studies, developing world diseases (e.g. malaria), diagnostics, drug design, drug discovery, drug targets, drug resistance, drug screening, human diseases and disorders (e.g. cancer, diabetes, heart disease, infectious diseases, infertility, neurological disorders), human behaviour, imaging, impact of land use practices on disease risk, modelling diseases, stem cells, tissue engineering, treatment of injuries, treatment strategies, vaccination

Animal health and welfare

animal breeding, best practice in the use of antibiotics and biocides, diagnostics, identification of targets to treat bacterial and protozoan infections, immune systems, therapeutic strategies, vaccination

Replacement, refinement and reduction of animals in experiments

artificial devices to eliminate the need for animal hosts, use of non-mammalian model systems, cell culture-based models, computer modelling, in-vitro test beds for preliminary pharmaceutical testing, non-invasive techniques, statistical techniques to reduce the number of animals required in experiments

Food security

agri-environment systems and organic farming, animal diseases, crop diseases, crop improvement, crop protection, crop yields, nodulation of non-leguminous plants, nutrient cycling in soil-plant systems, plant drought and stress tolerance, reduced inputs into agricultural systems, soil sustainability

The environment and combating climate change

artificial photosynthetic systems to generate fuels, bioenergy and biofuels, biosensors, conservation strategies, development of marginal land for renewable energy, safer pesticides

Government policy and meeting government priorities

carbon reduction policy, developing countries' policies and priorities for tackling malaria, set-aside agricultural policy, socio-economic implications of systematic disturbances of the circadian clock

56. The majority of fellows reported potential impacts which may arise from their research in future, rather than impacts which have already been realised. This is to be expected as the majority of fellows are still at a relatively early stage in their career, and there is usually a considerable time lag between research being conducted and the delivery of the most significant impacts. However, there were a number of notable examples where fellows' work had already produced important benefits.

> A C2 fellow at the Babraham Institute conducted research on an enzyme present in specialised white blood cells which are involved in recognising infection. During the fellowship, he used his research to inform drug discovery programmes devoted to the PI3-kinase family of enzymes. The fellow also consulted with a biotechnology company prior to its takeover by a world-leading pharmaceutical company.
>
> A C1 fellow based at the University of Oxford conducted research into the effects of maternal care on the welfare of animals in captivity. She demonstrated that high infant mortality in captive animals can be the result of poor maternal care, and that the effects were particularly strong in wide-ranging species such as lions or polar bears. Her findings have implications for the keeping of wide-ranging carnivores in captivity, indicating that the practice should be fundamentally improved or phased out. The fellow also contributed to Defra's 'Zoo Forum Animal Welfare Assessment Working Group' and MRC's 'Working Group on the Welfare of Genetically Modified Mice'. The researcher is now based at the University of Guelph in Canada, where she leads her own research group which focuses on animal welfare.
>
> A C3 fellow based at the University of Edinburgh co-authored an article on statistics in the prestigious journal *Immunity*. The paper is helping researchers reduce the number of animals used in their experiments, for example, by providing advice to immunologists on how to calculate optimal sample sizes.
>
> A C3 fellow at the University of Glasgow is using a systems biology approach to study the transmission of infectious diseases. As part of her work, she is examining the impact of changes in land-use practice on the spread of diseases such as malaria. She has conducted field research in southern Tanzania, developing links with the local Ministry of Health and Ministry of Livestock. In response to an unanticipated outbreak of rabies in her study area, she initiated a control programme by canine vaccination, which should limit infection in dogs and reduce the general force of transmission to livestock and wildlife species. The fellow also co-founded a new PhD scholarship scheme at the University of Glasgow which is specifically aimed at providing training in health and disease control to students from the world's least developed countries.

57. There were positive indications that the research conducted during the fellowship underpinned further developments, with fellows developing IP, establishing spin-out companies, and collaborating with non-academic partners. Fellows had also obtained further funding from other organisations to support more strategic and applied research, suggesting that they were seeking to broaden their research programmes and translate the discoveries made during the fellowship. Overall, there were encouraging signs that fellows were developing a culture within their research teams which recognised the importance of realising the wider benefits from their research.

3.4 International standing of UK bioscience research

58. Fellows made a valuable contribution to the international standing of UK bioscience research. They conducted high, international quality research both during and after the fellowship, which raised the profile of UK bioscience. Fellows also contributed to the wider international community through, for example, collaborations with international academics, invitations to speak at international conferences, membership of journal editorial boards, and participation in international funding programmes.

> A C3 fellow at the John Innes Centre (now at the University of Potsdam, Germany) was awarded funding through the European Area Network in Plant Genomics (ERA-PG) programme during their fellowship. He participated in the €2.3M 'ARelatives' project which includes eight partners from Belgium, Denmark, Finland, Germany and the UK. The project is using the genome sequences of two relatives of the model plant Arabidopsis to study the mechanism underlying plant adaption, with particular emphasis on two ecologically important traits: flowering time and self-incompatibility. The tools developed during the project are relevant to studies of crop domestication.
>
> A C2 fellow at the University of Oxford was awarded an ERA-PG grant shortly after their fellowship ended. He is participating in a €1.4M project which includes partners from Denmark, Germany and the UK. This 'STRESSNET' project is developing an improved understanding of how plants respond and adapt to stress. Such knowledge will be vital to the development of new crop varieties which will allow agricultural yields to be maintained in the face of changing land use and global climate changes.
>
> A C2 fellow based at the University of Leeds developed a new biochemical tool to study metabolic and photosynthetic membrane proteins. He subsequently became the coordinator of a €2.8M EU project (ENNSATOX) funded under the Framework 7 Nanomaterials in the Aquatic Environment theme. The project includes partners from Belgium, Italy, the Netherlands, Spain and the UK, and its objective is to examine the toxic effects of a well known nanoparticle (ZnO) on the marine environment. The fellow is examining how ZnO particles interact with biological membranes. An increased understanding about the toxic effects of nanoparticles will ensure appropriate environmental quality standards can be determined.

59. The Department for Business, Innovation and Skills publishes a number of Public Service Agreement target metrics for UK bioscience research as a whole. The metrics compare the performance of the UK in biosciences using bibliometric data from ISI National Science Indicators. The most recent data, published in 2009, show that in terms of the quality of its bioscience research, the UK was ranked second (behind the USA) for its share of citations in the biosciences, and was ranked first in citation impact (ratio of citations to publications). It is clear that the high-quality, widely cited publications of David Phillips fellows contributed to this high standing of UK bioscience research.

> A C1 fellow from the University of Cambridge investigated how the relative sizes of similar organs are determined. His work focused on the role of the *Ultrabithorax* gene in determining leg size in the model organism *Drosophila melanogaster*. The work from the fellowship contributed to two *Nature* publications as well as an article in the high-impact journal *Proceedings of the National Academy of Sciences of the USA*. In total, these three papers have been cited over 340 times.

3.5 Addressing BBSRC strategic priorities

60. The BBSRC Strategic Plan describes the research priorities and enabling themes which will drive the Council's investments over a five year period. The 2010-2015 Strategic Plan[3] was published in February 2010 and defines three major strategic research priorities for BBSRC: food security; bioenergy and industrial biotechnology; and basic bioscience underpinning health. These priorities have evolved from previous research strategies, and it should be noted that earlier strategic priorities applied during the lifetime of most of the fellowships supported over the evaluation period.

61. The David Phillips fellowship scheme is not formally aligned with any particular area(s) of BBSRC's strategic priority, although the majority of fellowships funded over the evaluation period fell within and addressed important priority areas. For example, fellows' research made contributions to past strategic priorities such as bioscience for industry, developing new tools and technologies for biological research, economic and environmental sustainability, exploiting genomics, the healthy organism, integrative biology, and sustainable agriculture. Fellows are also well placed to address BBSRC's current strategic priorities.

62. A key strength of the David Phillips fellowship scheme is that awards are made on the basis of scientific excellence, supporting the most talented researchers with the best ideas from any area of the BBSRC remit. There is no need to formally align the David Phillips fellowship scheme to specific priority areas. To do so would dilute a major strength of the scheme, and risk losing some of the brightest and most gifted early-career researchers. As fellows seek further research grant funding from BBSRC, they tend to align their own research programmes to BBSRC's long-term strategic priorities in the way which is most appropriate for them. There is also great value in supporting the most talented researchers beyond a narrow set of research priority areas. It is important that the UK research community has sufficiently broad expertise to address new challenges that may emerge. Moreover, the serendipitous nature of scientific investigation often leads to exciting discoveries with previously unimagined impacts.

63. Looking forward, there is likely to be a need to build capacity in strategically important areas within the BBSRC remit, and support for early-career scientists is an important aspect of this. However, capacity building should not be the role of the David Phillips fellowship scheme. Occasionally, BBSRC has encouraged applications for David Phillips fellowships in selected priority areas through the use of highlight notices. This can be helpful, but ultimately funding decisions for such a limited number of fellowships should be based on funding the best candidates.

[3] For details of the current Strategic Plan see: www.bbsrc.ac.uk/strategy

4. Career development and further funding

Summary

- The David Phillips fellowship scheme was successful in enabling early-career researchers to establish themselves in academia
- The career development outcomes of fellows were excellent, with a very high proportion of fellows obtaining an academic post or an equivalent leadership position in industry
- The transition from fellow to independent researcher was a very challenging aspect of the fellowship
- The support for career development varied substantially between host institutions
- One in four fellows changed host institution during their fellowship, primarily because of a lack of career development opportunities
- Fellows had attracted substantial further funding from a wide range of funding organisations and were successfully establishing their own research teams
- Issues with tenure prevented fellows from applying for research grants and studentships towards the end of their fellowship
- Overall, the fellowship had a very positive impact on fellows' career development

4.1 Context

64. This chapter presents the data on fellows' career development and further funding. Comparable data were not available for an equivalent group of researchers at a similar career stage. As such, it was not possible to determine how successful David Phillips fellows were relative to other scientists or to directly attribute their career development outcomes to the support provided by the fellowship. However, it was clear that fellows were successful in establishing independent academic careers, attracting further funding and building their research teams. There was also a very strong consensus among fellows that the fellowship had played a crucial role in their career development.

4.2 The transition from fellow to independent researcher

65. Obtaining an academic position is one of the most challenging aspects of the fellowship, and fellows were naturally very concerned about the difficulties associated with securing a permanent post. Individual experiences with the transition from fellow to independent researcher were varied; for some fellows, the transition was relatively smooth whereas for others, it was much more challenging. Overall, however, a very high proportion of C1/C2 fellows (88%) secured an academic post or an equivalent leadership position in industry, which was encouraging.

66. The choice of host institution had a major influence on fellows' experiences with securing an academic post. For example, some of the most prestigious host institutions

provided an excellent and stimulating research environment, but offered limited prospects for subsequent employment. They effectively acted as ‘research hotels’, only hosting fellows for the duration of their fellowship. Other institutions offered greater prospects for career development, but usually provided more modest resources and facilities for research. Moreover, the formal mechanisms for fellows’ career development and associated mentoring varied between institutions. It is appropriate for BBSRC to support fellowships based in a wide range of institutions. However, fellows need to ensure they are fully aware of the implications of the choice of host institution on their future career development.

Fellows who moved host institution during their fellowship

67. One of the flexible elements of the fellowship is it portability. TAC regularly raises the issue with a fellow of whether their current host institution is still appropriate in view of their long-term career aspirations. A substantial proportion of C1/C2 fellows (26%) changed host institution during their fellowship (for C3 fellows, the figure was 22% at the time of the evaluation surveys). The lack of career development opportunities was the primary reason for fellows leaving their original host institution. Although it was positive that fellows were able to negotiate positions with better prospects at other institutions, transferring the fellowship was not without difficulties. Fellows found it to be a stressful, disruptive process which negatively affected their productivity. A large number of fellows who transferred their fellowship were originally based in academic institutions which hosted fellows using a ‘research hotel’ model. The proportion of fellows who changed host institutions during their fellowship appeared to be slightly higher than experienced by other funders’ early-career fellowship schemes.

68. Fellows noted that if it is necessary to transfer the fellowship, this is best done as early as possible. This is partly because fellows’ leverage with institutions diminishes over time, as the number of years remaining on the fellowship and its financial value decreases.

69. It is important that fellows are provided with independent guidance to aid them in any decision about transferring the fellowship. In this context, the advice that the fellow should move institution to aid their career development can be helpful.

Employment at the host institution at the end of the fellowship

70. Fellows provide details of the post and duration of their employment on completion of their fellowship in their final reports. These data indicated that 79% of C1/C2 fellows were employed at their host institution (original or transferred) at the end of the fellowship[4]. This includes 54% of C1/C2 who were employed at their original host institution at the end of their fellowship.

[4] These data do not indicate the proportion of fellows who were offered a permanent academic position by their host institution at the end of the fellowship. For example, a fellow may have been offered a position with a probationary period, or may have obtained other fellowship funds to remain employed by the host institution. Conversely, a fellow may have been offered a permanent position by their host institution but chose to take a position at another institution. Fellows who were offered a short-term extension to their post were not classified as employed by their host institution at the end of the fellowship. Fellows who obtained additional personal funding (e.g. other fellowships, bridging funds) were classified as employed by their host institution if they subsequently remained employed by their host institution. Data exclude fellows who terminated their fellowships early.

Fellows' expectations of obtaining employment within their host institution

71. There was an expectation among fellows that, providing their performance was satisfactory, the host institution should offer them an academic position at the end of the fellowship. Many fellows expressed frustration at their host institution's attitude towards their career development and, in particular, the institution's unwillingness to underwrite the fellowship with an offer of employment at the end of the fellowship.

72. It is unreasonable to expect host institutions to guarantee fellows an academic position at the outset of the fellowship and BBSRC cannot compel them to do so. Institutions are also required to fill available academic posts with the best candidates through open competition. Fellows will be in a strong position to compete for these positions, having developed independent research programmes and demonstrated their ability to attract further funding during the fellowship.

73. Many fellows commented that it was not clear what was required from their host institution to secure employment at the end of the fellowship. BBSRC should encourage host institutions to formalise the procedures for fellows' career development and departmental decisions on future employment, and make these clear to fellows as early as possible. Looking forward, the transition from fellow to independent researcher is likely to become more challenging. Financial constraints within research organisations may limit their ability to offer academic posts to early-career scientists. As such, it will become increasingly important for host institutions to provide clarity regarding their fellows' potential employment at the end of the fellowship.

4.3 Current employment positions of fellows

74. At the time of the evaluation surveys, 81% of C1/C2 fellows were employed in academic positions at the level of lecturer or higher. A further 7% were employed in equivalent leadership positions in industry. This was impressive and indicated that the fellowship scheme was very successful in supporting career development and enabling early-career researchers to establish themselves in academia.

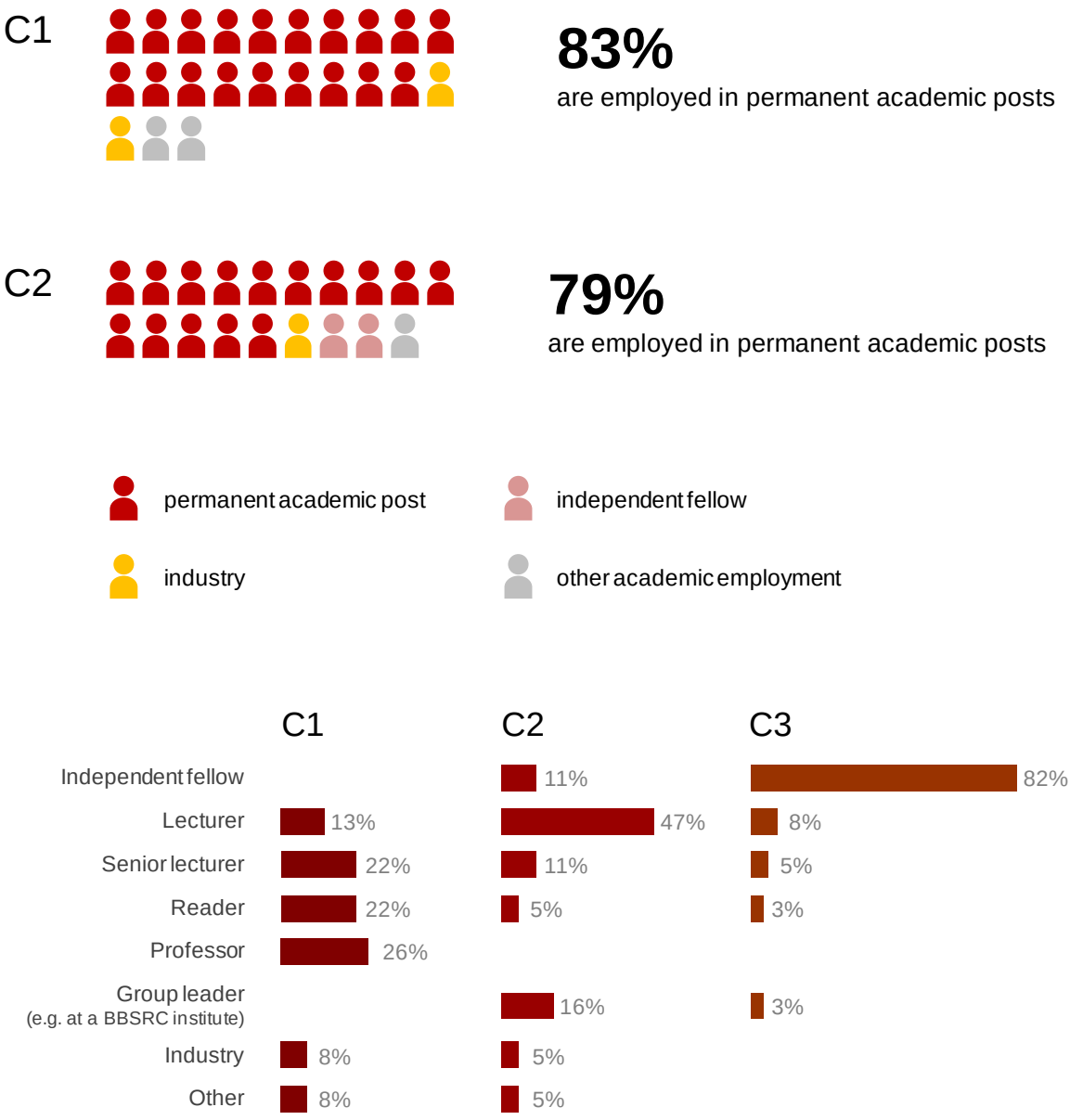
75. Five C1/C2 fellows (12%) had not established independent academic positions. Two (5%) remained employed at the host institution with the status of independent fellows and three (7%) were employed in other, less senior, roles in academia.

76. 63% of C1/C2 fellows are still employed at the institution where they ended their fellowship[5]. This includes 45% of C1/C2 fellows who are still employed at the institution where they began their fellowship.

77. Fellows continued to achieve successful career development outcomes after their fellowship ended, obtaining more senior academic positions and greater responsibilities within their institution. As might be expected, fellows' subsequent career advancement was varied, and not all fellows progressed at the same pace or to the same level. However, it was pleasing that many fellows had continued to follow a very steep career trajectory after the fellowship ended.

[5] Data as at March 2010. Data exclude fellows who terminated their fellowships early.

Fellows' employment at the time of the evaluation surveys



Data is based on fellows who returned a questionnaire. The three C1/C2 fellows who obtained equivalent leadership positions in industry included: a C1 fellow who was the Chief Executive Officer of their own spin-out company; a C1 fellow who was the Director for Technology Evaluation at Syngenta; a C2 fellow who was a group leader (Director level) in Wyeth Research. Other includes: a senior research associate; a associate scientist in non-profit research institute; a non research position (information technology) in a research institute; two independent fellows

A C1 fellow at the University of Strathclyde was promoted to senior lecturer and then to Professor within two years of ending their fellowship in 2002. In 2005, he became the Director of the Centre for Molecular Nanometrology. He is currently the Deputy Director for WestCHEM (the joint research school in chemistry between the Universities of Strathclyde and Glasgow), and is also the Head of Pure and Applied Chemistry at the University of Strathclyde.

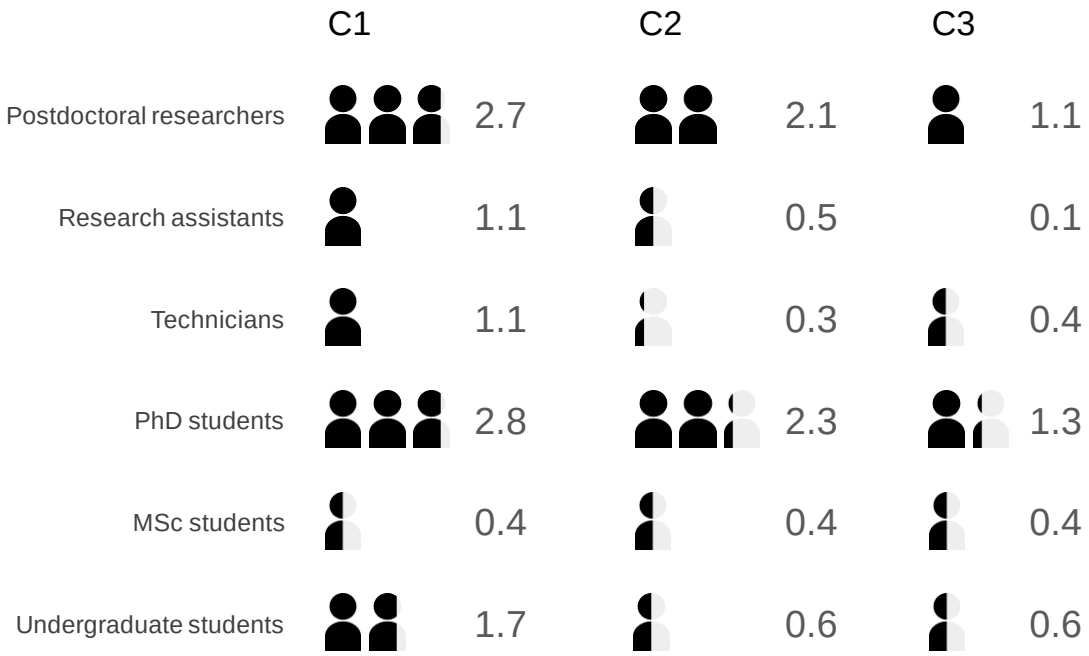
A C1 fellow at the University of Edinburgh was awarded a five year Royal Society University Research Fellowship (URF) at the end of their David Phillips fellowship. During the URF, he was promoted to Professor at the university. He is currently a Professor of Evolutionary Biology at the University of Oxford.

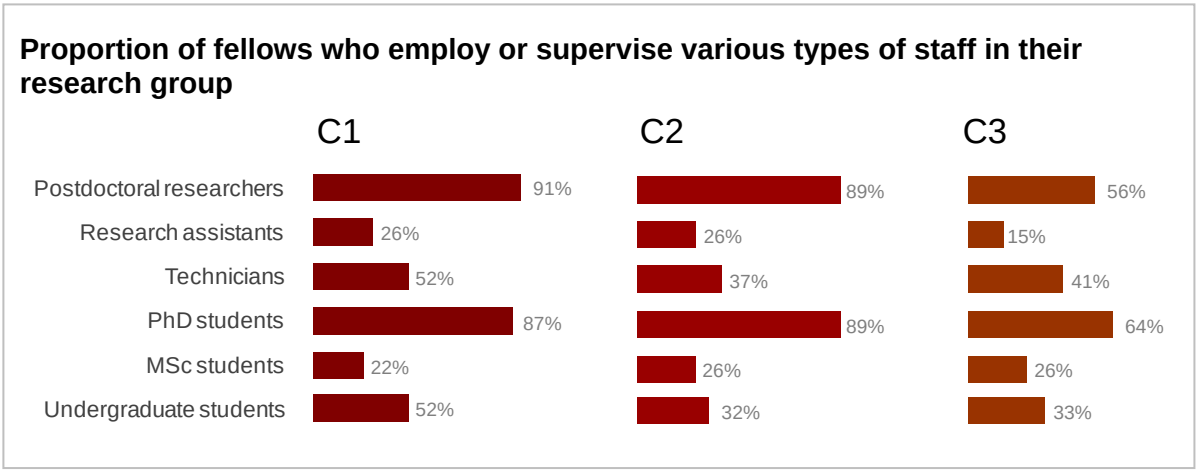
A C1 fellow at the University of Manchester was offered a lectureship position at the end of his fellowship in 2004, but deferred this to take up a five year Cancer Research UK Senior Fellowship. The Cancer Research UK fellowship was subsequently renewed and will run until 2016. The fellow is currently a Professor at the University of Manchester.

4.4 Size and composition of fellows' research groups

78. Fellows used the fellowship to pump-prime the establishment of their own research groups, obtaining further grant and studentship funding to build their research teams and develop their research programme. At the time of the evaluation surveys, the mean number of postdoctoral researchers employed by C1/C2 fellows was 2.5; the mean number of postgraduate students based in their research group was 2.6. 90% of C1/C2 fellows employed at least one postdoctoral researcher; 88% supervised at least one postgraduate student.

Mean number of full time equivalent (FTE) staff employed or based within fellows' research groups





4.5 Further funding awarded to fellows

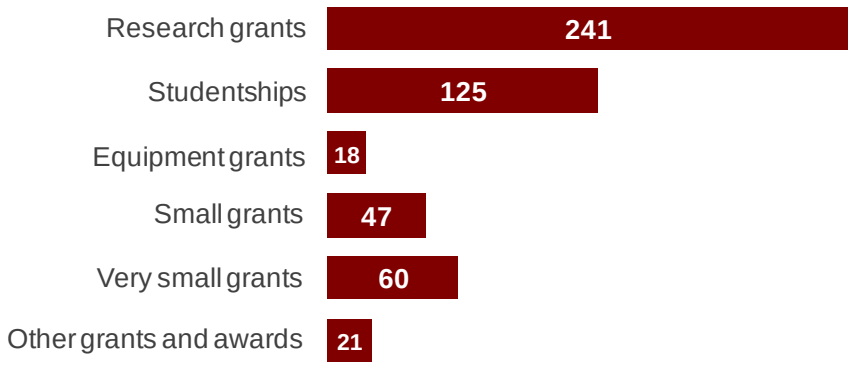
79. The further funding obtained by fellows is an important indicator of success for the David Phillips fellowship scheme. It demonstrates the extent to which the scheme is supporting high-calibre scientists who can successfully compete for research grant funding. Further funding is also essential for enabling fellows to develop their research programme, build their research teams, and establish their independence.

80. Details of fellows' further funding (both during and after the fellowship) were obtained from final reports, survey responses and BBSRC databases. For the purpose of the analysis, further funding was placed into six broad categories:
    - **research grants**: funding for research activities with a value of over £50K
    - **studentships**: funding for postgraduate research studentships
    - **equipment grants:** funding for equipment with a value of over £50K
    - **small grants**: funding with a value between £10K and £50K, usually for research activities or equipment
    - **very small grants**: funding with a value of less than £10K, typically supporting research activities, collaborative activities, equipment, meeting attendance, meeting organisation, pump-priming, travel or summer students
    - **other grants and awards**: includes facility grants, fellowships, commercialisation and technology transfer awards (including Follow-on fund), and prizes

81. 95% of C1/C2 fellows obtained further funding to develop their research programme. This was very pleasing and indicated that fellows were developing competitive research programmes. For C3 fellows, the figure was lower at 69% (although 92% had applied for further funding). This is to be expected, as many C3 fellows were only one or two years into their fellowship.

82. In total, C1/C2 fellows received 512 further grants and awards as either as a Principal Investigator (PI) or Co-investigator (Co-I). This included funding from BBSRC responsive mode and research initiatives, as well as a large number of other funding organisations.

Number of further grants and awards obtained by C1/C2 fellows



Proportion of fellows reporting further funding and mean number of grants obtained

Percentages indicate the proportion of fellows who reported further funding either as a PI or Co-I. Numbers represent the mean number of grants and awards. This analysis does not distinguish between grants where the fellow was a Principal Investigator (PI) or Co-Investigator (Co-I). This is because the fellows role on the grant (PI or Co-I) was only reported for about two thirds of the further funding. An analysis of the 341 grants and awards received by C1/C2 fellows where the fellows' role was known indicated that fellows were the PI on: 54% of research grants; 82% of studentships; 35% of equipment grants; 80% of small grants; 86% of very small grants; and 80% of other grants and awards. Many of the sixteen fellows based at BBSRC-sponsored institutes also received further support through institute core funding, This is not included in the analysis.

83. 75% of C1/C2 fellows received at least one research grant or equipment grant from BBSRC, including 61% who received further grant funding as a PI. The mean number of BBSRC grants awarded to C1/C2 fellows as a PI was 1.4. In total, C1/C2 fellows were awarded £19.1M from BBSRC in further funding as a PI. BBSRC was the largest single funder for approximately 60% of C1/C2 fellows.

84. The majority of fellows also obtained further funding from sources other than BBSRC. In total, 109 non-BBSRC funding sources were reported, with the main sources being other Research Councils. When grants and awards with a value of less than £50K were excluded from the analysis, 77% of C1/C2 fellows received further funding from non-BBSRC sources.

Non-BBSRC funding sources supporting BBSRC fellows

Other Research Councils: Engineering and Physical Sciences Research Council (EPSRC), Medical Research Council (MRC), Natural Environment Research Council (NERC). **UK Charities**: Action Medical Research, Alder Hey Children's NHS Foundation Trust, AO foundation, Arthritis Research Campaign, Birth Defects Trust, Breast Cancer Campaign, British Heart Foundation, Cancer Research UK, Diabetes UK, Electro Magnetic Field Biological Research Trust, Juvenile Diabetes Research Foundation, Kelvin Smith scholarship, Lawes Trust, Leverhulme trust, National Heart and Lung Institute Foundation, Neuroblastoma Society, Nuffield Trust, Royal Society for the Prevention of Cruelty to Animals, Samantha Dickson Brain Tumour Trust, The Great Britain Saskawa Foundation, Universities Federation for Animal Welfare, Wellcome Trust. **UK Government departments or agencies**: British Council, Defence and Evaluation Research Agency, Department for Environment, Food and Rural Affairs, Department for International Development, Department of Trade and Industry, East Midlands Development Agency, Great Western Research, Home Office, ITI TechMedia, Ministry of Agriculture Fisheries and Food, National Institute for Health Research (NHS), Scottish Enterprise, Scottish Executive. **Industry**: AstraZeneca, Avecia, Axis Shield, ChoiceBiotech, D3 technologies, e2v, GlaxoSmithKline, Oxonica, NanoInk, Pfizer, Philips, Puleva Biotech, Schering Healthcare Ltd, Syngenta, Unilever, Vastox, Zeneca. **Learned societies:** Biochemical Society, British Ecological Society, British Society for Plant Pathology, British Society of Antimicrobial Chemotherapy, Genetics Society, Physiological Society, Royal Society, Royal Society of Chemistry, Royal Society of Edinburgh. **Overseas funders:** American Institute for Cancer Research, Australian Research Council, Bauer-Stiftung (Germany), Canadian Fund for Innovation, Commonwealth Scientific and Industrial Research Organisation (Australia), Consejo Nacional de Ciencia y Tecnología (Mexico), Coordenação de Aperfeiçoamento de Pessoal de Nível (Brazil), David and Lucille Packard Foundation (USA), Department of Energy (USA), DOE Joint Genome Institute (USA), European Research Council, European Union, Fundación Ramón Areces (Spain), GABBA (Portugal), Gottlieb Daimler and Karl Benz Foundation (Germany), Grass Faculty Grant (USA), Human Frontiers Science Programme, International Fund for Animal Welfare, Japan Society for the Promotion of Science, Max-Plank-Gesellschaft (Germany), Ministry of Health (Spain), Ministry of Science and Education (Spain), Ministry of Technology (Japan), National Institutes of Health (USA), National Science Foundation (USA), Parkinson's Disease Foundation (USA), Peter Wall Institute for Advanced Studies (Canada), Portuguese government, RIKEN (Japan), Royal Thai Government, Sandia National Laboratories (USA), Smithsonian Tropical Research Institute (USA), Swiss government, Swiss National Science Foundation, The McKnight Foundation (USA), UBS Optimus Foundation (USA), United States Agency for International Development, United States Department of Agriculture, Venezuelan government. **Other university funding**: host institutions, Science Research Investment Fund, Scottish Higher Education Funding Council, SULIS seed corn fund, Synergy fund

Fellows obtained further research funding from BBSRC, other Research Councils, charities, government departments or agencies, industry, learned societies, and overseas funding agencies. The large number of overseas funding sources reported may be partially attributable to fellows who moved from the UK to another country since their fellowship ended (see Chapter 6).

Find sources

85. Several fellows obtained support from international funders, particularly the European Union. This was a good indication that the fellowship scheme was supporting high-calibre scientists, as these are very competitive sources of funding.

A C2 fellow at the John Innes Centre investigated symbiotic nitrogen fixation in plants using the model legume *Medicago trunculata*. During the fellowship, he was awarded funding from several EU programmes, participating in European Research Area Network in Plant Genomics and the Framework 6 Grains Legumes Integrated Project. He was also awarded a highly competitive, five year, €2.0M European Research Council Starting Grant to examine the mechanisms of specificity during symbiosis signalling.

86. Fellows also obtained funds from organisations which support more translational research, demonstrating that fellows were using the knowledge developed during their fellowship to underpin more strategic work which has potential to deliver wider benefits to the public good.

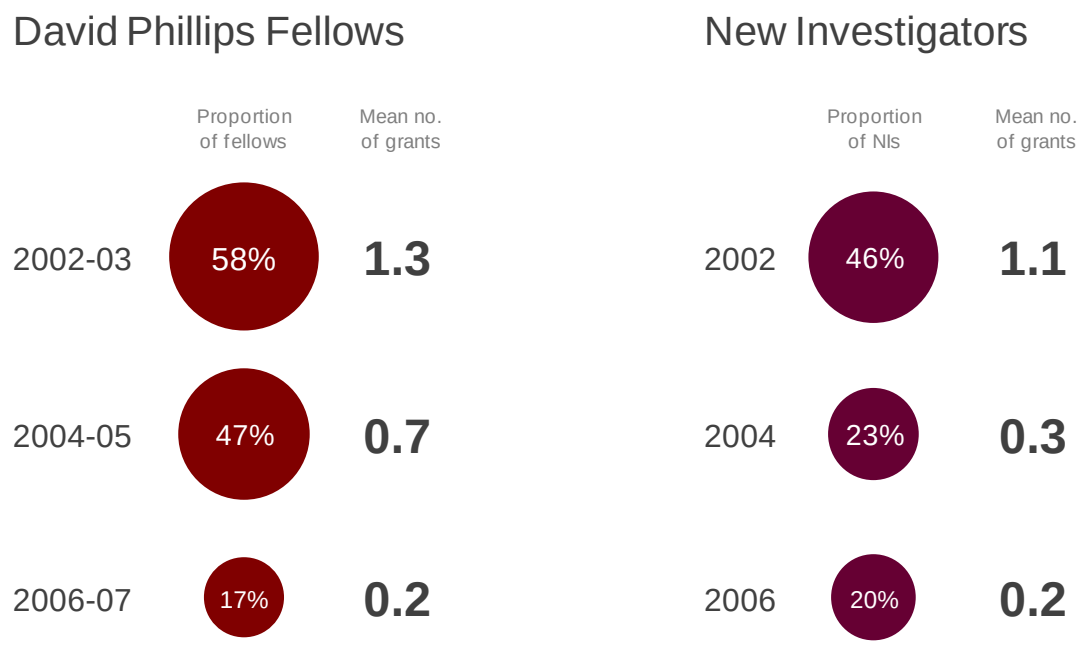
> A C2 fellow at the University of Cambridge conducted research to discover antibacterial small molecules with novel modes of action. He used a new approach to drug discovery, known as diversity-oriented synthesis (DOS), which efficiently generates structurally diverse and complex small molecules. The fellow has received further support from a number of world-leading pharmaceutical companies who are interested in the research. He has also received substantial further funding from EPSRC. He is currently in receipt of an EPSRC Advanced Fellowship which is focused on discovering biologically active molecules, such as antibiotics and other drugs, using DOS and 3D small molecule microarraying technology.
>
> A C3 fellow at the University of Newcastle (initially at the University of Oxford) conducted research on the influence of habitat structure on farmland bird populations. During the fellowship he obtained further funding from a diverse range of organisations including: Defra (studying soil compaction and biodiversity), English Nature (kestrels on farmland), Natural England (managing farmland for kestrels), NERC, a renewable energy company (the effect of wind turbines on farmland birds), and the Royal Society for the Protection of Birds (stubble management for farmland birds).

Comparison with BBSRC New Investigators

87. BBSRC also supports early-career researchers through the New Investigator scheme. This scheme is aimed at university lecturers and researchers at BBSRC and NERC institutes within three years of their first appointment. Its purpose is to assist those individuals to obtain their first responsive mode research grant. Applications are judged against the same criteria as other responsive mode proposals, but research potential rather than track record is taken into account.

88. The achievements of New Investigators (NIs) and David Phillips fellows are not comparable in all respects: the two schemes provide different levels of support to researchers who are at slightly different stages of their careers. Nevertheless, there were sufficient similarities to examine the further funding obtained by equivalent cohorts of NIs and David Phillips fellows. This indicated that David Phillips fellows were more successful in obtaining further funding.

Proportion of David Phillips fellows and New Investigators who obtained further funding from BBSRC as a Principal Investigator



Percentages indicate the proportion of researchers who obtained further BBSRC grant funding as a PI. The numbers indicate the mean number of research grants awarded. Data includes research grants and equipment grants, but excludes studentships and other funding schemes. Data are provided for all fellows including those who did not return a questionnaire. As the number of David Phillips fellowships started in each year is relatively small, data for two consecutive years have been collated. The data must be interpreted carefully as the level and length of support provided by New Investigator grants and fellowships are different. NIs will often have a greater teaching and administrative commitments than David Phillips fellows, which may affect their ability of apply for further funding. David Phillips fellows may not be able to apply for further funding as they will not have tenure for the full length of the grant; this is not an issue for NIs who have permanent academic positions. BBSRC may not be the primary source of further funding for some NIs or fellows.

4.6 Difficulties with securing grant funding during the fellowship

89. Although fellows were very successful in securing further grant funding during the fellowship, a notable proportion experienced difficulties. These went beyond the general observation that obtaining research grants is very competitive.

90. Lack of tenure was a major issue which affected fellows' ability to secure further grant funding. BBSRC grant conditions stipulate that a researcher must have a contract that extends for the full duration of any awarded grant. Unless fellows have secured an academic position or their institution agrees to underwrite their salary beyond the end of their fellowship, they are unable to apply for research grants in the final years of their fellowship. Host institutions differ in their willingness or ability to underwrite fellows' salaries. For some fellows, this effectively means that applications for a standard three-year BBSRC responsive mode grant must be made within the first eighteen months of the fellowship

91. Fellows' ineligibility to apply for further grant funding in the later years of their fellowship is a concern. It delays the pursuit of exciting research directions and damages fellows' momentum. It also creates additional stress for fellows who see their marketability decrease as their fellowship nears its end. BBSRC should explore ways to address this issue, taking care to avoid creating perverse incentives which would discourage institutions from making their own commitment to the future support of a fellow. One possible mechanism might be to permit fellows to apply for responsive mode funding without having guaranteed employment for the duration of the grant, and allow successful applicants to carry their grant to a different institution. The grant funding would only be released to the institution agreeing to employ the fellow. This would give fellows who were successful in securing grant funding more leverage with their host institutions and increase their marketability to other institutions.

92. Fellows also experienced difficulties with obtaining funding for postgraduate studentships. Again, the lack of tenure was a contributory factor, as fellows cannot normally supervise a studentship which will run beyond the duration of their fellowship. In addition, there was often strong competition for departmental studentship funds (e.g. from Doctoral Training Grant allocations). The ease with which fellows could obtain studentship funds varied between host institutions, further emphasising the need for fellows to factor the provision of wider support into the choice of host institution. However, there are opportunities for fellows to obtain studentship funding from non-departmental sources, including, for example, BBSRC Industrial CASE studentships which are awarded through open competition to individual researchers.

93. There are many benefits from fellows supervising postgraduate students: fellows are able to develop their supervisory skills, explore new research directions, develop their research programme and build capacity in their research groups. Moreover, students may also benefit from being trained within fellows' research groups: they will be trained by very talented individuals, and fellows will often have more time to spend with their students compared with senior academics. Some students actively seek out studentships with David Phillips fellows.

94. However, there can be tensions between the desire of fellows to supervise postgraduate students and the training needs of these students. It is important that students are based within stable research environments with sufficient resources to support their training and research. Students also benefit substantially from interactions with postdoctoral researchers within the same research group. Fellows will often have smaller, less-established research teams, and limited sources of funding to support student research projects. There is also a risk that some fellows may perceive studentships as a way to obtain an 'extra pair of hands' for research projects, rather than a vehicle for training and development which enables students to explore their own research ideas.

95. It is important that fellows who supervise postgraduate students are mentored by more experienced academics, for example, by a co-supervisor or members of a supervisory team. Some fellows used co-supervision arrangements to overcome issues associated with their lack of tenure, sharing supervisory responsibilities with a senior, more experienced principal supervisor. This is good practice which enables fellows to develop supervisory skills and provides a stable research environment for the student.

96. Fellows also expressed concerns about the eligibility criteria for the New Investigator scheme. To be eligible for the scheme, applicants must not have received competitive research funding from any source, as a Principal Investigator, that included postdoctoral research assistant staff costs. This is appropriate, as it focuses the scheme on early-career scientists who have not received significant previous support or fellows who only

receive their salary from their sponsor. However, one issue with the scheme's eligibility criteria was identified: early-career fellows supported by some organisations (e.g. the Wellcome Trust) are eligible for New Investigator funding despite receiving a very generous research support grant, as they tend to employ technical support rather than postdoctoral researchers. This may result in those fellows receiving unfair advantage.

4.7 Professional recognition and other measures of esteem

97. As fellows established themselves in academia, they gained professional recognition from their peers and participated in a range of activities within the wider research community. For example, of C1/C2 fellows:
    - 33% had contributed to the editorial boards of scientific journals
    - 38% had assisted funding organisations with decision making or other strategic advice through participation in Funding Committees, Strategy Panels or other equivalent level bodies such as Steering Committees or Working Groups
    - 19% had roles within learned societies or other scientific organisations
    - 24% had received awards or prizes for their research
    - two (4%) had been elected to prestigious scientific societies (American Association for the Advancement of Science; Fellow of the Royal Society of Edinburgh)

A C1 fellow at the University of Cambridge established a research programme examining photosynthesis within 'C4' leaves. He is now part of an international consortium which aims to introduce 'C4' photosynthesis into rice in order to increase the yield of this crop. In 2007, he was awarded the Melvin Calvin award. This international prize recognises outstanding investigations into metabolic and cellular aspects of the photosynthetic process by an early-career researcher. The fellow was also named as one of five crops researchers who could change the world in a 2008 article in *Nature*.

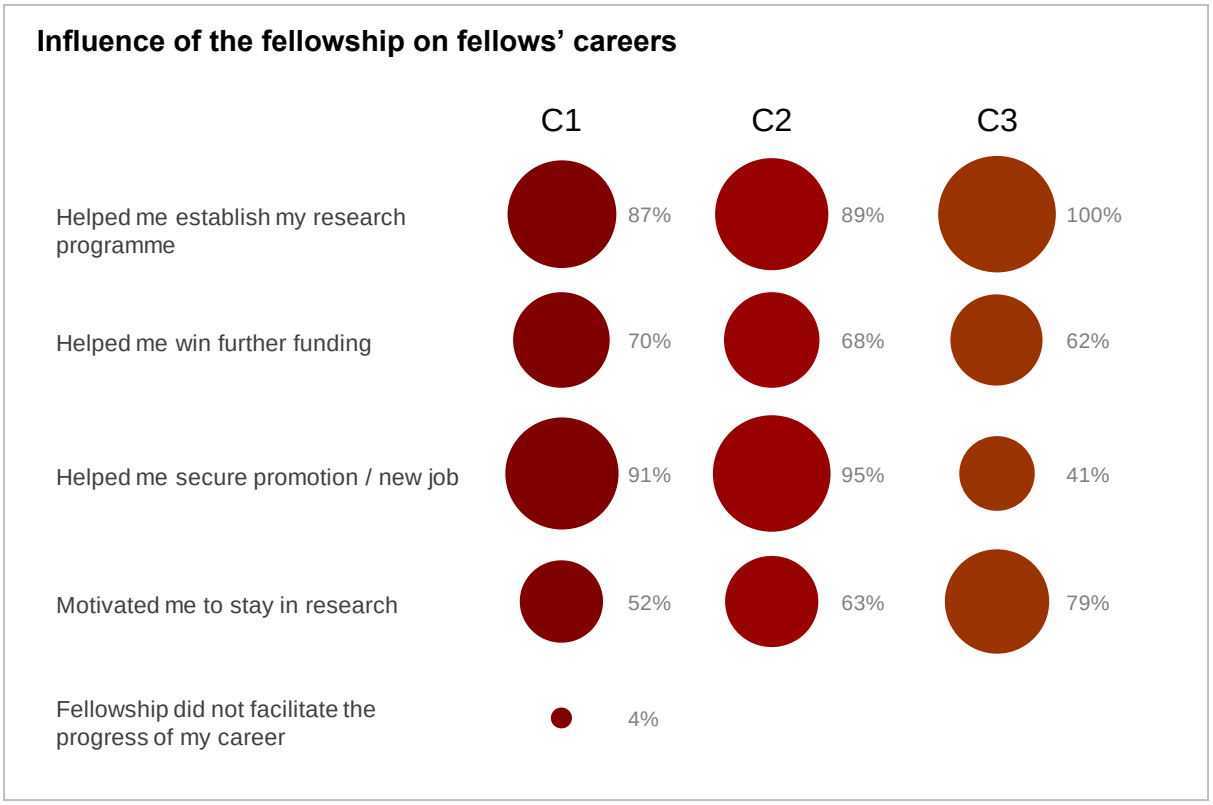
A C2 fellow at the University of Leeds conducted research on electron and proton transport in membrane proteins. During the fellowship, he received the 2006 British Biophysical Society Young Investigator award. This biennial award celebrates an outstanding contribution in any area of biophysics made by an early-career researcher in the UK and Ireland.

A C3 fellow at the University of Dundee (initially at the University of Cambridge) is using a molecular biology approach to investigate multicellular behaviours exhibited by bacteria such as biofilm formation. Bacteria living in biofilms have increased resistance to antimicrobial agents and environmental stress, which can cause significant problems in clinical and industrial settings. In 2009, the fellow received the Society for General Microbiology Fleming Prize for her work. This prestigious prize is awarded for outstanding research in any branch of microbiology by a scientist in the early stages of their career.

4.8 Influence of the fellowship on fellows' careers

98. Fellows were extremely positive about the influence of the fellowship on their career development, with 98% of C1/C2 fellows indicating that it had been beneficial. The fellowship helped them to secure promotion or a new job, establish their research programme, and win further funding. In addition, the fellowship motivated fellows to continue with their research careers.

99. Further very positive comments about the role of the fellowship played in career development included that the fellowship had:
    - provided fellows with greater academic freedom and independence
    - enabled fellows to conduct research with a minimal administrative load
    - led to fellows being given greater responsibilities within the host institution
    - improved fellows' reputations
    - increased fellows' confidence in their own abilities
    - provided leverage within the host institution
    - enabled fellows to move institutions to secure academic positions
    - facilitated the development of collaborations
    - led to invitations to present their work at conferences and other institutions



"The fellowship gave me confidence and some leverage. It resulted in a permanent post and was invaluable to my career by allowing me a flying start to research without the burden of a heavy teaching or administrative load."

"The fellowship could not have been more helpful to my career. I owe the scheme a great deal."

"The fellowship helped me secure a lectureship position and allowed me to develop as an independent researcher with minimal administrative loads. It was central to my early career development."

"The fellowship was the single most important event that launched and secured my career as a research scientist and academic."

"I had two periods of maternity leave on the fellowship and the support of the BBSRC enabled me to stay in research and maintain my career."

"It is impossible for me to imagine how my career would be without the fellowship. Not only was it instrumental in setting up myself as a PI, because of the fellowship I was able to change institute and partly move sideways between disciplines!"

"The fellowship has cemented my belief that I am able to lead and manage a team, and both identify and conduct, and independent and fundable research programme."

"I consider this award crucial to my career."

"It would be difficult to overestimate the importance of this fellowship on my career – it has been instrumental in giving me the space, time and confidence to grow my research group and take my time to tackle some really challenging problems without the pressure to produce immediate results."

Comments from current and former fellows

5. Support for fellows during the fellowship

Summary

- Good quality support from the host institution is vital to the success of the fellowship
- There were substantial differences in the level of support provided by individual host institutions
- There is a need to improve the provision of formal mentoring at some institutions
- As part of the application process, institutions should be clear about the support they will provide
- The non-financial support BBSRC provides to fellows is very valuable
- The Fellows' Conference is a particular highlight of BBSRC's fellowship support

5.1 Support provided by the host institution

100. The success of an early-career fellowship is dependent upon the calibre of the individual fellow and the quality of their research project. It also depends to a large extent on the quality of support provided by the host institution. Good quality support is essential in enabling fellows to achieve their full potential and, conversely, poor support acts as a major constraint.

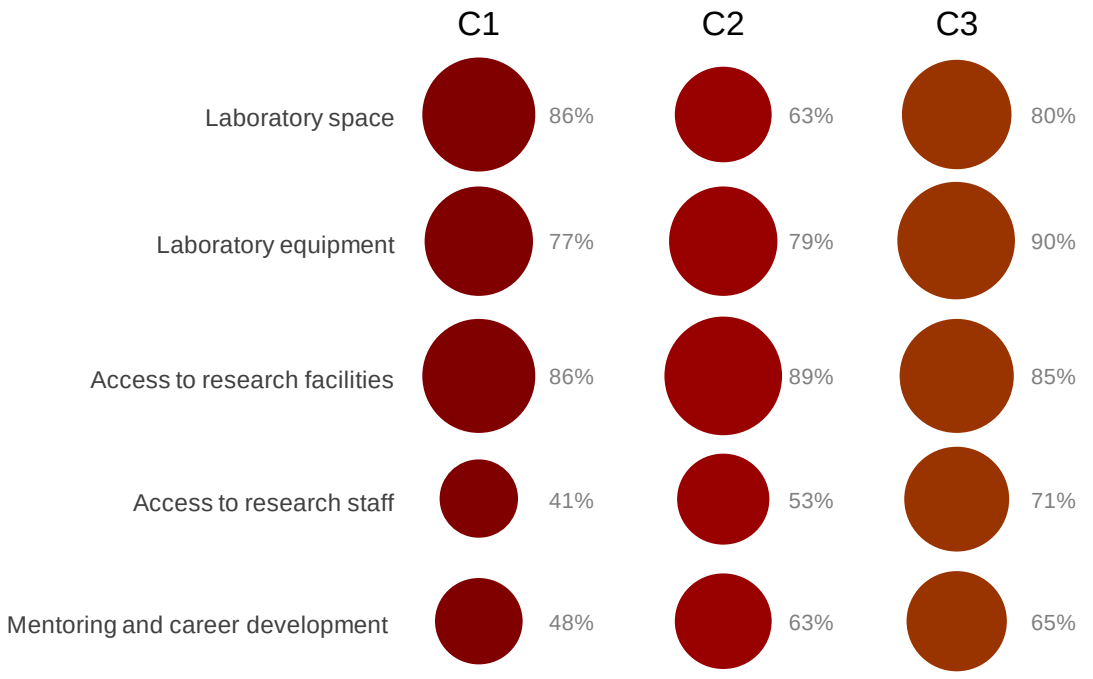
101. There is an expectation that host institutions will provide fellows with sufficient support to enable them to establish themselves in academia. This includes access to research infrastructure (laboratory space, equipment, research facilities), mentoring and career development opportunities. There were substantial differences in the level of support provided by host institutions: many fellows received very good support which aided their development as independent researchers, whereas for others the support was relatively poor. In general, the provision of research infrastructure was good, but there were notable issues with the provision of mentoring.

102. There was a concern that fellows had not fully considered the implications of their choice of host institution at the outset and, subsequently, this had led to frustrations with the level of support provided. Ultimately, the choice of host institution is a decision for fellowship applicants, but it is important that they are encouraged to examine all the factors which will contribute to the fellowship experience and their future career development. As well as the prestige of the institution, its intellectual capital, the quality of its research environment, and its research infrastructure, fellows should consider the wider support provided by the host institution: support with obtaining further funding, the quality of mentoring, and career development opportunities. Issues with the host institution's support are best addressed at the application stage, and BBSRC should examine how the application process might be improved to ensure fellows are more informed about the implications of their choice of host institution.

103. The 'Fellowship Agreement for BBSRC David Phillips and BBSRC Institute Career Path Fellows' sets out the Council's expectations of host institutions' responsibilities to its fellows. The agreement is based on the premise that in scientific matters a fellow will

be treated by their host institution in the same way as its established academic or scientific staff. When applicants submit a fellowship proposal, the host institution is required to give an undertaking about the support they will provide to the fellow. BBSRC should consider whether this process can be made more robust, ensuring applicants are given clear commitments from the proposed host institution. BBSRC could also assist applicants by providing them with a checklist of issues to discuss and clarify with their proposed host institution before submitting their application.

Proportion of fellows who rated the support by their host institution as good or very good



5.2 Mentoring within the host institution

104. Good quality mentoring is vital to maximising fellows' chances of establishing themselves in an independent scientific career. In some institutions the quality of mentoring was good or excellent: fellows received help, support and advice on preparing grant applications, career development and involvement in management roles within the institution. However, in other institutions there were no or minimal mechanisms for formal mentoring and, as a result, provision was often poor. Fellows recognised that good quality mentoring relied on the generous contributions of senior colleagues and many expressed their gratitude for the excellent support provided by specific individuals.

105. BBSRC makes a substantial investment in early-career fellowships and research organisations benefit considerably (academically and financially) from hosting fellows. The instances of poor mentoring by some institutions were therefore very disappointing. Poor mentoring was a major contributory factor in the small number of fellowships which failed to meet their research objectives or did not lead to good career

development outcomes. Moreover, it is likely that some successful fellowships could have achieved even greater success with improved mentoring and support.

106. BBSRC should provide clearer guidance to host institutions on its expectations regarding mentoring, and ensure that these are addressed as part of the application process. For example, there may be benefits in requesting that host institutions identify a named mentor as part of the application process.

5.3 Training in scientific leadership and laboratory management

107. The transition from postdoctoral researcher to independent fellow requires early-career scientists to take on new responsibilities such as managing a research programme and staff. Only 15% of C1/C2 fellows stated that their training prior to taking up the fellowship had left them well or very well prepared to manage an independent research group. C3 fellows were more positive about their previous training, with 38% of fellows stating that it had left them well or very well prepared.

108. 29% of C1/C2 fellows received formal training during their fellowship to develop their leadership and management skills. The proportion of fellows who received formal management skills training has increased over the lifetime of the scheme; 13% of C1 fellows reported such training compared with 61% of C3 fellows. Training was most useful when it occurred at an early stage of the fellowship.

109. Fellows who attended high-quality training courses in scientific leadership and laboratory management were very positive about the benefits. In particular, fellows who attended the EMBO Laboratory Management Course rated this training very highly. The Roffey Park middle management course, which is available to employees of BBSRC-supported institutes, was also recognised as very useful. In 2008, BBSRC introduced additional guidance on scientific leadership and laboratory management training. This encourages fellowship applicants to include the costs of attendance at a suitable training course within their application, and is a very positive development. There was, however, some concern about the quality of host institutions' internal management skills training, which appeared to vary from very good to poor.

110. Although formal training in scientific leadership and laboratory management is very beneficial for fellows, informal support is equally important. Active mentoring by senior colleagues, who could provide guidance on management issues, is invaluable and was recognised as such by fellows.

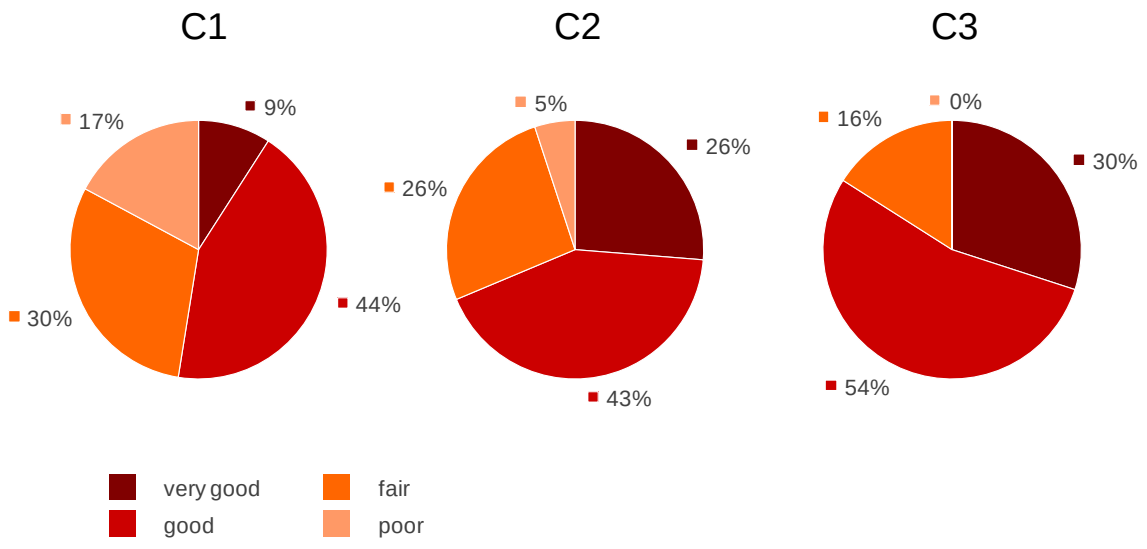
5.4 Non-financial support provided by BBSRC

111. BBSRC provides a variety of non-financial support to fellows during their fellowship. This currently includes a mentoring programme, the BBSRC Fellows' Conference, feedback on annual reports by the Training Awards Committee (TAC), a mid-term progress review, media training, and an induction day at the beginning of the fellowship.

112. This non-financial support is a very valuable part of the fellowship package. Many of the elements of this wider support were not in place at the David Phillip fellowship scheme's inception, and it was very pleasing that the scheme has evolved over time to

provide a much improved level of support. This was reflected in the higher ratings given to BBSRC's non-financial support by the C2 and C3 cohorts, compared with the C1 cohort.

Fellows' assessment of the non-financial support provided by BBSRC during the fellowship



113. The monitoring of fellows' progress through annual reporting and the mid-term review was useful. For example, fellows noted that it provided a mechanism by which they could evaluate their own progress, it facilitated meetings with senior staff in the host institution, and the feedback could provide leverage with regard to future employment. The mid-term review and interview were felt to be especially helpful. However, it was also recognised that the feedback on annual reports could be improved: feedback was often brief and superficial, the advice provided was not specific enough, and it could take a long time to be received.

114. Fellows are assigned a BBSRC mentor from TAC who is an external source of professional and personal guidance. This mentoring programme is a very valuable support mechanism, although there are still opportunities for improvements. For example, it would be more useful if the mentor visited the fellow's host institution within the first six months of the fellowship, rather than the first two years as is currently the requirement. In addition, as the BBSRC mentor is not normally an expert in the fellow's scientific field, BBSRC might consider appointing a second external, non-TAC mentor with expertise in the relevant research area. Several fellows also noted that they would benefit from an increased level of interaction with their mentor.

115. There was a minor concern that some fellows may rely too much on the support provided by internal and external mentors. Fellows should be learning to trust their own judgement and be proactive about seeking advice from a wide range of colleagues in their host institution. They should also be developing a network of academic contacts who can provide them with guidance relevant to their specific research area.

5.5 BBSRC Fellows' Conference

116. BBSRC organises a biennial Fellows' Conference to which fellows from many BBSRC-sponsored fellowship schemes are invited[6]. The conference has an academic focus, and includes scientific presentations from researchers at early, middle and senior career stages; some David Phillips fellows who are approaching the end of their fellowship present their work. The conference also provides the opportunity to discuss broader academic and scientific issues.

117. The Fellows Conference is a particular highlight of the fellowship scheme and its value is clearly evident. It provides an inspiring and stimulating environment for fellows, acting as a showcase for leading science from across the BBSRC remit. The conference is an excellent opportunity for fellows to network with each other, senior academics and BBSRC staff. It provides a forum to discuss experiences with managing an independent research group and career development, and allows fellows to benchmark themselves against their peers. The conference also ensures that fellows understand that the fellowship is a vehicle to establish an independent scientific career, rather than a senior postdoctoral position.

118. BBSRC could build on the success of the Fellows' Conference by organising an additional event, exclusive to early-career fellows, in between the biennial conferences. This could have a different focus to the main Fellows Conference, perhaps concentrating on specific issues or themes (e.g. scientific leadership, career development). Alternatively, smaller, regional meetings could be organised in between the biennial conferences.

119. Although the Fellows' Conference was highly regarded for the networking opportunities it provided, it did not tend to foster academic collaborations. This might be expected, as the conference delegates are working on a diverse range of topics from across the BBSRC remit. Nevertheless, a few fellows did use the conference to establish collaborations, and others initiated interactions with colleagues from different disciplines which may eventually result in interdisciplinary collaborations.

[6] Fellowship schemes administered by BBSRC include: David Phillips Fellowships, Research Development Fellowships, Institute Career Path Fellowships, Institute Development Fellowships, and Industrial Impact Fellowships. In addition, BBSRC supports a number of other fellowship schemes administered by other organisations: Industry Fellowships (Royal Society), Daphne Jackson Memorial Fellowships (Daphne Jackson Trust), and Enterprise Fellowships (Royal Society of Edinburgh).

6. Balance and coverage of the fellowship awards

Summary

- The balance and coverage of the fellowship awards were appropriate
- The David Phillips fellowship scheme has supported talented researchers from across the BBSRC remit
- BBSRC was the most appropriate funder for the awarded fellowships, all of which fell within its remit
- There was a strong emphasis on supporting basic research
- The balance of awards by gender was good, but BBSRC should continue to examine ways of attracting more applications from female candidates
- The fellowship scheme is open to early-career researchers of all nationalities; this was one of the scheme's strengths and has helped attract the best talent to the UK

6.1 Funding by research area

120. The breadth of the research within the David Phillips fellowship scheme was particularly impressive, with funding provided to talented early-career researchers from across the whole BBSRC remit. The scheme has supported fellows whose research crossed disciplinary boundaries, including several who were working across the remits of more than one Research Council. Overall, it was evident that the David Phillips fellowship scheme has established a suitable niche within the wider landscape of early-career fellowships. BBSRC was the most appropriate funder for the awarded fellowships, all of which fell clearly within its remit.

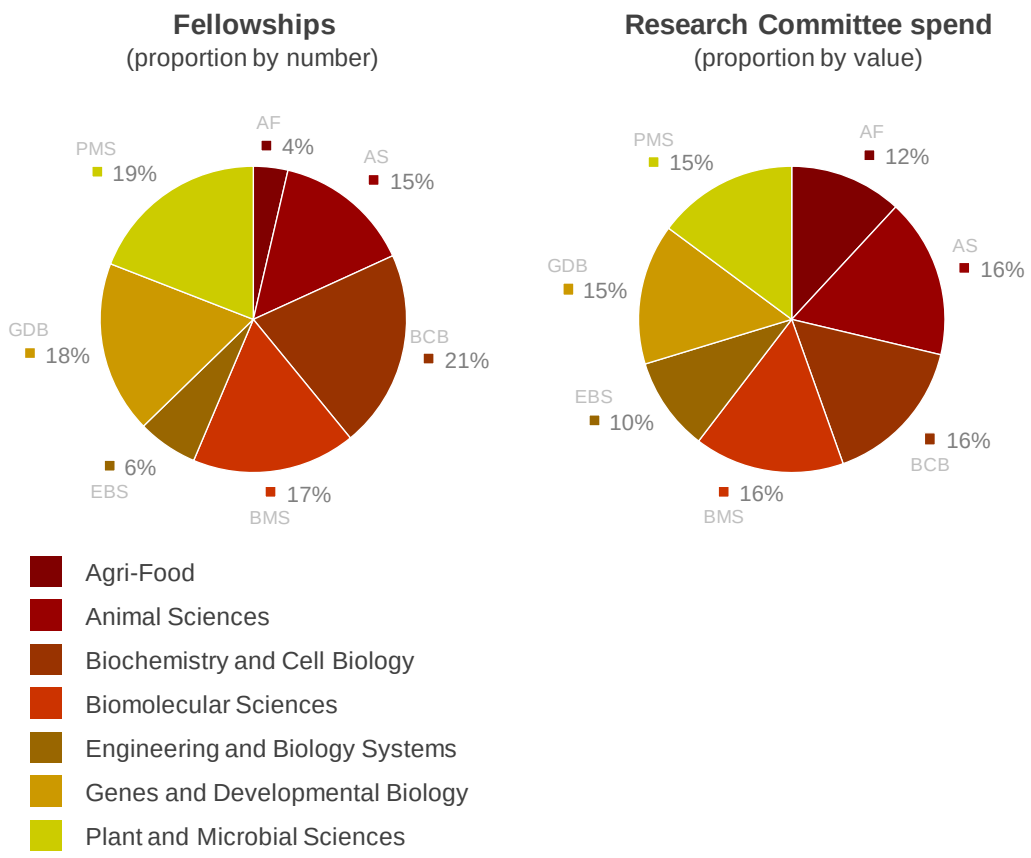
> A C2 fellow at the University of Exeter investigated the photonic structures in invertebrates using optical and electron microscopy to characterise these fascinating organisms. His interdisciplinary research used fundamental studies and novel modelling approaches to determine how colour ensues without pigmentation in insect wings, and how brilliant whiteness is achieved in beetle scales. The work resulted in an array of manuscripts in very high impact journals (including *Nature* and *Science*). It also has potential impacts in technology such as anti-counterfeiting surfaces, ultra-whiteness in new generation paper, photonic cosmetics and improved solar collection efficiency.
>
> A C2 fellow at the University of Glasgow used a blend of physics, chemistry and biology to investigate microengineered surfaces which could direct stem cell growth and differentiation. The research resulted in a paper in the high impact journal *Nature Materials* which has been cited over 220 times. The work also led to a patent application and a BBSRC Follow-on Fund grant was secured to develop the novel technology for bone tissue engineering.

121. All the former BBSRC Research Committee areas were represented across the fellowship scheme. Relatively large numbers of fellowships were funded in the Animal

Sciences, Biochemistry and Cell Biology, Biomolecular Sciences, Genes and Developmental Biology, and Plant and Microbial Sciences Committee areas, but the Agri-Food and Engineering and Biological Systems Committee areas were comparatively underrepresented.

122. The David Phillips fellowship scheme supported a broad range of exciting research projects which were relevant to BBSRC and UK science strategy. However, a very small number of awards supported fellows whose research was unlikely to receive long-term funding in the UK despite its high quality. As might be expected, these fellows subsequently moved to other countries where there were better funding opportunities and larger, more established research communities. BBSRC may wish to consider further how best to balance the desire to support the most talented early-career researchers against the likelihood that the fellowship will lead to a sustainable research programme within the UK.

Breakdown of fellowships by former BBSRC Research Committee area



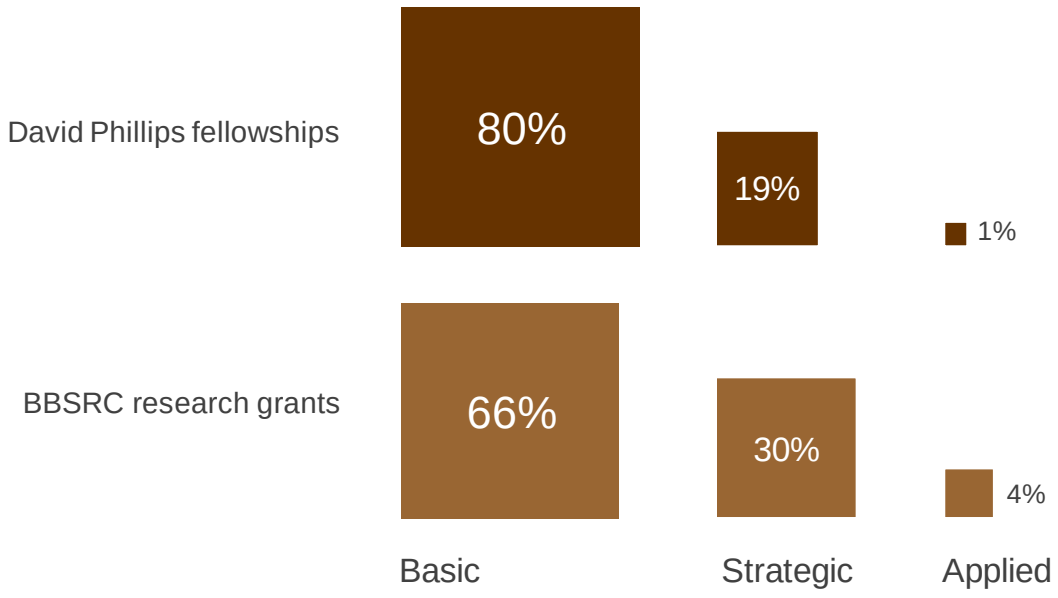
Fellowships are awarded by the Training Awards Committee, rather than by BBSRC Research Committees. However, each fellowship is assigned to an individual Research Committee area. The proportion of BBSRC research grant funding awarded to individual Research Committees is provided for context (data is based on the estimated spend by Research Committee for the 1996-97 to 2007-08 financial years). In general, the research funded through the AF and EBS Committees was more user-oriented than that of the other former Research Committees.

6.2 Support for basic, strategic and applied research

123. Early-career scientists can receive support for basic, strategic or applied research projects through the David Phillips fellowship scheme:
    - **basic**: research conducted for the advancement of knowledge
    - **strategic**: research conducted with the expectation that it will form a broad base of knowledge likely to underpin the solution of recognised or expected current or future problems
    - **applied**: research that is directed primarily at addressing a specific, practical problem or objective

124. The David Phillips fellowship scheme has provided very strong support for basic research. 80% of fellowship awards were classified as basic, higher than in the wider BBSRC responsive mode portfolio. The strong support for basic research was welcome and should be maintained. Basic research provides a bedrock of knowledge which underpins future developments, both within fellows' research programmes and more broadly. Moreover, discoveries from fellows' basic research can produce unexpected impacts.

Breakdown of David Phillips fellowships by type of research

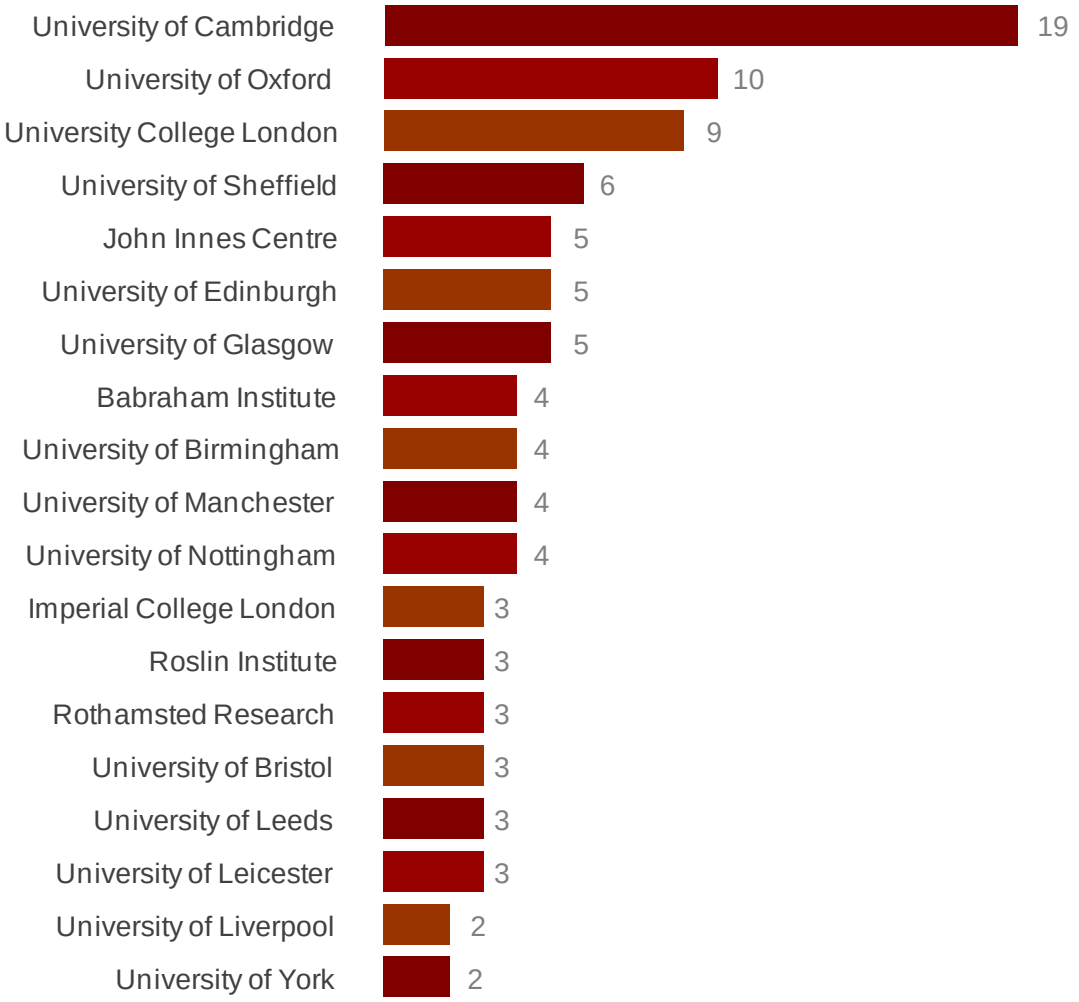


Data are based on Frascati codes assigned to fellowships awarded between 1995 and 2006 (data for the 2007 and 2008 calls were unavailable). For information, the data on BBSRC research grant funding by research type is also shown, and is based on research grants funded in the 2004/05, 2005/06 and 2006/07 financial years.

6.3 Funding by institution

125. Thirty two different universities and BBSRC-supported institutes have hosted fellowships. At the start of the fellowship, 85% of fellowship were hosted at universities and 15% were hosted at BBSRC-supported institutes.

Fellows' host institutions at the start of the fellowship



Institutions which hosted a single fellow:

Birbeck College; Cardiff University; Cranfield University; University of Bath; University of Dundee; University of East Anglia; University of Exeter; University of Kent; University of Reading; University of Southampton; University of St Andrews; University of Strathclyde; Institute of Grassland and Environmental Research

6.4 Profile of supported fellows

Postdoctoral experience

126. At the time of their application, fellows had a median of four years of postdoctoral experience and their median age was 30.5. Both these figures have increased slightly over the lifetime of the scheme.

Fellowship awards by gender

127. 28% of fellowship awards were made to female candidates. This was encouraging and is higher than the proportion of BBSRC project grants awarded to female researchers (17%). However, it was concerning that in the past two calls for the David Phillips fellowship scheme, only one award was made to a female candidate. BBSRC has identified this as an issue and is examining the application procedures to ensure that there are no biases in the assessment or selection process.

128. BBSRC should strive to understand the reasons why women may chose not to apply for early-career fellowships and continue to explore ways of removing any barriers. The fellowships are extremely flexible, family friendly and provide very good support for career breaks. BBSRC should promote these aspects of the scheme widely. In addition, the publicity for the fellowship scheme might usefully include examples of the achievements from the many successful female fellows.

Researcher mobility

129. 64% of fellows at the time of their application were already based in the institution where the fellowship would be subsequently hosted. At the end of the fellowship, there was no noticeable difference in the employment of these fellows by the host institution compared with those who started their fellowship in a different institution to the one at which they were employed at the time of application.

Fellows' nationality and residency

130. BBSRC's early-career fellowships are open to researchers of all nationalities. 59% of fellows were British nationals at the time of their application and 80% were UK residents. The open nature of the fellowship competition is one of its strengths as it helps attract the most talented researchers. It also supports British nationals who wish to return to the UK after conducting postdoctoral research overseas (14% of fellows were British nationals based overseas at the time of their application). Moreover, the openness of the fellowship competition helps to strengthen the UK research base and positions the UK to take advantage of the increasing globalisation of scientific activity.

131. Although it is commendable that BBSRC early-career fellowships provide support for foreign nationals, there are some associated risks. For example, fellows may chose to return to their home country after the fellowship ends, limiting the extent to which the UK benefits from its investment. In practice, the majority of fellows (UK and foreign nationals) remained in the UK after their fellowship ended: 75% of C1/C2 fellows are still based in the UK. British nationals were more likely to remain in the UK than foreign nationals, but the difference was relatively small (78% of British C1/C2 fellows are still based in the UK, compared with 68% of foreign C1/C2 fellows). Those fellows who

moved overseas often retained strong links with the UK, and these have helped to strengthen international collaborations.

7. Application and administration processes

Summary

- The application and administration processes are fair and effective
- The eligibility criteria are appropriate and ensure that the fellowships are targeted on individuals with suitable experience
- The assessment procedures are effective, with a suitably strong emphasis on the calibre of the applicant and the scientific quality of the proposed research project
- There are opportunities to improve the application process further, for example, by improving feedback to applicants and increasing transparency
- The current level of financial support provided by BBSRC's early-career fellowship awards is good
- The prestige of the David Phillips fellowship is currently very high
- The David Phillips fellowship scheme has evolved over its lifetime to address the concerns of fellows and emerging issues relating to career development

7.1 Fellowship eligibility criteria

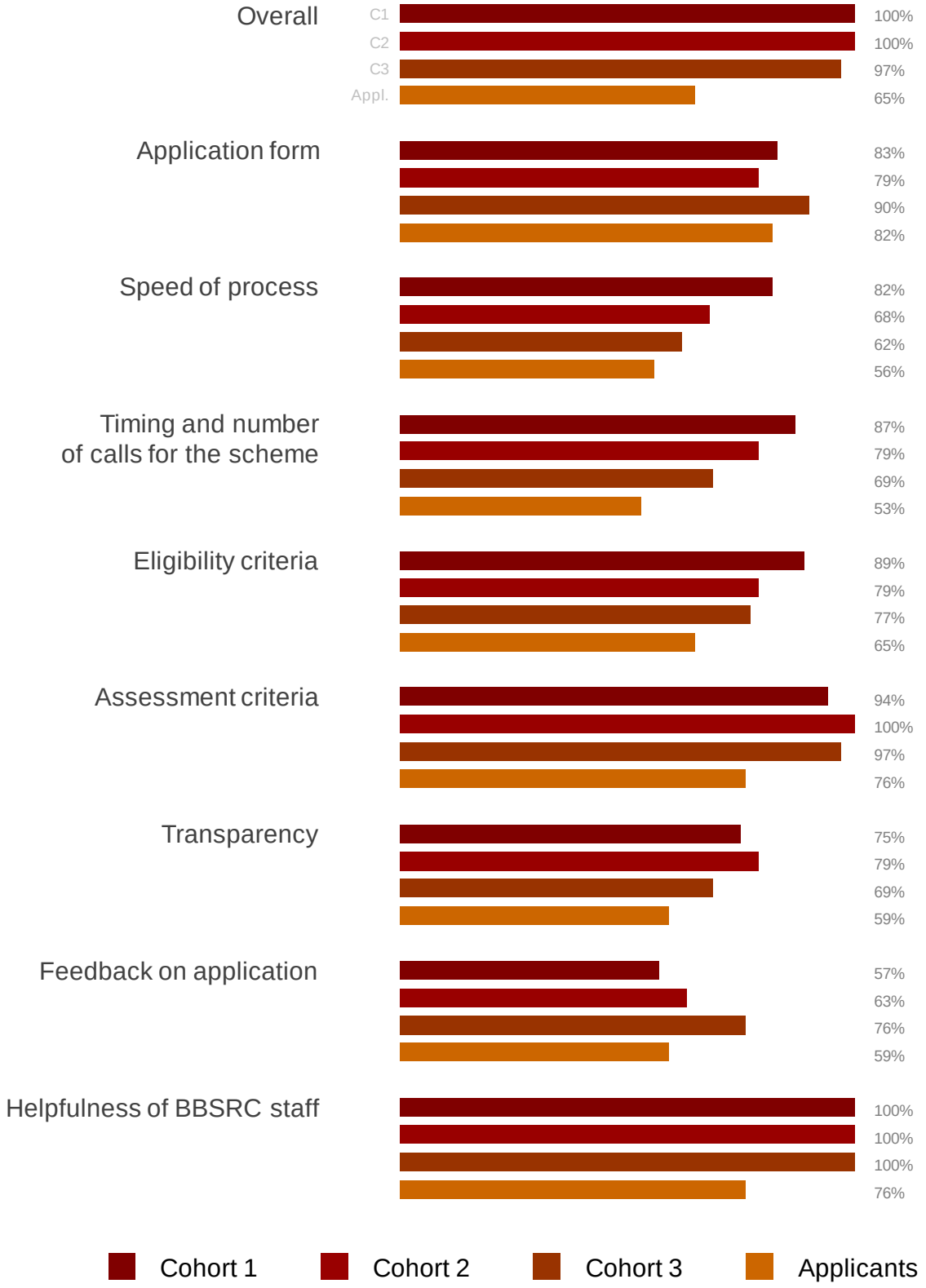
132. The eligibility criteria for BBSRC's early-career fellowships are based on candidates' previous active research experience, and make allowances for periods of maternity or paternity leave, as well as for individuals who wish to return to research after a career break. The criteria are appropriate and ensure that the fellowships are targeted on individuals with suitable experience. Some of the restrictions on eligibility, particularly the upper limit on previous active research experience, were perceived as being inflexible by some fellows and applicants. However, the application process seeks to identify the best researchers at a specific stage in their career and the restrictions are necessary to make fair comparisons between candidates.

7.2 Application and assessment processes

Overview

133. The application and assessment processes were effective. 99% of fellows and 65% of other fellowship applicants (i.e. who were not subsequently awarded fellowships) rated the overall process as good or very good. However, there were a few areas where the application process could be further improved, for example, increasing transparency of the process, improving feedback to applicants, and ensuring that the timing of interviews and funding announcements were coordinated with the other major early-career fellowship schemes.

Proportion of fellows and fellowship applicants who rated aspects of the application and assessment process highly



Fellows and fellowship applicants were asked to rate specific aspects of the application process as poor, fair, good or very good. Percentages indicate the proportion of fellows or fellowship applicants who stated that each aspect of the process was good or very good.

Assessment of applications

134. Proposals for David Phillips fellowships are assessed against a range of criteria (see Chapter 1). The assessment criteria are fair and appropriate, and place a suitably strong emphasis on the scientific potential of the candidate and the quality of the proposed research project.

135. Shortlisted candidates attend an interview as part of the application process. Fellows and fellowship applicants requested that the provision of pre-interview guidance be improved. For example, they noted that there was insufficient information provided regarding the purpose of the interview and the expectations of the interview panel (e.g. Is the purpose to give a *de novo* presentation of their work, or is it to answer questions of clarification on the application? Is the purpose to assess the proposed research project or the candidate?). Some applicants expressed concerns that there was no one on the interview panel with specific expertise in their scientific field; these concerns may have been alleviated if the purpose of the interview and the use of reports from scientific referees was clarified.

136. BBSRC will normally contribute up to £250 towards the costs of travel to and from the interview. This is clearly not sufficient to cover the travel costs of applicants based overseas, particularly those who require a long-haul flight. It is unreasonable for BBSRC to expect applicants to pay for their own travel to attend an interview, and BBSRC should meet these costs in full.

137. Fellows and fellowship applicants were generally satisfied with the application process and the associated assessment criteria. However, the multiple stages of the application process were not well understood by applicants and, in particular, it was not clear to them who was conducting the assessment or how the assessment criteria were applied at each stage. BBSRC could improve the transparency of the application process by placing this information on its website.

Speed and timing of the application process

138. It takes approximately six months from the fellowship application deadline to the final funding decision announcement, although applicants who are unsuccessful at any stage of the process are informed at that time. Fellows and applicants felt that the application process took too long. However, given the complexity of the assessment process, it would be challenging to speed it up significantly.

139. The timing of the funding announcement is a particular issue for early-career fellowships, as it has implications for fellows' decision(s) regarding other fellowship awards and job offers. It is important that fellows are provided with a decision on their application as soon as possible. Moreover it is important to coordinate the timing of interviews and the funding announcement with other early-career fellowship funders. This assists fellows with their decision making and ensures that there is fair competition between the major fellowship schemes for the best candidates.

Feedback on the application

140. BBSRC provides feedback to fellowship applicants on request, although the level of detail provided will vary depending on whether the application was sent out for peer-review. The two main criticisms about the provision of feedback were the length of time

it took to receive and its lack of detail. It is important that BBSRC provides applicants with good quality feedback on their application in a timely manner, and it would be more helpful to provide applicants with reviewers' comments as a matter of routine rather than on request.

The use of outline applications

141. There is very strong competition for early-career fellowships. BBSRC receives a large number of applications for a relatively small number of awards and, consequently, many candidates prepare applications that have little or no chance of being funded. Preparing a fellowship application can be burdensome and has associated costs. It requires a substantial investment of time from the applicant as well as from the proposed host institution. Moreover, the initial sift of applications places a large burden on members of the Training Awards Committee.

142. BBSRC is currently considering whether to introduce outline proposals as part of the application process. The Panel endorsed this approach, noting that it is used successfully by other funders of early-career fellowships such as the Wellcome Trust. The use of outline applications would produce a number of benefits. It would reduce the burden on uncompetitive or ineligible candidates, as well as the wider research community (e.g. host institutions, peer-reviewers). It would allow BBSRC to provide some feedback to applicants, enabling them to address issues with their application and, in particular, clarify the level of support they will receive from their proposed host institution. It may also help achieve a more balanced gender profile among applicants.

143. There are some risks associated with the use of outline applications. For example, if the application is not sufficiently clear it may be difficult to make an informed decision. In such cases, it will be important to ensure that the 'benefit of the doubt' is given to the applicant and a full application invited. The use of outline applications will also increase the length of time between submission and the decision announcement, as applicants will need sufficient time to prepare their full application after the initial sift.

Administration of the scheme

144. The administration of the scheme is effective. BBSRC staff are viewed as helpful and sympathetic by fellows and fellowship applicants. They adopt a flexible approach to the administration of the fellowship award which benefits fellows and enables them to take advantage of opportunities as they arise. Fellows felt that they received a lot of support from BBSRC Office.

> *"I don't think I have ever come across a more helpful and friendly bunch of people."*
>
> *"Whenever I ask questions to the relevant BBSRC staff by email or telephone they are always helpful and supportive. Thus I can concentrate on research."*
>
> *"The BBSRC staff have been extremely helpful, friendly and easy to contact. All my queries have been answered promptly and clearly, for which I am most grateful."*
>
> *"BBSRC staff were helpful and sympathetic during the process."*
>
> *Comments from fellows and a fellowship applicant*

7.3 Size and duration of awards

145. The current level of financial support provided by BBSRC's early-career fellowship awards is good. The research grant is of sufficient value to allow fellows to conduct a competitive research project and it takes into account additional costs associated with specific research areas (e.g. *in vivo* animal work). The level of financial support is a notable improvement from the early years of the David Phillips fellowship scheme when the research support grant was very limited and fellows were forced to spend a lot of time writing grant applications rather than conducting research. The five year duration of the fellowship scheme is also essential, as it provides sufficient time for fellows to establish an independent academic career. This would be very difficult to achieve if the duration of the award was any shorter.

146. BBSRC recently introduced a mechanism whereby fellows could, in principle, obtain an extension to their fellowship beyond the five year duration. For fellowships commencing after May 2006, where the fellow's research is producing dramatic new findings, exceptionally an extension of up to two years beyond the original five years may be awarded. Extensions are awarded on a competitive basis and fellows are notified of the proposal process in conjunction with their mid-term reviews. The funding for any extension is taken from the same funding pot which supports new fellowships. The opportunity for fellows to extend their fellowship is a useful addition to the scheme. However, BBSRC should prioritise support for new fellows, ensuring that the current level of support and the number of awards can be maintained[7].

147. The balance between the number of awards and their value should be maintained. There is little value in BBSRC providing more awards if they do not provide sufficient resources to enable the fellow to establish an independent research programme.

7.4 Prestige of the David Phillips fellowship

148. The prestige of an early-career fellowship scheme affects a funding organisation's ability to attract the highest-calibre candidates. It also influences how fellows are regarded by their host institution. A prestigious fellowship award can help fellows establish themselves as independent researchers and secure an academic post: fellows who hold a prestigious fellowship may have a higher reputation and greater leverage within their host institution.

149. The prestige of the David Phillips fellowship has increased over the lifetime of the scheme and is now very high. This reflects the level of support, financial and non-financial, which BBSRC provides to its fellows. However, there is a perception that the scheme is slightly less prestigious than the early-career fellowships provided by the Royal Society and the Wellcome Trust, and the scheme has limited international recognition.

150. Fellows indicated that the major fellowship schemes which offered advantages over the David Phillips fellowship were those provided by the MRC, the Royal Society and the Wellcome Trust. The main advantages of the Royal Society fellowships were that they were more prestigious and that they were often extendable beyond the original duration of the award. However, candidates had to balance these benefits against a limited

[7] No costed extensions to David Phillips fellowships were ever awarded through this mechanism. Following the recent Spending Review settlement, BBSRC decided to remove the ability to obtain costed extensions from the David Phillips fellowship scheme and focus its resources on supporting new fellows.

research support grant. The Wellcome Trust fellowship support was perceived as more prestigious than the David Phillips fellowship, primarily because it offered more generous support (salary and research support grant).

7.5 Development of the scheme over time

151. The David Phillips fellowship scheme has evolved over its lifetime to address the concerns of fellows and emerging issues relating to career development. The most significant changes were increases in the research support grant[8]. Other notable changes to the scheme included: changes to the eligibility criteria to ensure they are family-friendly; improvements to the non-financial support provided by BBSRC during the fellowship; and guidance recommending that fellows should include a course in scientific leadership and laboratory management in their application. The continuous, active development of the fellowship scheme was very welcome, and ensured that the scheme remains fit for purpose.

7.6 Fellows' perceptions of the fellowship

152. The David Phillips fellowship scheme was viewed very positively by early-career scientists. Researchers were encouraged to apply for a David Phillips fellowship because of the provision of a substantial research support grant, the prestige of the fellowship award and the limited opportunities to apply for funding to establish an independent research programme elsewhere. The provision of the research support grant was the most influential factor in the decision to apply: 98% of fellows and 94% of applicants reported that this encouraged or strongly encouraged their application.

153. Fellows were extremely positive about the influence of the fellowship on their own careers and, more broadly, the value of the scheme in supporting early-career scientists. There was very strong consensus among fellows that the scheme should be continued for future generations of early-career scientists.

[8] The changes to the level of the research support grant were:

- 1996: the research support grant was fixed at £15K per annum
- 1999: the value of the research support grant was substantially increased; fellows could now apply for a support grant of up to £200K over five years
- 2005: fellowships were awarded under Full Economic Costing, with BBSRC funding 80% of the total costs of the fellowship. The cap on the research support grant was removed, although the fellowship handbook advised that BBSRC would not normally wish to consider requests exceeding a total of £600K (excluding the fellow's salary)
- 2008: reference to a maximum value for the support grant which BBSRC would normally consider was removed from the fellowship handbook

“I would like to stress how amazing I think the scheme is, that it plays a hugely important role in nurturing young researchers, and that I feel extremely privileged and lucky to have held one.”

“Early-career fellowships are really essential building blocks for careers.”

“Great scheme that was invaluable for me in getting started.”

“I will always be very, very grateful to the Committee which awarded my fellowship, as they decided to support what must have seemed like ‘off-the-wall’ basic, fundamental science – none of us could have predicted, at that time, where it would lead.”

“The fellowship was very important for my career development.”

“I can’t see how I would have got to where I am now without the fellowship.”

“Without the fellowship I would not be where I am today, hence I will always be grateful for the BBSRC for this opportunity.”

“The award was fantastic and I am strongly in favour of continuing this type of scheme to young and promising researchers.”

“I want to make clear that these awards do ‘change’ peoples’ careers and should continue to be awarded.”

“The BBSRC David Phillips fellowship scheme is one of the best schemes for early-career researchers in the UK.”

“I think BBSRC has an outstanding fellowship programme, certainly the best of the major funders, and I very much hope this will be maintained even in the face of funding cuts elsewhere.”

Comments from current and former fellows

8. Conclusions and future perspectives

Summary

- The David Phillips fellowship scheme is extremely successful and supports outstanding early-career scientists
- David Phillips fellowships are an essential part of BBSRC's funding portfolio and they must continue to be supported
- BBSRC should place a high priority on protecting the David Phillips fellowship scheme in the context of future funding constraints
- Support for early-career researchers is vital to the long-term strength, sustainability and international competitiveness of the UK bioscience research community

154. The David Phillips fellowship scheme is extremely successful. It supports outstanding early-career researchers and enables them to establish independent academic careers. The scheme is adventurous in its support for future talent and represents an excellent investment in the next generation of research leaders. Fellows' achievements are very impressive and are demonstrated by a number of different measures of success including the quality of fellows' research, their career development outcomes, the establishment of sustainable research programmes, and the economic and societal impacts arising from their research.

155. A major strength of the David Phillips fellowship scheme is its support for the most talented researchers with the best ideas from any area of the BBSRC remit. The scheme is addressing BBSRC strategy without the need to be formally aligned with BBSRC priority areas, and it is delivering excellent outcomes and impacts. It is important that outstanding early-career scientists continue to have the freedom to explore their own research agenda. The open nature of the fellowship competition should also be maintained.

156. The David Phillips fellowship scheme has evolved over time to address the concerns of fellows and emerging issues relating to career development. This is a major contributory factor in the scheme's success. Improvements to the financial and non-financial support provided to fellows ensure that the scheme remains fit for purpose and is able to achieve its objective of promoting the career development of early-career scientists.

157. Some of the weaknesses within the David Phillips fellowship scheme are related to the variations in the support provided by host institutions and would be best addressed at the application stage. BBSRC should explore ways to ensure host institutions make clear and explicit statements about the support and mentoring they will provide during the fellowship as part of the application process. In addition, BBSRC should encourage host institutions to formalise procedures for fellows' career development and make these clear as early as possible. It is recognised that BBSRC can only influence the behaviour of host institutions indirectly. In this context, fellowship applicants must ensure they consider the full implications of their choice of host institution on the

fellowship experience and their future career development. It should also be noted that many fellows received good or excellent support from their host institution.

158. The David Phillips fellowship scheme is an essential part of BBSRC's funding portfolio and it must continue to be supported. The scheme is very competitive and all the fellowships are awarded to very high-calibre researchers. The scheme provides good value for money, with a very high proportion of fellowships delivering successful outcomes. In the context of future funding restrictions, BBSRC should prioritise support for the David Phillips fellowship scheme and seek to maintain the number of available awards. The future funding climate is unlikely to be as favourable as it has been in the recent past and this will have a particularly hard impact on early-career scientists. Fellows will face additional challenges such as lower responsive mode success rates, reductions in university funding and the number of academic positions, and increased competition from overseas. BBSRC should endeavour to protect its fellows from the worst effects of these changes, and should ensure that the David Phillips fellowship scheme remains flexible and continues to adapt to the changing research environment.

159. Support for early-career researchers is vital to the long-term strength, sustainability and international competitiveness of the UK bioscience research community. Early-career scientists are the research leaders of tomorrow and their talent, creativity and entrepreneurial spirit will be essential for solving some of the most challenging current and emerging global problems. The provision of early-career fellowships to researchers with limited track records is an inherently risky investment. However, it is clear from the impressive achievements of David Phillips fellows that bold and adventurous support of outstanding early-career scientists delivers tremendous rewards.