

Biotechnology and Biological Sciences Research Council – proposals for a new 5-year Strategic Plan

Consultation response prepared by the Institution of Chemical Engineers

Introduction

IChemE is the hub for 30,000 chemical, biochemical and process engineering professionals worldwide. We are the heart of the process community, promoting competence and a commitment to sustainable development.

Professional bodies such as IChemE occupy a unique place in society. Our Royal Charter and charitable status confers upon us an obligation to advance the discipline for the benefit of society as a whole and support the professional development of our membership, which spans a wide range of individuals from industry, regulators, academia and consultancies. We can call upon our member's expertise in these fields without bias or favour, in order to reach objective advice based on sound science.

The Institution of Chemical Engineers (IChemE) welcomes the opportunity to comment on this consultation document.

The consultation document contains questions which are numbered according to the page number within that document. The institution has responded to each question using the same nomenclature.

Consultation response

Page 6 - Overview: Strategic Plan 2010 - 2015

IChemE supports the three strategic priorities (Bioenergy and Biorenewables, Food security, and Bioscience for Health) and agrees that these are indeed extremely important. We applaud the policy of stimulating the creation of novel bioscience in these areas.

We also applaud the emphasis in the document on the delivery of "Outcomes and Impact" (defined on p6 of the consultation). Society expects that government-funded research will produce solutions, so it is appropriate for the Council both to aspire to keep the UK a leader in bioscience, and to tackle the great issues. We comment though that the outcomes are defined in such general and high-level terms that it will be impossible to tell whether the strategy has been a success. We suggest that thought be given to lower-level, but measurable, outcomes in each of the three priority areas.

We are less happy with the choice of five enabling themes which are intended to link the bioscience to the outcomes and impact. This is mainly because engineering, which will be essential to delivering the impact within the strategic priorities, is largely absent.

Page 7 - World class bioscience

We agree that it is right to encourage the research community to work on the three strategic priorities. This will have the benefit of building teams with critical mass and expertise in these important areas, developing a variety of new science and technology.

At the same time it is essential to maintain a steady flow of responsive-mode funding, which is needed for the health of the biology and biotechnology disciplines. We believe that there is a place for more speculative research because, in the end, this may lead to more radical and unexpected solutions, and new transformational opportunities. We particularly draw attention to the need for funding mechanisms to encourage young researchers to set up independent lines of research, and launch careers in these vital areas of endeavour.

Page 8 - Three key strategic priorities

Yes we support the strategic priorities.

Page 9 - Next generation bioenergy and biorenewables

The document acknowledges that there is a need to work with overseas partners, such as Brazil and USA, which have very large programmes in this area, and we welcome this. We would add that there are also significant programmes in Europe.

As well as research to understand the molecular and cellular basis of biorenewable chemicals and fuel, we would like to see emphasis on sustainability and economic evaluation of novel feedstocks. Promoting the move to new “green industries” is an excellent policy, but new industry will not be viable unless a great deal of engineering expertise is deployed to take the bioscience from the laboratory bench to industrial scale, and profitable operation.

Page 10 - Food Security

We note that the UK's food and drink sector is its largest manufacturing industry (annual turnover £72.6 bn), but there is little recognition of this in the key research areas which are mentioned. We agree that there is a need to boost private sector investment in research, as suggested in the strategy, and believe that this could best be promoted through joint programmes in which industrial needs are considered, and to which funding councils contribute (see comments below on IBTI and BRIC).

Page 11 - Bioscience for Health

We agree that understanding fundamental human biology is a key challenge. However delivering outcomes and impact to improve healthcare will also require other technical challenges to be addressed.

We are particularly concerned with the strategy as it affects the pharmaceutical industry, which is very important to the UK economy. Biopharmaceutical discovery and development is a hugely multidisciplinary activity. We do not believe that the necessary interactions are sufficiently recognised by the strategy of dialogue with partners, though this is of course important. Concepts such as “Designing for manufacturability” require that engineering considerations are taken into account at an early stage, as new biology is developed. In the proposed areas of focus we would like to see mention of “biotechnology” as a key research area to be supported, with topics like biosystem design, bioreactors and gross behaviour of cell cultures, bioseparations, biosensors (eg for contamination detection) and bioprocess control.

Page 12 - Five enabling themes

As already mentioned, we think that engineering and biotechnology development should be an integral part of the research programme. An enabling theme for the whole programme, essential for maximising impact, is thus “Biosystems Engineering and Technology”. This theme plays into all three priority areas, in which, indeed, biotechnologists and biochemical engineers are already active. All three areas of application have a serious need for engineers trained in the various aspects of handling biological systems in a practical context, who can participate in the multidisciplinary teams that industry invariably requires.

Page 13 - Integrative and systems biology

We agree that systems biology is a novel area justifying focussed attention, and support the strategy of encouraging programmes in this area. Modelling, biosystem design and control are vitally important to the goal of developing new and useful biology.

Page 14 - Exploiting ‘big data’

We strongly support the need for a significant programme in this area – bioinformatics - and welcome the list of activities given. Modelling large and complex systems is particularly a skill in which biotechnologists, biochemical and biomedical engineers (and others) should be

encouraged. We mention as additional example the various global projects modelling human physiology, which give insight into the reaction of that particular biological system to external stimuli and naturally occurring pathologies.

Page 15 - Tools, resources and facilities

We cannot find specific targets on page 15 of the strategy, but nevertheless believe that BBSRC should indeed use a portion of its budget to support the UK's bioscience and biotechnology infrastructure. We note that the Diamond synchrotron will not only be useful for studies in structural biology, but probably also in the development of new biomaterials.

Pages 16 – 20

We are pleased to see emphasis on Translation, innovation and skills, which is a key part of the strategy. A recent BERR report (IB2025 Maximising UK Opportunities from Industrial Biotechnology in a Low Carbon Economy) estimates that the global Industrial Biotechnology market in 2025 may be worth around 150 – 360 £bn. The report comments that Industrial biotechnology (IB) – the use of biological substances, systems and processes to produce materials, chemicals and energy – will play an essential part in the creation of a low-carbon knowledge-based economy in the UK. The UK has a rather unenviable reputation for developing science, but not seeing it through to commercial application, so it is encouraging to see in the IB2025 report, examples in which BBSRC is working, with others, on this translational process. We should aspire to match, and preferably exceed, the innovation performance of our global competitors.

However, as already mentioned, we think that the BBSRC strategy crucially lacks the enabling theme “Biosystems Engineering and Technology” which should play a natural and leading role, both in the fundamental research programme, and in taking the bioscience into practice. Without this enabling theme, there is a gap in the centre of the Translation, innovation and skills plan. So whilst the need for top-class bioscientists is clearly articulated, we do not see the same clarity about the need for skills in applied bioscience, leading into biotechnology.

It is recognised (p16) that more than half of BBSRC funded PhD students go on to work in non-academic roles, and this is an extremely important flow of skilled individuals into industry and commerce. It is essential that a good proportion of this trained manpower has advanced skills in engineering and the application of bioscience in a commercial context. Thus engineers, as well as scientists, are needed, and we would like to see this explicitly recognised in the strategy.

In summary, we miss a definition of the competencies and roles required. The strategy discusses skill gap closure, training and development without a clear statement of what skills are needed. We would like to see the development of a competency model and then an audit against that model to understand the needs, and prioritise the actions.

Pages 21-22 - Partnerships

Biology is a fundamental science, and the revolution in our understanding of the molecular basis of living systems has brought bioscience close to chemistry, physics and information science. And as fundamental ideas have been taken into practice, bioscience has moved strongly into various engineering and medical fields. Thus we applaud the recognition that partnerships with bodies that fund research in closely allied areas are essential. So many potential partnerships are possible though, that some prioritising and focussing is needed, identifying where alliances are required to advance the strategic vision in the three priority areas.

The pervasive nature of bioscience means that there will be many calls on BBSRC funds from groups outside the traditional base of University departments of biology and related topics. Ways therefore have to be found to support a wider spread of bioscience and biotechnology research, without weakening the existing science base. Working with other funding agencies, and also with industry will be important.

An important area of partnership will be in the activities of the IB Forum, set up following the IB2025 report, to promote the UK's Industrial Biotechnology vision. In this area, we welcome the Integrated Biorefinery Technologies Initiative (IBTI) set up jointly with EPSRC in 2008.

We believe that the BRIC (Bioprocessing Research Industry Club) supported by BBSRC and EPSRC is another successful model of partnership. As well as its obvious role in stimulating and delivering exciting new bioscience and biotechnology, it has had an important role in building a community across disciplines, and developing important skills in young researchers. The stop-start nature of the funding available has been something of a problem in keeping the community alive. Ideally a steady stream of funds should be available, also for studentships. But the overall experience of BRIC has been very positive.

Page 23 - Outcomes and Impact

We agree that Bioscience (and also Biotechnology) makes a great contribution to the UK economy. BBSRC funded projects have a great deal of exciting science to demonstrate to the public, and impacts to be proud of in Food, Health and Pharmaceuticals. These are real success stories with public interest, and making publicity for them is to the benefit of the research community, and is undoubtedly a job for professional scientists and engineers.