

BBSRC: Enriching biological science with vaccines, broccoli and equal opportunities

Strategy, expertise and leadership are vital components for addressing emerging biological global challenges. Combatting antibiotic resistance or tackling the ever-concerning ratio of food supply to population growth: the enormity of biological issues such as these affects everyone worldwide. **Professor Melanie Welham**, Chief Executive of the Biotechnology and Biological Sciences Research Council (BBSRC), understands the adversity surrounding these issues better than most, funding vital UK research hoping to find effective solutions.

Research Councils were reorganised following the 1993 UK Government White Paper "Realising our Potential: a strategy for science, engineering and technology."

In 1994, the BBSRC was established by Royal Charter by incorporation of the former Agricultural and Food Research Council (AFRC) with the biotechnology and biological sciences programmes of the former Science and Engineering Research Council (SERC).

The Biotechnology and Biological Science Research Council (BBSRC) is now one of seven Research Councils that work together as Research Councils UK (RCUK) and are funded by UK Government's Department for Business, Energy and Industrial Strategy (BEIS).

The BBSRC plays a crucial role in the health and vibrancy of UK bioscience due to a proven track record and strong vision for the future that will develop, strengthen and support the UK's bioscience base. Through innovation, translation and partnership, the BBSRC's aim is to build the bio-economy for a more productive and prosperous nation.

In 2015-2016, the BBSRC invested £473 million in world-class bioscience, people and research infrastructure to date, and supports approximately 1600 scientists and 2000 research students in universities and institutes across the UK.

Meet the Chief Executive

Whether it be the ever-growing population, the ever-ageing population, or the ever-

shortening food supply to feed said population, major societal challenges which have a biological dimension are commonplace. Fortunately, nobody understands how to combat these problems better than Professor Melanie Welham, who represents the Biotechnology and Biological Sciences Research Council (BBSRC).

In 2016, Professor Melanie Welham took on the role of Chief Executive of the BBSRC. Previously, Prof Welham was Executive Director, Science, at the BBSRC, a role she held since joining the Council from the University of Bath in October 2012. At the University of Bath, Melanie was Professor of Molecular Signalling and was the first woman to be appointed a professor in her department.

Earlier in her career, Prof Welham was also a BBSRC Research Development Fellow and progressed to become a leading researcher in molecular signalling and stem cell biology. She was co-director of the Bath Centre for Regenerative Medicine where she oversaw the activities of this interdisciplinary centre. Prof Welham also served on BBSRC peer review committees for a number of years.

Now, as Chief Executive, Professor Welham leads BBSRC's work with teams of experts to pinpoint areas of UK research to fund, that can help tackle these major challenges. Areas of particular research focus include: finding sustainable food-supply solutions in light of a continuously expanding population and limited resources; ensuring that as we age, we do so healthily; and combatting the impact of climate change.

Not only that, but Prof Welham also aims to instil an equal opportunities pre-requisite into the BBSRC and beyond, ensuring women's voices are heard within scientific research. She recently sat down with us at *Research Features* to discuss this, and more, in further detail.

Hello Melanie! Having had a long association with the Biotechnology and Biological Sciences Research Council (BBSRC) in a leadership role, and as a member of research committees, can you give us an overview of the organisation and the science it supports? We're the largest public funder of biological sciences research in the UK: our annual investment in research is about £450 million of taxpayers' money, and we want to invest that wisely because it's public funds. We support and invest in the most exciting and best research wherever it's found in the UK.

The UK is in a unique position because, however you measure it, UK-based bioscience research is world-leading in a number of different measures. Obviously, we can't claim to support and be responsible for all of the world-leading research, but clearly, at the BBSRC, we want to help maintain that position.

We do this by supporting three different aspects: we support research grants to



Professor Melanie Welham, Chief Executive of BBSRC

researchers in universities and institutes; we support training for the next generation of researchers; and then we support the infrastructure – the equipment, buildings, etc. We support these three pillars across all non-medical bioscience research. Our remit spans across plant and animal science, the study of microbes, right through to nutrition and human health – we have a broad portfolio and some of it is really at the frontier. The researchers we support are asking fundamental questions about how biological systems work, and that often involves research not just between bioscientists, but between other disciplines as well.

In the BBSRC's strategic plan, the 21st century is described as the age of bioscience. Can you explain why this is?

If you think about it, society is facing many challenges. The population is growing and, as such, that population needs feeding. Not only this but increasing urbanisation and standards of living are driving demand for particular types of food. The climate is also changing and we must take steps to mitigate that, because otherwise we won't be able to grow enough food to feed everybody. There is also the issue of fossil fuels; we can't continue to rely on them due to their finite lifespan and the influence of climate change.

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Additionally, people are now living longer due to advances in modern medicine, but we need to make sure that happens in a healthy way. Not a day seems to go by where we don't hear about the burden on the NHS and social care, and the increasing incidence of dementia. There are a number of different recognised challenges but, when you consider them, there is a really important contribution that biology can make to solving them – whether it is increasing the productivity of our Agri-food systems, improving well-being and health, or creating renewable sources of energy. I'd describe the 21st century as being on the cusp of a green revolution, relying on the precision that we see in biology, while also needing to take inspiration from it.

Could you tell us more about BBSRC's strategic plan?

Our strategic plan prioritises research related to agriculture and food security – how can we improve productivity and resilience across the supply chain? I think a lot of people don't realise how important the agricultural sector is to the UK. It employs a huge number of people and makes a massive contribution to the economy in the UK too. It's important that we continue to innovate in this area, so that we can support productivity in the agriculture and food sector in the UK.

The second strategic research priority area we support is harnessing the power and diversity of biology to find new bio-renewable sources and processes that can replace our dependence on fossil fuels. We call this industrial biotechnology and bioenergy, and it focuses on how we can bring the power of biology into more industrial processes. That might be to produce new medicines, to produce biofuels, or to produce high value chemicals. It might even be to produce things for personal goods, such as shampoos or fragrances, but generally, it's about finding an alternative biological route.

The third area of strategic research we support is around bioscience for health, determining approaches to ensure that we maintain our health throughout our life span. Components of this include the importance of nutrition, particularly related to improving understanding of how important the microbes that live in our gut are to our health and wellbeing. Another key area is understanding how we can maintain the robustness of our immune system as we age. Older people don't respond as well to vaccinations and yet, they are vital for protecting the elderly from disease. So how can we boost that? These are



Parhyale (genus of amphipod crustaceans). Researchers led by Dr Aziz Aboobaker at the University of Oxford have just sequenced this critter's DNA and observed a few mutants along the way.

the areas our strategic plan has a particular focus on.

So, is there a potential for vaccines to be developed that are more effective for elderly people?

I think it's more about combining effective vaccines with knowledge of how to boost the immune response in the elderly. There has been some interesting research into this recently, so we are beginning to gather some clues as to why the immune response worsens as you age. Once we understand the mechanisms involved, we can then start to design interventions to boost the system up again.

Frontier bioscience is another major area of BBSRC's funding. Could you explain some more about what this is?

Frontier bioscience asks fundamental questions about biological processes. 60 years ago, we knew that DNA was the stuff of life but we didn't understand how it functioned – the fundamental research carried out by Watson and Crick on the structure of DNA changed this and transformed our understanding of biological systems. So, frontier bioscience is about improving our

understanding of fundamental processes, to make further discoveries you don't expect to find, and open up new avenues for research.

Frontier bioscience is about saying: "I never would have thought that would have happened", and that is where the real excitement is – pushing the boundaries of what is possible. It also allows people working from different disciplines to work together and, because of this, biologists working with engineers or physicists can look at things in different ways, bringing different perspectives and expertise to the research.

Are both frontier science and the strategic areas you've highlighted equally valuable to the BBSRC?

It is all very important and striking the balance between them is key. One of the ways we do this is by seeking advice from our research community around priorities in different areas. Science moves forward all the time and you're always having to look out for where the next areas are emerging. We have a very well developed advisory structure to gather that information, but all our funding decisions are based on expert

peer review. It's not myself and colleagues sitting in the office going: "We'll fund this one, this one, and that one" – that's not how we do it.

Instead, when researchers submit applications to us, they know that they will be sent out to other experts in their field for further assessment. Those assessments come back to us and we then convene an expert panel, and they will determine through peer review which applications we should be supporting. We want to fund the best science wherever it's found in the UK, and we are totally committed to doing that in a transparent way using expert peer review.

Do you have any examples of these funded projects?

One thing that is quite high profile in the media at the moment is around the increasing resistance of bacteria to the antibiotics that are available to us. Research carried out at the University of East Anglia in Norwich has discovered that novel antibiotics are produced by bacteria living in a symbiotic relationship on an African ant. These novel antibiotics have been shown to be potent in killing superbugs. So, this is a really exciting area of research, because of the potential to combat antibiotic resistance.

Another example would be research conducted into understanding how the flowering time of plants is controlled by temperature. A lot of plants come into life during spring, and this is because they can sense temperature changes.

When the temperature starts to rise, the plants become more active, and when temperatures become colder, they know to go into a period of dormancy. So, researchers have taken that knowledge and asked how can we apply that to crops? For instance, with broccoli, we currently get one crop per year because it's grown out in the field, and is dependent on having to go through a period of cold to grow and flower. Researchers have identified and removed the part of the broccoli DNA that is dependent on that temperature control, meaning that broccoli yield could now increase from one crop per year to potentially four or five.

That's fascinating! Changing track slightly, you mention the importance of collective intelligence in research, quoting your daughter as saying 'women bring a different perspective that men might not see'. Could you explain what you meant by this?

I think this is really interesting because research is all about finding the truth, and, part of this is about looking from different perspectives to really challenge yourself to respond to questions that you might not have thought of. Bringing a diversity of views together is vital because it results in a better outcome. If you get a group of people who combine their collective experiences and intelligence to consider a problem, you're probably going to get a more fully-formed solution than if you simply asked one person. It is about being open to different perspectives and being inclusive in the way you approach things.

There is evidence that shows where you've got a diverse and inclusive group of individuals, businesses are more competitive, and the outcomes are improved around tasks. It's important that people recognise and understand that the evidence is there to support this, as I think women in particular can be quite reluctant sometimes to offer their views within a group. They view their opinion as unimportant, just because it's different from other people, but that doesn't mean that it's wrong. If anything, recognising that difference can be extremely valuable.

Do you recognise that at BBSRC?

I think within BBSRC we're really lucky actually. Our Senior Executive team is gender balanced, and I think we are very inclusive in the way that we work, both within that team but then across the office in other teams as well. Our equality, diversity,

and inclusivity plan is an area that we take very seriously and we have certain actions that we're trying to put in place – training that we're using to support people so that people recognise unconscious bias in themselves.

Have you noticed a change as a result of implementing that plan so far?

The action plan I mentioned was only launched last year, but we have had one in place at BBSRC for the last three years which is being reviewed later this year. We've also looked at making sure our funding opportunities use a language that doesn't put people off, after we found during a study that women were less likely to apply for grants. We want to understand why this is and what the barriers are for them.

It takes time to get these things bedded in and to move forward, but I think the fact that we're paying attention to it and we're trying to make sure that we've got as fair, consistent, and inclusive approach as possible is important. Women seem to be very good at persuading themselves not to do something, whereas I think our male colleagues often don't get that same level of doubt.

• *For further information on BBSRC's research or events, or if you would like to get involved with them in any way, please visit their website at www.bbsrc.ac.uk.*



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