

REFRESHING BBSRC'S STRATEGIC PLAN: THE AGE OF BIOSCIENCE

A response from the Society of Biology

The [Society of Biology](#) is a single unified voice, representing a diverse membership of individuals, learned societies and other organisations. We are committed to ensuring that we provide Government and other policy makers - including funders of biological education and research – with a distinct point of access to authoritative, independent, and evidence-based opinion, representative of the widest range of bioscience disciplines.

This response was prepared on behalf of the Society of Biology with particular input from the [UK Plant Sciences Federation](#) (UKPSF), a special interest group of the Society. The UKPSF brings together 30 member organisations from across the breadth of plant sciences in the UK, to provide one voice for the UK plant science community and create a coordinated approach to research, industry, education and outreach.

(i) World-class Bioscience

How can BBSRC best continue to support UK bioscience and derive the widest possible benefit from our investment of public funding?

While strategic investment is important to address key challenges, a long term vision should recognise the potential for innovation to arise from non-strategic research and that maintaining a broad fundamental research base will be essential to sustain knowledge transfer, a wide range of skills and expertise, and to manage new and potentially unexpected challenges successfully. We recommend therefore that BBSRC maintains a significant level of responsive mode funding, focussing on research excellence across a diverse remit.

What are the main threats to the UK's world-class bioscience research base and how might we address them?

The UKPSF recently carried out a survey of 257 members of the UK plant science community, which revealed a strong consensus that education and inspiring the next generation of scientists are major strategic challenges facing this sector during the next decade. This is likely to be true of other bioscience sectors.

There are concerns that reductions in overall funding will exclude certain areas of science and concentrate research in fewer centres, compromising the capacity of higher education institutions to deliver a holistic education and threatening the future skills base of the research sector. This problem can be addressed by ensuring that the UK invests in the widest range of basic bioscience research. However, in light of limited funding we recommend that BBSRC prioritises areas that are not eligible to receive funding from other sources.

The UK's leading position is threatened by the expanding number of researchers globally, particularly in emerging economies such as China, and by our declining rate of national investment in research relative to

Charles Darwin House, 12 Roger Street, London WC1N 2JU +44 (0)20 7685 2550 info@societyofbiology.org
www.societyofbiology.org

the other G8 nations. This is of particular prevalence in agricultural research which has eroded over the past two decades, suffering from closure of research sites and a loss of the specialist expertise needed to ensure an adequate skills and training pipeline.

(ii) Strategic research priority 1: Food security

Food security is a broad and multidisciplinary challenge. BBSRC cannot do everything, so where should we place the most emphasis so that our funding can have the greatest benefit to society and the economy?

The UK has a world class plant science research base within universities and research institutes. However, data we collected in collaboration with GARNet (the *Arabidopsis* Community group) estimates that plant sciences receive only 3% of the total grant funding from BBSRC, CRUK, Royal Society, STFC, MRC, Gatsby Charitable Foundation, Wellcome Trust, EPSRC, NERC, Bill and Melinda Gates Foundation, Defra and DfID (figures from grants awarded between 2009 and 2012). Greater investment in plant and crop sciences is clearly needed to meet the challenge of sustainable food security, and as the only major research council funding this area BBSRC should consider this as a priority.

We welcome BBSRC's proposal to place increased strategic focus on research into plant pest and disease control, stress tolerance, resource use efficiency and biodiversity/ecosystems services. These all ranked highly as priority areas identified by our recent survey.

Since 1982, at least 88% of the increase in yield for the major cereal crops and oil seed rape has been attributable to genetic improvement. However the UK has become somewhat weak in the translational research needed to move work from academia into commercial breeding programmes. Universities tend to lack the facilities or expertise to carry out crop pre-breeding (i.e. the identification and integration of desirable traits into cultivars that breeders can use in breeding programmes). Furthermore, the relevant research assessment exercises give priority to high level academic publications, resulting in a disincentive to working on agricultural science and its application. However both approaches need to be valued and receive investment.

The rate of innovation in breeding programmes could be increased by the development of publicly available genetic and genomic resources for widely used UK crop varieties, which breeding companies are not able to fund from their limited royalty income. Resources could include germplasm collections (including mutant and transgenic populations), and annotated genomic sequence, transcriptome, mapping and phenotypic data.

The UK's investment and expertise in systems biology could also be exploited to analyse complex traits in crop species and be linked to genetic and phenotypic resources. Innovation in bioinformatics resources for crop scientists to rapidly and fully exploit available information using entry points that suit the user (plant breeder, molecular biologist, ecologist, systems biologist etc.) is a key opportunity.

(iii) Strategic Research Priority 2: Bioenergy and industrial biotechnology

How can BBSRC best help to ensure that the UK becomes a global leader in industrial biotechnology?

Continued support for industrial scale fermentation facilities is important for scale-up development to ensure research outputs are applicable outside the lab. In addition there is a real need to stimulate fundamental research into bioenergy and biomass to create a critical mass of skilled researchers. In a recent UKPSF

survey asking in which areas of plant science Government investment would produce the maximum benefit, bioenergy and industrial biotechnology did not rank highly as priorities among the survey respondents (with less than 2% providing bioenergy as a reply compared with 19% answering plant pests/diseases). This needs to be addressed.

What are the barriers that might prevent UK bioscience from achieving its potential in this area, and how can they be overcome?

We welcome BBSRC's plan to place greater emphasis on the diversity of industrial biotechnology applications since many of these are in their infancy and it is important to invest in them now, to establish the UK as a global leader in IB and capitalise on its full potential for generating economic growth.

(iv) Strategic Research Priority 3: Basic bioscience underpinning health

Basic bioscience that informs and underpins health is a key part of our strategy where we work at the interface with other major funders such as MRC, the Wellcome Trust and third sector funders. Given this complex mix, where can BBSRC's funding have the greatest impact and value for money?

This should remain a core area for BBSRC since much basic research underpins health related R&D. Ensuring a transparent and close relationship with the other research councils is essential. An area for focus could be the underlying molecular science underpinning drug discovery.

(v) Enabling Theme 1: Knowledge exchange, innovation and skills

How can BBSRC continue to enable the widest possible benefit from the high quality research and skilled people that we fund?

For the UK to maintain its world-class research base it is necessary to invest in nurturing "home-grown" talent with a diverse portfolio of skills. We welcome BBSRC's initiatives to support the development of early career researchers, including Doctoral Training Partnerships and Fellowship Schemes. However, more emphasis is needed on ensuring that all areas of biology are taught at degree level. There has been a trend towards recruiting more biomedical researchers in university bioscience departments due to their ability to draw in funding from multiple sources. As a consequence, expertise in other areas of biology is diminishing and there is a serious risk that certain skills will not be passed on to new students. A skills audit should be considered in the context of the life science and forthcoming agricultural strategy, and a small fund created to support rare skills based doctoral and postdoctoral research training.

(vi) Enabling Theme 2: Exploiting new ways of working

What are the key challenges in ensuring that we are able to exploit fully new ways of working in a field such as bioscience, that is adopting and developing new technical capabilities at an ever increasing rate?

The next generation of researchers must be equipped with to deal with the tools for systems biology, modelling and handling large data sets, which requires greater biology-focused maths and bioinformatics training early on in the skills pipeline (i.e. within schools and universities). Project management, networked research activity and a smaller divide between academia and industry will be needed as research is

increasingly carried out across sites with greater movement of people. Communication of research to both professionals and the public will be an increasingly important skill.

What are likely to be the 'next generation' of technological breakthroughs that will revolutionise bioscience?

- High throughput field phenotyping techniques.
- Multi-scale modelling (from the molecular level to field scale) and the development of new tools for this.
- Methods of tracking and monitoring individual molecules and cells (e.g. label-free¹ technologies and ultra-resolution microscopy).
- Single cell biophysical methods.

(vii) Enabling Theme 3: Partnerships

How can BBSRC make even better use of partnerships in delivering its vision for UK bioscience?

We welcome BBSRC's efforts to raise the profile of bioscience research and strengthen biology teaching through their schools and public engagement initiatives.

Given the limited amount of research funding and the increasing complexity of biological problems, we encourage the development of more joint calls between research councils, particularly in areas of multidisciplinary research where the science crosses their boundaries. The SynTax scheme² was a highly successful co-funded initiative that stimulated high quality taxonomy and systematics research projects but regrettably this was a short-term initiative. Food security and synthetic biology are other good examples of effective cross council programmes.

Are there any UK or international partnerships that BBSRC should prioritise, or that require particular attention?

The ERA-Net schemes have been effective in building EU collaborations and providing opportunities for UK researchers to interact with EU companies without unnecessary administration.

The development of bilateral funding arrangements would be of particular benefit within the EU and beyond. Although difficult to achieve obvious partners would be the DFG in Germany, and NSF, USDA and DoE in the USA.

Any other comments?

Is there anything else that BBSRC should consider in refreshing its Strategic Plan?

There are concerns over the short term nature of funding schemes which are not sufficient to address certain problems, particularly in crop species and trees. There have been some welcome moves such as

¹ Label-free technologies offer the ability to study molecular interactions without the possible complications of binding interference, non-native behaviour or toxicity to living cells that can be caused by labels.

² <http://www.bbsrc.ac.uk/news/archive/2009/091116-pr-new-funds-to-stimulate-systematics-taxonomy-research.aspx>

the Crop Science Initiative and Crop Improvement Research Club; however these are not rolling programmes and continued investment is required.

The UK research community is well placed to be a leader in GM technology; however public opinion and EU legislation are still major barriers to the development and commercialisation of GM products. We support BBSRC's initiatives to stimulate public dialogue on this issue and welcome its plans to continue them.

The Society of Biology is pleased for this response to be publicly available. For any queries, please contact Mimi Tanimoto at: UK Plant Sciences Federation, Society of Biology, Charles Darwin House, 12 Roger Street, London, WC1N 2JU. Email: mimitanimoto@societyofbiology.org.

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