

## **Professor Dame Athene Donald DBE FRS – Written evidence (PSU0033)**

*Writing in a personal capacity*

**Athene Donald**, DBE FRS is Master of Churchill College, Cambridge, and professor emerita of Experimental Physics at the University of Cambridge. From 2010-14 I chaired the Royal Society's Education Committee and currently am the lead for their Community of Interest on the Research System, with particular responsibility for their work on 'People'. Their most recent publication ([Regional absorptive capacity: the skills dimension](#)) is directly relevant to this enquiry, as is an earlier report ([The research and technical workforce in the UK](#)). I served on the UKRI-funded Talent Commission, looking at technicians in HEIs and which produced a report [Strategic insight into technical skills of the future](#) earlier this year. Skills is a topic about which I write regularly on my own blog, but also for WonkHE and the Bennett Institute for Public Policy. I served on the ERC's Scientific Council from 2013-18, as well as numerous of the UK's research councils (both EPSRC and BBSRC) committees over the years. I have a particular interest in issues around gender, and recently gave evidence (both oral and written) to the Commons Science and Technology Committee enquiry into Diversity and Inclusion in STEM.

### **International talent**

1. The strength of the UK's university research sector has traditionally made it an extremely attractive destination for scientists from around the world, with free movement within the EU making it particularly so for European researchers.
2. Science is an international endeavour, and such mobility is vital for optimal delivery.
3. However, the cost of visas plus the health surcharge has become prohibitively expensive, especially for those who wish to bring a family with them. An adult with three family members coming to the UK on a five-year skilled worker permit must pay £12,880 in upfront applicant costs (2019 figures)<sup>1</sup>. It makes us uncompetitive and unattractive with other nations and is undoubtedly having an impact in attracting the researchers we need.
4. Our failure to associate to Horizon Europe has meant some scientists awarded ERC grants have chosen to leave the UK so that they can hold the grants in mainland Europe<sup>2</sup> rather than rely on the UK's alternative funding promised. Others are rejecting positions in the UK because they will be cut off from applying for these funds.
5. We are no longer desired partners in other parts of the Horizon Europe programme, and UK scientists – in academia and industry – are being excluded from what would previously have been ready collaborations, and are unable to lead such collaborations.

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<sup>1</sup> Royal Society 'UK science and immigration: why the UK needs an internationally competitive visa offer' July 2019 <https://royalsociety.org/-/media/policy/Publications/2019/international-visa-systems-explainer-july-2019.pdf>

<sup>2</sup> Research Professional, June 2022, 'At least 18 ERC grantees to leave UK amid Horizon uncertainty' <https://www.researchprofessionalnews.com/rr-news-uk-politics-2022-6-at-least-18-erc-grantees-to-leave-uk-amid-horizon-uncertainty/>

6. The consequence is we are losing access to the talent we used readily to attract from Europe before Brexit at both at postdoctoral and at faculty level. Overall, OECD figures indicate that (in 2020) there was a net outflow of nearly 1,300 scientists in 2020, having been a net importer of academics in 2015 before the Brexit vote<sup>3</sup>.
7. The working of the intended scheme ('Plan B') to replace ERC funds remains unclear<sup>4</sup>, but there is a widespread feeling amongst the community that it will not be as attractive as ERC itself, in particular lacking prestige but also, for all the reasons given above, not able to attract international scholars to work on the grants.
8. The unexpected and sudden cuts to ODA funding, even where contracts existed, mean that we are no longer seen as trusted partners around the world, another way our status and influence as a science nation has been damaged by recent actions.
9. The combination of all these effects means the UK will no longer be seen as the attractive place to do science it has been for decades. Our prestige has been damaged, and we can expect to see further consequences in the years ahead.
10. One relatively easy change that could be made would be to reduce visa costs and health charges to something far more affordable for the average early career scientist who will, anyhow, be paying tax which should be sufficient contribution to the Treasury for access to the NHS.
11. Association to Horizon Europe is still seen as the most desirable outcome by the vast majority of scientists.

## **STEM skills**

12. Recent reports from the Royal Society have explored both the demographics of the current scientific workforce<sup>5</sup>, and the role and distribution of skills in delivering regional absorptive capacity<sup>6</sup>.
13. There is no doubt that there are shortages in some places and in some fields. In particular, there is a long-term lack of those with intermediate (Level 4/5) skills, often occupying technician roles and those crucial to the diffusion of knowledge to permit firms to innovate.<sup>7</sup>
14. The 2021 Royal Society report also highlighted that the technician workforce is ageing and not being replaced.
15. Research and innovation are crucial to productivity growth and ensuring that firms have access to those with the right skills is a key part of being able to deliver for the UK economy.

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<sup>3</sup> Science Business, 'Scientists leave the UK as China overtakes US as most favoured destination', February 2022, <https://sciencebusiness.net/news-byte/scientists-leave-uk-china-overtakes-us-most-favoured-destination>

<sup>4</sup> Nature, 'A guide to Plan B: the UK's vague strategy for post-Brexit science funding' July 2022, <https://www.nature.com/articles/d41586-022-01922-6>

<sup>5</sup> Royal Society Policy Briefing, 'The research and technical workforce in the UK' February 2021, <https://royalsociety.org/-/media/policy/Publications/2021/2021-02-12-research-and-technical-workforce-in-the-uk.pdf>

<sup>6</sup> Royal Society, 'Regional absorptive capacity: the skills dimension, April 2022, <https://royalsociety.org/topics-policy/publications/2022/absorptive-capacity/>

<sup>7</sup> Paul Lewis, 'Technicians and innovation: a literature review' Gatsby Foundation, June 2019, <https://www.gatsby.org.uk/uploads/education/technicians-and-innovation.pdf>

16. This is not just about graduates, and more attention needs to be paid to technical education, including in FE Colleges. The Augar Review highlighted this as a poor relation of HEIs, but the Government response to the Review hardly addressed this issue at all.
17. The constantly changing situation of FE's and their funding is a topic that has been highlighted in various publications<sup>8</sup> <sup>9</sup>. The uncertainty produced by this churn in policy and funding does not provide the best outcome for either student or employer.
18. Adult education has been severely truncated over the years, and firms do not invest substantially in on-the-job training. A recent IfS report highlighted a 38% reduction in spending on adult education and apprenticeships over the last decade, with an even higher reduction (50%) in spending on classroom-based adult education.<sup>10</sup> The numbers of adult learners also fell significantly.
19. It is possible the announced Lifelong Loan Entitlement will increase take-up of adult education, but the fact remains it is a loan not a grant, and many adult workers (particularly those with families, mortgages or other substantial financial commitments) may not feel able or willing to take on a loan of this sort.
20. Colleges need to have long-term secure funding to enable them to plan and to provide adequate infrastructure and staffing, as proposed in the Augar Review. Although there are significant increases in funding promised (an additional £900 million in 2024–25) this will still be 25% lower in 2024–25 compared with 2010–11.<sup>11</sup>
21. Apprenticeships seem concentrated on higher levels, rather than basic and intermediate, which will not help to address the lack of skilled workers at sub-degree level.
22. There appears to be very little joined-up thinking between BEIS and DfE to make sure that skills/education and jobs are looked at holistically. Who considers what the needs are (in terms of numbers and geography) to ensure that skills are adequate and in the right place, rather than leaving it to 'market forces', when there is inadequate funding even when there is a will to open up new directions?
23. Improved communication and joint action between these two key departments is an absolutely vital improvement that needs to be made.

## Education

24. The gender imbalance in many STEM subjects is notable, long-lasting and stubborn. The particular issue of girls in Physics formed a key part of the recent Commons Science and Technology Select Committee into Diversity and Inclusion, and much of the evidence presented there (including my own oral<sup>12</sup> and written<sup>13</sup> <sup>14</sup>contributions) are relevant here too.

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<sup>8</sup> Institute for Government, 'All Change' <https://www.instituteforgovernment.org.uk/publications/all-change>

<sup>9</sup> Further Education Trust for Leadership 'Honourable Histories', <https://fetl.org.uk/wp-content/uploads/2021/01/Honourable-Histories-1.pdf>

<sup>10</sup> Institute for Fiscal Studies *Adult education: the past, present and future* <https://ifs.org.uk/publications/16081>

<sup>11</sup> Institute for Fiscal Studies *Adult education: the past, present and future* <https://ifs.org.uk/publications/16081>

<sup>12</sup> <https://parliamentlive.tv/event/index/f1ed4b79-08a1-44ca-9321-cb467ab919dd>

<sup>13</sup> <https://committees.parliament.uk/writtenevidence/42294/pdf/>

<sup>14</sup> <https://committees.parliament.uk/writtenevidence/109051/pdf/>

25. With relatively few pupils taking Physics A-Level overall (and the numbers fell again in the most recent cohort), and of these less than a quarter being girls, there is a clear problem for disciplines such as Engineering (in its myriad forms), as well as Physics itself. The lack of diversity also leads to a lack of diversity of thought and approach when those who do study the subject progress to the job-market, damaging opportunities for innovation.
26. However, there is a vicious circle at work here, beyond diversity arguments, in that there is a huge shortfall in teachers qualified in the subject ready to inspire the next generation of students. According to a 2021 Ofsted report<sup>15</sup>, 26.6% of teaching hours in physics in 2019 were taught by teachers who had no qualifications in Physics beyond A level.
27. Data collected by the Royal Society in 2014 indicated that only 5% of primary teachers are thought to hold specialised science degrees and teaching qualifications.<sup>16</sup>
28. The lack of qualified teachers in these subjects means that bright children may be too easily put off the subjects when their curiosity cannot be satisfied by the teacher's responses.
29. A failure to meet teacher recruitment targets in key STEM subject has been a persistent problem, with a July 2022 report indicating that teacher shortages are reported by 95% of schools and with the problem being particularly acute in Physics.<sup>17</sup>
30. Teacher retention is also a major problem in the STEM subjects, exacerbated by the lack of access to CPD, so that teachers feel they may no longer be *au fait* with what is required.
31. The introduction of funded and mandatory annual CPD would aid both quality of teaching and retention, and would therefore be a cost-effective intervention.<sup>18</sup>

### **Academic Careers**

32. The lack of diversity in academia was well-covered in the evidence to the recent Commons Committee on Science and Technology enquiry on diversity and inclusion in STEM.
33. Precarity arises because of the shape of the academic pyramid, with far more PhDs being awarded than could possibly be absorbed by university faculty. PhDs don't always approach their research understanding this. A complete rethink of the shape of the pyramid would be needed to remove this precarity. What shape would be desirable? How many PhDs are needed in different subjects and in different regions and are these questions asked? Is a PhD a training for an academic career or something much broader? Some fundamental questions need to be asked, instead of the numbers of research students (and, increasingly, masters' students too) increasing without consideration.

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<sup>15</sup> Ofsted (2021), 'Research review series: science' <https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science#fn:34>

<sup>16</sup> Royal Society (2014), 'Vision for science and mathematics education', <https://royalsociety.org/topics-policy/projects/vision/>

<sup>17</sup> Association of School and College Leaders survey, July 2022, <https://www.ascl.org.uk/News/Our-news-and-press-releases/ASCL-survey-shows-teacher-shortages-at-crisis-point>

<sup>18</sup> Education Policy Institute, 'The effects of high-quality professional development on teachers and students', April 2021, <https://epi.org.uk/wp-content/uploads/2021/04/EPI-CPD-entitlement-cost-benefit-analysis.2021.pdf>

34. Training for work beyond academia does not always form a significant part of a PhD, and topics such as project or people management are rarely covered.
35. The HE sector relies too heavily on academics carrying out multiple roles, necessarily absorbing far more time than the statutory week.
36. There is little exchange of personnel between academia and industry, and few incentives to facilitate this. Indeed career progression in most subjects in academia would likely be hindered by a spell outside.

### *STEM skills*

2) *What STEM skills is the UK lacking and what skills are likely to be in high demand in future?*

37. *Are businesses able to recruit people with appropriate STEM skills?*
38. *Are STEM graduates being sufficiently prepared for highly skilled careers?*
39. *What is being done to allow for people to develop STEM skills across multiple disciplines throughout their career? What could improve this?*
40. *Is the STEM skills gap growing or shrinking?*

1) *How attractive is the UK as a place for people with STEM skills to move to and make a career and has this changed recently?*

41. *What challenges face scientists and people with STEM skills seeking to move to the UK? What can be done to address these?*
42. *Can the UK learn from steps taken by other countries to attract and incentivise STEM talent?*
43. *Is the UK's post-Brexit visa system, including the criteria applied, appropriate to attract the STEM talent the UK needs?*
44. *Is there any evidence of a "brain drain" from the UK in STEM fields? Should consideration be given to schemes to incentivise skilled individuals to return to the UK from abroad, for example to work in the NHS?*

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50. *Education sector*

3) *What measures is the Government taking to address any STEM skills gap? Are they sufficient to address the requirements of wider government policy aims for science and technology, including net zero?*

51. *Do cultural influences such as social media have a role to play in increasing uptake in STEM careers? Could the Government do more to encourage this?*
52. *Is there sufficient training in STEM skills available for workers who want to retrain? What schemes are there and how easy are they to access?*
53. *How easy is it to recruit teachers with scientific skills and expertise? What more can be done to encourage highly skilled individuals from all backgrounds to go into STEM education?*

54. How much of a role could (and should) the private sector play in retraining their workers, or supporting workers to retrain?
55. Quality of academic careers

4) What major challenges face those in academic scientific careers at present, and in the recent past?

56. How should the Government encourage a wider range of people to pursue STEM academic careers?
57. What more could be done to address the precarity of STEM academic careers, particularly in the early stages?

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